

### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q1	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate**	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Gordana Jovanović	Research associate	IPB
Svetlana Stanišić	Full professor	US
Marija Mitrović Dankulov	Senior research associate	IPB
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US
Ana Vranić	Junior research assistant	IPB

\*Insert only names of the project participants who were engaged during this reporting period.

\*\*In case of any changes in the status of academic and research titles of team members, submit the appropriate decision on acquiring academic and research title of the team member(s) in question, justifying the change of the status.

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation.

During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.

During the reporting period there was no unforeseen circumstances requiring a change in any of the team members, including the PI. The only change was that in the meantime the project participant Andreja Stojić was promoted in senior research associate, which does not affect the planned project outcomes and results in any way.

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestones title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M3	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a milestone is reached, enter N/A.

N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.1 - Project Management Plan	M1	Yes	/
2.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M3	Yes	/
3.	WP 1 - Coordination, Management, and Dissemination	D1.3.1 - Communication Strategy and Action Plan	M3	Yes	/
4.	WP 1 - Coordination, Management, and Dissemination	D1.3.2 - Project website, <a href="https://ai.ipb.ac.rs/">https://ai.ipb.ac.rs/</a>	M3	Yes	/
5.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.1 - Technical report "Mathematical models of fuzzy spatial primitives"	M3	Yes	/
6.	WP 5 - Integrated platform	D5.1 - Data and information management layer	M3	Yes	/

\*Based on tasks presented in Table 3.2. in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

\*\*Based on deliverables presented in Table 3.4 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

N/A

<p><b>3.5. Project results (recommended up to 250 words)</b> – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).</p> <p>The financial and administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project. The PI, prof. Endre Pap and project participant Andreja Stojić were keynote speakers in the plenary session of the International scientific conference on information technology and data related research, held on October 17<sup>th</sup> 2020, in Belgrade. One of the conference sessions was dedicated to the artificial intelligence and the ATLAS project. As a result of the project research, 9 scientific papers were published, out of which 7 conference papers and 2 original papers in relevant highly-ranked journals (M21a and M22).</p> <p>Furthermore, the project website was launched at <a href="https://ai.ipb.ac.rs/">https://ai.ipb.ac.rs/</a> with all relevant information, and the project was presented to the wider audience via social networks, including Researchgate, Instagram, Facebook and LinkedIn.</p> <p>The report Mathematical models of fuzzy spatial primitives was done presenting the mathematical models of basic planar imprecise geometric objects (fuzzy line, fuzzy triangle and fuzzy circle), as well as the basic measurement functions (distance between fuzzy point and fuzzy line, fuzzy point and fuzzy triangle, two fuzzy lines and two fuzzy triangles), spatial operations (linear combination of two fuzzy points), and main spatial relations (coincidence, between and collinear). These models represent the theoretical foundation for spatial modelling in ATLAS platform and the report was made publicly available via project website. As a result of research, new theoretical results for non-additive measures and corresponding integrals were obtained, with applications in decision making.</p> <p>During the first quarter, we have collected geo-referenced air pollutants and meteorological data from 2008-2018 that cover Europe and the USA and calculated meteorological surface data for each measurement site from GDAS1 meteorological fields.</p> <p>We have successfully organized and finalized the public procurement of additional computing nodes that will deliver the CPU performance of 7.3 TFlops. Finally, an infrastructure for data storage that supports relational databases was done and populated with representative data.</p> <p>In addition to acquisition of data from various third-party sources, air pollution, meteorological, and publicly available mobility data obtained under Covid-19 measures in the Belgrade area were also included in the ATLAS raw database.</p> <p><b>3.6. Project deviations (recommended up to 250 words)</b> – In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.</p> <p>N/A</p>
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<b>3.7. Project risks</b>			
<b>3.7.1.a. Foreseen risks</b> - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.			
Risk No.	Description of risk	Work Packages/Tasks concerned	Risk-mitigation measures (as in Project Description)
1.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The report Mathematical models of fuzzy spatial primitives was successfully done after new theoretical results for non-additive measures and corresponding integrals were obtained, with applications in decision making.

<b>3.7.1.b. Status of risk mitigation measures</b>			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	No	Yes	N/A

<b>3.7.2.a. Unforeseen Risks</b> – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).			
Risk No.	Description of risk	Work Packages/Tasks concerned	Proposed risk-mitigation measures

1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1 - Communication Strategy and Action Plan and D3.2. - Project's website.	The scientific conference has been held online this year.
2.	The complexity of the administrative procedures	WP 1 - Coordination, Management, and Dissemination/D1. Project Management Plan and D3.1. Communication Strategy and Action Plan	The project team will make an attempt to better predict the future circumstances related to the budget in order to prevent that administration procedures and communication with Fund instances affect the realization of the project activities.

3.7.2.b. Status of risk mitigation measures (for unforeseen risks)			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The scientific conference has been held online this year, supported by the application of the Microsoft Teams Live Event software.
2.	Yes	Yes	The project team will make an attempt to better predict the future circumstances related to the budget.

3.8. Publishable summary* – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.
<p><b>English</b> (up to 250 words)</p> <p>As a result of the project research, 9 scientific papers were published, out of which 7 conference papers and 2 original papers in relevant highly-ranked journals. One of the conference sessions of the International scientific conference on information technology and data related research held on October 17th 2020 was dedicated to the artificial intelligence and the ATLAS project.</p> <p>The project website was launched at <a href="https://ai.ipb.ac.rs/">https://ai.ipb.ac.rs/</a> with all relevant information, and the project was presented to the wider audience via social networks, including Researchgate, Instagram, Facebook and LinkedIn.</p> <p>The detailed analysis of mathematical models representing the theoretical foundation for spatial modelling in the ATLAS platform was performed and the report was made publicly available via project website. As a result of research, new theoretical results for non-additive measures and corresponding integrals were obtained, with applications in decision making.</p> <p>Furthermore, the geo-referenced air pollutants and meteorological data from 2008-2018 that cover Europe and the USA and calculated meteorological surface data for each measurement site from GDAS1 meteorological fields were collected.</p> <p>The public procurement of additional computing nodes that will deliver the CPU performance of 7.3 TFlops has been successfully organized and finalized. Finally, an infrastructure for data storage that supports relational databases was done and populated with representative data.</p> <p>In addition to acquisition of data from various third-party sources, air pollution-related data obtained under Covid-19 measures in the Belgrade area were also included in the ATLAS raw database.</p>
<p><b>Serbian</b> (up to 250 words)</p> <p>Kao rezultat istraživanja na projektu, 9 radova je objavljeno, od čega je 7 radova prezentovano na međunarodnoj konferenciji, dok su 2 rada objavljena u visokorangiranim naučnim časopisima. Jedna od sesija međunarodne konferencije posvećene informacionim tehnologijama i istraživanju podataka koja je održana 17. oktobra 2020. godine je posvećena veštačkoj inteligenciji i ATLAS projektu.</p> <p>Sajt projekta je dostupan putem linka <a href="https://ai.ipb.ac.rs/">https://ai.ipb.ac.rs/</a> sa svim relevantnim informacijama. Projekat je takođe predstavljen široj publici kroz profile na društvenim mrežama Researchgate, Instagram, Facebook i LinkedIn.</p> <p>Detaljna analiza matematičkih modela koja predstavlja teorijske osnove za prostorno modelovanje na ATLAS platformi je izvršena i izveštaj je postavljen na sajtu projekta kako bi bio javno dostupan. Kao rezultat istraživanja dobijeni su novi teorijski rezultati iz neaditivnih mera i odgovarajućih integrala sa primenom u donošenju odluka.</p>

Takođe, prikupljeni su geo-referencirani podaci o koncentracijama zagađujućih materija u vazduhu i meteorološkim parametrima za period 2008-2018. godine koji se odnose na Evropu i SAD, kao i izračunati meteorološki podaci za svako merno mesto na bazi GDAS1 meteorološkog polja.

Javna nabavka dodatnih kompjuterskih čvorova koji će biti obezbediti performanse procesora od 7,3 TFlops je uspešno organizovana i izvedena. Konačno, dizajnirana je i formirana infrastruktura za skladištenje podataka koja podržava relacione baze podataka i popunjena je reprezentativnim podacima.

Pored prikupljanja podataka iz različitih nezavisnih izvora, podaci o zagađenju vazduha dobijeni u okviru merenja tokom vanredne situacije zbog Covid-19 na području Beograda takođe su uključeni u sirovu bazu podataka ATLAS.

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

#### 4. Dissemination\*

**4.1. Scientific publications** – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.

[1] Nešić, N., Vidović, M., Radosavljević, I., Mitrović, A., Obradović, Đ. (2020). An End to End Learning Approach for Distance Estimation Trained with Artificially Generated Stereo Images. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-3-7

[2] Perišić, M., Jovanović, G., Vranić, A., Stanišić, S. (2020). Benzene Source Apportionment Using Bivariate Correlation and Regression Analyses. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-8-13

[3] Petrović, J., Jovanović, M. (2020). Conversational Agents for Learning Foreign Languages a Survey. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-14-22

[4] Stojić, A., Mustać, B., Jovanović, G. (2020). Explainable Machine Learning Prediction of PCB-138 Behavior Patterns in Edible Fish from Croatian Adriatic. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-23-28

[5] Jovanović, G., Stanišić, S., Perišić, M. (2020). Multifractal Characteristics of Criteria Air Pollutant Time Series in Urban Areas. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-29-34

[6] Stojić, A., Matek Sarić, M., Herceg Romanić, S. (2020). Shapley Additive Explanations of Indicator PCB-138 Distribution in Breast Milk. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-35-40

[7] Stanišić, S., Perišić, M., Stojić, A. (2020). The Use of Innovative Methodology for the Characterization of Benzene, Toluene, Ethylbenzene and Xylene Sources in the Belgrade Area. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research. doi:10.15308/Sinteza-2020-41-45

[8] Mihailović, B., Pap, E., Štrboja, M., & Simićević, A. (2020). A unified approach to the monotone integral-based premium principles under the CPT theory. *Fuzzy Sets and Systems*, 398, pp. 78-97.

[9] Zhang, D. and Pap, E., (2020). Fubini theorem and generalized Minkowski inequality for the pseudo-integral. *International Journal of Approximate Reasoning*, 122, pp. 9-23.

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

#### 4.2. Type of dissemination and communication activities\*

The PI, prof. Pap and project participant A. Stojić were keynote speakers in the plenary session of the International scientific conference on information technology and data related research, held on October 17th 2020, in Belgrade. One of the conference sessions was dedicated to the artificial intelligence and the ATLAS project. As a result of the project research, 9 scientific papers were published, out of which 7 conference papers and 2 original papers in relevant highly-ranked journals.

More information on the conference can be found at: <https://sinteza.singidunum.ac.rs/>

The conference proceedings can be found at: <http://portal.sinteza.singidunum.ac.rs/Media/files/2020/Sinteza-2020.pdf>

The papers published in journals can be found at:

<https://www.sciencedirect.com/science/article/abs/pii/S016501142030052X>

<https://www.sciencedirect.com/science/article/abs/pii/S0888613X2030150X>

Furthermore, the project website was launched at <https://ai.ipb.ac.rs/> with all relevant information, and the project was presented to the wider audience via social networks, including:

- Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>),
- Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)),
- Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and
- LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

The project PI, prof. Endre Pap and Andreja Stojić were guests on Sputnjik Srbija, and they were talking about the role of PARADOX supercomputer in the ATLAS project, which can be viewed at:

[https://www.youtube.com/watch?v=yND8umpCAdc&feature=emb\\_share&fbclid=IwAR13xWmetl15Yyyxyj7GzJynUH7g-nG4hw2rTPqwxot-XDcBHyUWwwpi6pl](https://www.youtube.com/watch?v=yND8umpCAdc&feature=emb_share&fbclid=IwAR13xWmetl15Yyyxyj7GzJynUH7g-nG4hw2rTPqwxot-XDcBHyUWwwpi6pl)

Andreja Stojić was guest at Vrt Fizike, a dedicated serial produced by the Institute of Physics Belgrade, and two radio station broadcasts, talking about the artificial intelligence, air pollution and the ATLAS project, which can be viewed/heard at:

<https://www.youtube.com/watch?v=nZGd2HgyPh4>, <https://www.emisijaeureka.rs/post/eureka-64-masinsko-ucenje-i-kvalitet-vazduha>, and <https://www.buzzsprout.com/708018/6399268>

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

5. Ethical approvals (if applicable)					
	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

5.1. If the ethical approval has not been obtained, please elaborate.
N/A

6. Additional information relevant for Project implementation (if needed)
N/A

7. Date and signature
We hereby confirm that all information in the Quarterly Administrative Report is accurate.
<b>Name and last name of the authorized person</b>
1. _____ date Leading SRO - Prof. Milovan Stanišić, President of Singidunum University
2. _____ date Project PI - Prof. Endre Pap, Singidunum University
3. _____ date SRO 1 - Dr. Aleksandar Bogojević, Director of Institute of Physics Belgrade

### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q2	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate**	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Gordana Jovanović	Research associate	IPB
Marija Mitrović Dankulov	Senior research associate	IPB
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US
Ana Vranić	Junior research assistant	IPB

\*Insert only names of the project participants who were engaged during this reporting period.

\*\*In case of any changes in the status of academic and research titles of team members, submit the appropriate decision on acquiring academic and research title of the team member(s) in question, justifying the change of the status.

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.

During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.
During the reporting period there was no unforeseen circumstances requiring a change in any of the team members, including the PI.

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestone title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M2.1 - Computing cluster online	M6	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a milestone is reached, enter N/A.

N/A
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**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M6	Yes	/
2.	WP 2 - Data and Computing Facilities	D2.1.1 - Report on integrated datasets	M6	Yes	/
3.	WP 2 - Data and Computing Facilities	D2.2 - Supercomputer upgrade	M6	Yes	/
4.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.2 - Technical report "Class model of a complex planar fuzzy object"	M6	Yes	/
5.	WP 4 - Computational Intelligence base: Software components	D4.1 - Software library of primitives for fuzzy spatial modelling	M6	Yes	/
6.	WP5 - Integrated platform	D5.2 - Models repository	M6	Yes	/

\*Based on tasks presented in Table 3.2. in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

\*\*Based on deliverables presented in Table 3.4 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

N/A
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**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the second quarter, the financial and administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project.



<p>As a result of the project research during the second quarter 2 original scientific papers in relevant highly-ranked journals (M21a and M21). Furthermore, the ATLAS PI, prof. Endre Pap has signed the contract with Springer international scientific publisher regarding the contribution of project participants in the forthcoming monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence. The Springer monograph Artificial Intelligence: Theory and Applications will be an up-to-date collection of knowledge in AI and environmental research, dedicated to the results of ATLAS project. The proofreading of 8 papers prepared for publishing in the Springer monograph was financed by the project financial resources.</p> <p>During the second quarter, the first part of the supercomputer upgrade equipment arrived at the IPB. The equipment was successfully integrated, increasing the PARADOX-IV cluster's capacity with additional 240 CPU cores or approximately 5 TFlops. Within deliverable D2.2, we reported the procurement process, the integration of the purchased equipment into the existing cluster, as well as corresponding testing and validation.</p> <p>Previously collected geo-referenced air pollutants and meteorological data and produced meteorological surface data were unified into corresponding datasets. The process of dataset production and usage guidelines are documented in the deliverable D2.1.1.</p> <p>The technical report “Class model of a complex planar fuzzy object” was accomplished and published on Project site. In brief, our approach to modelling complex fuzzy planar objects relies upon Linear fuzzy space, GEOS - Geometry Engine - Open Source (<a href="https://trac.osgeo.org/geos/">https://trac.osgeo.org/geos/</a>), and Shapely Project (<a href="https://shapely.readthedocs.io/en/stable/">https://shapely.readthedocs.io/en/stable/</a>). The model follows GEOS architecture, which is modified as to support imprecise spatial data. Accordingly, our model consists of: (1) Geometries: fPoint, fLineString, fPolygon, fMultiPoint, fMultiLineString, fMultiPolygon, fGeometryCollection; (2) Predicates: flintersects, fTouches, fDisjoint, fCrosses, fWithin, fContains, fOverlaps, fEquals, fCovers; (3) Operations: fUnion, fDistance, flIntersection, fSymmetric Difference, fConvex Hull, fEnvelope, fBuffer, fSimplify, fPolygon Assembly, fValid, fArea, fLength. Software library of primitives for fuzzy spatial modelling was implemented as Python package/library implementation. Library consists of: basic planar imprecise geometric objects (fuzzy point, fuzzy line, fuzzy triangle and fuzzy circle), basic measurement functions (distance between fuzzy point and fuzzy line, fuzzy point and fuzzy triangle, two fuzzy lines and two fuzzy triangles), as well as of spatial operation (linear combination of two fuzzy points) and main spatial relations (coincidence, between and collinear).</p> <p>Library is publicly available at: <a href="https://gitlab.com/obradovic.djordje/linearfuzzyspace">https://gitlab.com/obradovic.djordje/linearfuzzyspace</a></p> <p>Our approach to establishing models repository relies upon OpenML approach (<a href="https://www.researchgate.net/publication/263890323_OpenML_Networked_science_in_machine_learning">https://www.researchgate.net/publication/263890323_OpenML_Networked_science_in_machine_learning</a>).</p> <p>Our repository model is a subset of the entire OpenML model, which adapts concepts Task type, Task, Flow, and Run proposed by the OpenML architecture to better serve specific requirements of environmental science, in particular air quality control. Full document is available on Project site.</p>
<p><b>3.6. Project deviations (recommended up to 250 words) –</b> In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.</p>
<p>N/A</p>

<p><b>3.7. Project risks</b></p>			
<p><b>3.7.1.a. Foreseen risks -</b> the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.</p>			
Risk No.	Description of risk	Work Packages/Tasks concerned	Risk-mitigation measures (as in Project Description)
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Procurement	WP 2 - Data and Computing Facilities	The IPB team has experience in sourcing this type of equipment and reliable market estimate, so the planned equipment was delivered on time.
3.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The Report on integrated datasets was successfully done, after problematic data was excluded from further analyses

			by preprocessing and verification of the raw data.
4.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The technical report "Class model of a complex planar fuzzy object" was successfully done after improvement and elimination of non-adequate methods.

3.7.1.b. Status of risk mitigation measures			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	No	Yes	The measures proposed in Project description were adequate.
2.			
...			

3.7.2.a. Unforeseen Risks – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).			
Risk No.	Description of risk	Work Packages/Tasks concerned	Proposed risk-mitigation measures
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during the second quarter of the project.
2.	Budgetary issues	WP 1 - Coordination, Management, and Dissemination/ D1. – Project Management Plan	Delay in receiving budget funds. The project team will make an attempt to better predict the future circumstances related to the budget.

3.7.2.b. Status of risk mitigation measures (for unforeseen risks)			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.
2.	Yes	Yes	The project team PI will regularly contact the Fund of Science regarding the financial issues and attempt to find the way to overcome the circumstances and financial difficulties.

3.8. Publishable summary* – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.
<p><b>English</b> (up to 250 words)</p> <p>During the second quarter of the ATLAS project, the smooth coordination between SRO members and across activities was established and meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application. As a result of the project research 2 original scientific papers in relevant highly-ranked journals (M21a and M21). Furthermore, the project PI has signed the contract with Springer international scientific publisher regarding the contribution of project participants in the forthcoming monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, dedicated to the results of ATLAS project.</p> <p>The first part of the supercomputer upgrade equipment arrived at the IPB and was successfully integrated, increasing the PARADOX-IV cluster's capacity with additional 240 CPU cores or approximately 5 TFlops. Previously collected geo-referenced air pollutants and meteorological data and produced meteorological surface data were unified into corresponding datasets. The approach to modelling complex fuzzy planar objects relied upon Linear fuzzy space, GEOS - Geometry Engine - Open Source (<a href="https://trac.osgeo.org/geos/">https://trac.osgeo.org/geos/</a>), and Shapley Project</p>

(<https://shapely.readthedocs.io/en/stable/>). Software library of primitives for fuzzy spatial modelling was implemented as Python package/library implementation. Our repository model was organized as a subset of the entire OpenML model, which adapts concepts Task type, Task, Flow, and Run proposed by the OpenML architecture to better serve specific requirements of environmental science.

**Serbian** (up to 250 words)

Tokom drugog kvartala ATLAS projekta uspostavljena je neometana koordinacija aktivnosti učesnika projekta, a sastanci tima su redovno održavani, u cilju podržavanja razvoja teorijske osnove veštačke inteligencije i njene primene za potrebe istraživanja. Rezultati istraživanja koja su sprovedena u okviru projekta su objavljena u 2 originalna rada u visokorangiranim časopisima kategorije M21 i M21a. Takođe, rukovodilac projekta je sa Springer international scientific publisher potpisao ugovor o doprinosu učesnika projekta u izradi monografije Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence koja će biti posvećena rezultatima projekta.

Prvi deo opreme za nadogradnju superkompjutera je stigao na Institut za fiziku nakon čega je uspešno integrisan, što je povećalo kapacitet PARADOX-IV cluster za dodatnih 240 procesora ili približno 5 TFlops. Prethodno prikupljeni georeferentni meteorološki podaci i podaci o koncentracijama zagađujućih materija u vazduhu su objedinjene u odgovarajuće skupove podataka. Pristup modelovanju složenih fuzzy planar objekata se oslanjao na Linear fuzzy space, GEOS - Geometry Engine - Open Source (<https://trac.osgeo.org/geos/>), i Shapley Project (<https://shapely.readthedocs.io/en/stable/>). Softverska biblioteka primitive za fuzzy prostorno modeliranje je implementirana u okviru Python package/library implementation. Naš model repozitorijuma je organizovan kao podskup OpenML modela koji prilagođava koncepte Task type, Task, Flow, and Run koji je predložila OpenML arhitektura kako bi bolje služio specifičnim zahtevima nauke o životnoj sredini.

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

#### 4. Dissemination\*

**4.1. Scientific publications** – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.

1. Stanišić, S., Perišić, M., Jovanović, G., Milićević, T., Romanić, S.H., Jovanović, A., Šošćarić, A., Udovičić, V. & Stojić, A. (2021) The PM<sub>2.5</sub>-bound polycyclic aromatic hydrocarbon behavior in indoor and outdoor environments, Part I: emission sources. Environmental Research, 110520.
2. Vranić, A., Mitrović Dankulov, M. (2021) Growth signals determine the topology of evolving networks. Journal of Statistical Mechanics: Theory and Experiment 013405.

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

#### 4.2. Type of dissemination and communication activities\*

As a result of the project research during the second quarter 2 original scientific papers in relevant highly-ranked journals (M21a and M21). Furthermore, the ATLAS PI, prof. Endre Pap has signed the contract with Springer international scientific publisher regarding the contribution of project participants in the forthcoming monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence. The Springer monograph Artificial Intelligence: Theory and Applications will be an up-to-date collection of knowledge in AI and environmental research, dedicated to the results of ATLAS project. The proofreading of 8 papers prepared for publishing in the Springer monograph was financed by the project financial resources.

The papers published in journals can be found at:

<https://www.sciencedirect.com/science/article/abs/pii/S0013935120314171>

<https://iopscience.iop.org/article/10.1088/1742-5468/abd30b/meta>

The relevant information on project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

5. Ethical approvals (if applicable)					
	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				
2.	N/A				
3.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

<b>5.1. If the ethical approval has not been obtained, please elaborate.</b>
N/A

<b>6. Additional information relevant for Project implementation (if needed)</b>

<b>7. Date and signature</b>
We hereby confirm that all information in the Quarterly Administrative Report is accurate.
<p><b>Name and last name of the authorized person</b></p> <p>1. _____ date _____                  Leading SRO (stamp)</p> <p>2. _____ date _____                  Project PI</p> <p>3. _____ date _____                  SRO 1 (stamp)</p>

## Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q3	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Gordana Jovanović*	Research associate	IPB
Marija Mitrović Dankulov	Senior research associate	IPB
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US
Ana Vranić	Junior research assistant	IPB

\* The project team member Gordana Jovanović was hired until April 27, 2021, and after that, her engagement was taken over by Mirjana Perišić.

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.

During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.

During the reporting period, the project team member Gordana Jovanović started using maternity leave. According to the approval from Science Found of the Republic of Serbia, her engagement was transferred to team member Mirjana Perišić.

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestone title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M9	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a milestone is reached, enter N/A.

N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M9	Yes	/
2.	WP 2 - Data and Computing Facilities	D2.1.2 - Database online	M8	Yes	/
3.	WP 3 - Data and Computing Facilities	D3.3 - Technical report "Specification of the software tool for managing complex planar fuzzy spatial models"	M9	Yes	/
4.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.4 - Conference papers	M9	Yes	/
5.	WP5 - Integrated platform	D5.4 - Computation management infrastructure	M8	Yes	/

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

N/A

**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the third quarter, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project. As a result of the project research during the third quarter, the conference paper was presented at the 11th International

Conference on Information Society and Technology – ICIST 2021, and one original scientific paper is published in relevant highly-ranked journal Information Sciences (M21).

During the third quarter, The Springer monograph Artificial Intelligence: Theory and Applications, an up-to-date collection of knowledge in AI and environmental research, dedicated to the results of the ATLAS project was finished and prepared for publishing. A printed version of the book is expected to be published during the fourth quarter of the Project.

During the third quarter, the rest of the supercomputer upgrade equipment arrived at IPB. The equipment was successfully integrated, increasing the capacity of the PARADOX-IV cluster with additional 240 CPU cores or approximately 5 TFlops. As part of the deliverable D2.2, we reported the procurement procedure, the integration of the purchased equipment into the existing cluster, as well as the appropriate testing and validation. The system installation report from April 27 will be the part of the additional documentation of the project report Q3.

During the third quarter, previously collected geo-reference air pollutants and meteorological data and produced meteorological surface data were combined into appropriate data sets. Within deliverable D2.1.2 - Database online, the corresponding data are now available on the servers of the Institute of Physics Belgrade.

The technical report “Specification of the software tool for managing complex planar fuzzy spatial models” was accomplished and published on the Project site. In addition to functionalities comprising previously proposed fuzzy models of complex planar objects, our model of the software tool introduced two ontological models. The first model is an ontology of geospatial data which provides the semantic foundation of geospatial data integration and sharing. To manage uncertainties in data, the original ontology proposed in the paper “Geospatial data ontology: the semantic foundation of geospatial data integration and sharing” (2019) was extended with elements that support fuzzy semantics of geospatial data relations. The second model is an ontology that describes Machine Learning domain. The basis which we adopted for our software tool is an ontology described in the paper “A Machine Learning Ontology” (2020), which consists of seven top classes (Algorithms, Applications, Dependencies, Dictionary, Frameworks, Involved, and MLTypes). We have modified this model to enable fuzzy descriptions of the classes Algorithms, Applications, Dependencies, and Frameworks expressing their suitability for the specific ML task.

#### D5.4 - Computation management infrastructure

During the third quarter, computational management infrastructure, a solution that provides a unified environment for running machine learning experiments and research project management was established. The solution is a microservice oriented web platform that can be used to manage research projects, catalogue datasets, define, validate, and execute machine learning experiments. Some of the advantages of the presented solution are its ability to integrate experiments directly into the research project management process, and to automatically version and validate those experiments with respect to the constraints imposed by the authors or reviewers of the experiments. An additional advantage of the solution is the use of the graphical DSL to define experiments, thus allowing researchers who are not skilled in programming to use the ATLAS platform.

**3.6. Project deviations (recommended up to 250 words) –** In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.

N/A

### 3.7. Project risks

**3.7.1.a. Foreseen risks** - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.

Risk No.	Description of risk	Work Packages/Tasks concerned	Risk-mitigation measures (as in Project Description)
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Procurement	WP 2 - Data and Computing Facilities	The IPB team has experience in sourcing this type of equipment and reliable market estimate, so the planned equipment was delivered on time.
3.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The Report on integrated datasets was successfully done, after unreliable data was

			excluded from further analyses by preprocessing and verification of the raw data.
4.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The technical report "Specification of the software tool for managing complex planar fuzzy spatial models" was successfully done after improvement and elimination of non-adequate methods.

**3.7.1.b. Status of risk mitigation measures**

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	No	Yes	The measures proposed in Project description were adequate.

**3.7.2.a. Unforeseen Risks** – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).

Risk No.	Description of risk	Work Packages/Tasks concerned	Proposed risk-mitigation measures
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during the third quarter of the project.
2.	Budgetary issues	WP 1 - Coordination, Management, and Dissemination/ D1. – Project Management Plan	Delay in receiving budget funds. The PI and the project team will make an attempt to better predict the future circumstances related to the budget.
3.	Project member replacement	WP 1 - Coordination, Management, and Dissemination/ D1.1 - Project Management Plan	Due to the use of maternity leave a member of the project team Gordana Jovanović, a redistribution of her engagement on the project is planned so that the remaining months will be transferred to another member of the project team. According to the approval from Science Found of the Republic of Serbia, her engagement was transferred to team member Mirjana Perišić.

**3.7.2.b. Status of risk mitigation measures (for unforeseen risks)**

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.
2.	Yes	Yes	The project team PI will regularly contact the Fund of Science regarding the financial issues and attempt to find the way to overcome the circumstances and financial difficulties.



3.	Yes	Yes	The project team PI contacts the Fund of Science regarding the appropriate replacement of the project team member, and in the meantime, approval for the engagement's redistribution was received.
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**3.8. Publishable summary\*** – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.

**English** (up to 250 words)

During the third quarter of the ATLAS project, the smooth coordination between SRO members and across activities was established and meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application. As a result of the project, a research conference paper was presented at the 11th International Conference on Information Society and Technology – ICIST 2021. The forthcoming monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, dedicated to the results of the ATLAS project was finished, and printed books are expected in the next period.

The supercomputer upgrade is completed at the IPB and new equipment was successfully integrated, increasing the PARADOX-IV cluster's capacity with additional 240 CPU cores or approximately 5 TFlops. Previously collected geo-referenced air pollutants and meteorological data and produced meteorological surface data were unified into corresponding datasets available at the IPB servers.

The approach to modelling complex fuzzy planar objects relied upon Linear fuzzy space, GEOS - Geometry Engine - Open Source (<https://trac.osgeo.org/geos/>), and Shapely Project (<https://shapely.readthedocs.io/en/stable/>). A software library of primitives for fuzzy spatial modelling was implemented as Python package/library implementation. Our repository model was organized as a subset of the entire OpenML model, which adapts concepts Task type, Task, Flow, and Run proposed by the OpenML architecture to better serve specific requirements of environmental science.

**Serbian** (up to 250 words)

Tokom trećeg kvartala ATLAS projekta uspostavljena je neometana koordinacija aktivnosti učesnika projekta, a sastanci tima su redovno održavani, u cilju podržavanja razvoja teorijske osnove veštačke inteligencije i njene primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su na međunarodnoj konferenciji – ICIST 2021. Takođe, završena je monografija Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence koja će biti posvećena rezultatima projekta, i u narednom period očekuje se objavljivanje online i štampane verzije knjige.

Kompletirana je nadogradnja superkompjuteru na Institutu za fiziku u Beogradu, oprema je uspešno integrisana, što je povećalo kapacitet PARADOX-IV cluster za dodatnih 240 procesora ili približno 5 TFlops. Prethodno prikupljeni geo-referentni meteorološki podaci i podaci o koncentracijama zagađujućih materija u vazduhu objedinjeni su u odgovarajuće baze podataka, dostupne na serverima Instituta za fiziku u Beogradu.

Pristup modelovanju složenih fuzzy planar objekata se oslanjao na Linear fuzzy space, GEOS - Geometry Engine - Open Source (<https://trac.osgeo.org/geos/>), i Shapely Project (<https://shapely.readthedocs.io/en/stable/>).

Softverska biblioteka primitive za fuzzy prostorno modeliranje je implementirana u okviru Python package/library implementation. Naš model repozitorijuma je organizovan kao podskup OpenML modela koji prilagođava koncepte Task type, Task, Flow, and Run koji je predložila OpenML arhitektura kako bi bolje služio specifičnim zahtevima nauke o životnoj sredini.

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

**4. Dissemination\***

**4.1. Scientific publications** – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.

1. Nedović Ljubo, Pap Endre and Dragić Đorđe (2021) Aggregation of triangle of distortion functions. *Information Sciences*, 563, pp: 401-417.
2. Ivan Radosavljević, Đorđe Obradović, Zora Konjović, Aleksandra Mitrović, Stanko Gavrić, Mladen Vidović and Nebojša Nešić (2021) Experiment-driven system for machine learning based research management. *11th International Conference on Information Society and Technology – ICIST 2021*, Mar 7-10, Kopaonik, Serbia.

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

**4.2. Type of dissemination and communication activities\***

As a result of the project original scientific paper was published in the international journal Information Sciences, and a research conference paper was presented at the 11th International Conference on Information Society and Technology – ICIST 2021. Also, the ATLAS project was presented by Andreja Stojić within the national presentation of the Horizon 2020 project on April 22nd (National Initiatives for Open Science – NI4OS): <http://media.rcub.bg.ac.rs/wp-content/uploads/wp-uploads/2021/04/07-Andreja-Stojic.mp4>

The relevant information on project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

5. Ethical approvals (if applicable)					
	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

**5.1. If the ethical approval has not been obtained, please elaborate.**

N/A

**6. Additional information relevant for Project implementation (if needed)**

N/A

**7. Date and signature**

We hereby confirm that all information in the Quarterly Administrative Report is accurate.

Name and last name of the authorized person

1. \_\_\_\_\_ date \_\_\_\_\_  
 Leading SRO (stamp)

2. \_\_\_\_\_ date \_\_\_\_\_  
 Project PI

3. \_\_\_\_\_ date \_\_\_\_\_  
 SRO 1 (stamp)

### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q4	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Svetlana Stanišić	Full professor	US
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.
During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.
NO

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestone title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M12	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

If a milestone is reached, enter N/A.

N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M12	Yes	/
2.	WP 1 - Coordination, Management, and Dissemination	D1.3.1 - Communication Strategy and Action Plan	M12	Yes	/
3.	WP 4 - Computational Intelligence base: Software components	D4.2 - Software tool for managing complex planar fuzzy spatial models	M12	Yes	/
4.	WP 4 - Computational Intelligence base: Software components	D4.3 - Software library of primitives for advanced spatio temporal process modelling	M12	Yes	/
5.	WP 5 - Integrated platform	D5.5 - Presentation layer	M12	Yes	/

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

If a deliverable is reached, enter N/A.

N/A

**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the Q4, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project.

As a result of the project research during the fourth quarter, one conference paper was presented at the *6<sup>th</sup> Conference on Mathematics in Engineering: Theory and Applications*, and five conference paper was presented at the *5<sup>th</sup> International Conference of Experimental and Numerical Investigations and New Technologies*.

The printed version of Springer monograph *Artificial Intelligence: Theory and Applications* (from the series *Studies in Computational Intelligence*), an up-to-date collection of knowledge in AI and environmental research, dedicated to the results of the ATLAS project became available in the fourth quarter.

<p>A prototype version of the Software tool for managing complex planar fuzzy spatial models (D4.2) (<a href="http://pc80-53.ipb.ac.rs/">http://pc80-53.ipb.ac.rs/</a>) is implemented with aim to integrate all services/tools/libraries into one software system according to specification given in the technical report “Specification of the software tool for managing complex planar fuzzy spatial models”. It consists of three main packages: user management, data management and advanced spatio temporal process management (D4.3). Data management is implemented as tool for intelligent data filtering, exploration, presentation, validation and annotation. Presentation layers (D5.5) are implemented as collection of components for data views like map, table and graph view as an integral part for all data filters. They are implemented as an extension to open-source libraries for map presentation (openlayers, leaflet), graph presentation (D3js) and table presentation (Vuetify, material table component).</p>
<p><b>3.6. Project deviations (recommended up to 250 words) –</b> In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.</p>
N/A

<b>3.7. Project risks</b>			
<b>3.7.1.a. Foreseen risks</b> - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.			
<b>Risk No.</b>	<b>Description of risk</b>	<b>Work Packages/Tasks concerned</b>	<b>Risk-mitigation measures (As in Project Description)</b>
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Procurement	WP 2 - Data and Computing Facilities	The IPB team has experience in sourcing this type of equipment and reliable market estimate, so the planned equipment was delivered on time.
3.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The Report on integrated datasets was successfully done, after unreliable data was excluded from further analyses by preprocessing and verification of the raw data.
4.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	The technical report “Specification of the software tool for managing complex planar fuzzy spatial models” was successfully done after improvement and elimination of non-adequate methods.

<b>3.7.1.b. Status of risk mitigation measures</b>			
<b>Risk No.</b>	<b>Did the risk occur?</b>	<b>Did you apply risk mitigation measures?</b>	<b>If the risk still applies, describe the next steps for risk mitigation.</b>
1.	No	Yes	The measures proposed in Project description were adequate.

<b>3.7.2.a. Unforeseen Risks</b> – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).			
<b>Risk No.</b>	<b>Description of risk</b>	<b>Work Packages/Tasks concerned</b>	<b>Proposed risk-mitigation measures</b>
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. -	The team meetings have been held online during the fourth quarter of the project.

		Communication Strategy and Action Plan.	
2.	Budgetary issues	WP 1 - Coordination, Management, and Dissemination/ D1. – Project Management Plan	During the fourth quarter, thanks to constant communication between the project PI and the employees in The Science Fund, all the circumstances that led to delays in the disbursement of funds were overcome. All budget funds which were late in the previous period arrived so that the second year of the project is entered without payment delay.
3.	Project member replacement	WP 1 - Coordination, Management, and Dissemination/ D1.1 - Project Management Plan	Due to the use of maternity leave during the fourth quarter of the project, the employment of a member of the project team Gordana Jovanović was transferred to Mirjana Perišić.

#### 3.7.2.b. Status of risk mitigation measures (for unforeseen risks)

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.
2.	Yes	Yes	The risk has been successfully overcome.
3.	Yes	Yes	The risk has been successfully overcome.

#### 3.8. Publishable summary\* – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.

##### English (up to 250 words)

During the fourth quarter of the ATLAS project, the smooth coordination between SRO members and across activities was established and meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application. As a result of the project, a six research conference papers were presented at the 6<sup>th</sup> Conference on Mathematics in Engineering: Theory and Applications and at the 5<sup>th</sup> International Conference of Experimental and Numerical Investigations and New Technologies. The monograph *Artificial Intelligence: Theory and Applications*, was published as a printed book.

A software tool prototype is implemented enabling integration of all services/tools/libraries into one software system. It consists of three main packages: user management, data management and advanced spatio temporal process management. They are implemented as an extension to open source libraries for map presentation (openlayers, leaflet), graph presentation (D3js) and table (Vuetify, material table component).

##### Serbian (up to 250 words)

Tokom četvrtog kvartala ATLAS projekta uspostavljena je neometana koordinacija aktivnosti učesnika projekta, a sastanci tima su redovno održavani, u cilju podržavanja razvoja teorijske osnove veštačke inteligencije i njene primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su na međunarodnim konferencijama CNN TECH Conference 2021. i 6th Conference on Mathematics in Engineering: Theory and Applications. Takođe, monografija posvećena rezultatima projekta *Artificial Intelligence: Theory and Applications*, objavljena je u okviru Springerove serije *Studies in Computational Intelligence*, i dostupna je u štampanom izdanju.

Implementiran je prototip softvera koji omogućava integraciju svih neophodnih servisa/alata/biblioteka u jedan softverski sistem. Sastoji se od tri glavna paketa koji omogućavaju upravljanje sa stanovišta korisnika, upravljanje podacima, i napredno upravljanje modelima prostorno vremenskih procesa. Implementiran je kao ekstenzija open source biblioteka za mapiranje (openlayers, leaflet), grafičku (D3js) i tabelarnu (Vuetify, material table component) prezentaciju.

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

4. Dissemination*
<b>4.1. Scientific publications</b> – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.
<ol style="list-style-type: none"><li>1. Pap, E. (Editor) (2021) Artificial Intelligence: Theory and Applications, Springer, Studies in Computational Intelligence 973. <a href="https://www.springer.com/gp/book/9783030727109">https://www.springer.com/gp/book/9783030727109</a></li><li>2. Pap, E. (2021) Mathematical base for Artificial Intelligence, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 3-30.</li><li>3. Stojić, A., Mustać, B., Jovanović, G., Đinović Stojanović, J., Perišić, M., Stanišić, S., Herceg Romanić, S. (2021) Explainable machine learning prediction of PCB-138 behavior patterns in edible fish from Croatian Adriatic, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 175-189.</li><li>4. Jovanović, G., Matek Sarić, M., Herceg Romanić, S., Stanišić, S., Mitrović Dankulov, M., Popović, A., Perišić, M. (2021) Patterns of PCB-138 occurrence in the breast milk of primiparae and multiparae using SHapley Additive exPlanations analysis, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 191-206.</li><li>5. Stanišić, S., Perišić, M., Jovanović, G., Maletić, D., Vudragović, D., Vranić, A., Stojić, A. (2021) What information on volatile organic compounds can be obtained from the data of a single measurement site through the use of artificial intelligence? in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 207-225.</li><li>6. Obradović, Đ., Konjović, Z., Pap, E., Šošćarić, A. (2021) The Linear Fuzzy Space: Theory and Applications, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 227-253.</li><li>7. Pap, E., Nedović, Lj., Ralević, N. (2021) Image fuzzy segmentation using aggregated distance functions and pixel descriptors, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 255-273.</li><li>8. Nešić, N., Vidović, M., Radosavljević, I., Mitrović, A., Obradović, Đ. (2021) A generative model for the creation of large synthetic image datasets used for distance estimation, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 275-291.</li><li>9. Stanišić, N., Radojević, T., Stanić, N. (2021) Appraisal of Apartments in Belgrade using Hedonic Regression: Model Specification, Predictive Performance, Suitability for Mass Appraisal, and Comparison with Machine Learning Methods, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence, 293-312.</li><li>10. Dorde Dragić, Endre Pap and Ljubo Nedović (2021) Agregacija fazi mera, The 6th Conference on Mathematics in Engineering: Theory and Applications, June 11-13th, Novi Sad, Serbia.</li><li>11. Mirjana Perišić, Andreja Stojić, Gordana Jovanović, Andrej Šošćarić, Dimitrije Maletić, Dušan Vudragović, Svetlana Stanišić (2021) The potential for forecasting the particulate matter levels in complex urban environment, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia; <a href="http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf">http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf</a></li><li>12. Andreja Stojić, Gordana Jovanović, Svetlana Stanišić, Andrej Šošćarić, Ana Vranić, Marija Mitrović Dankulov, Mirjana Perišić (2021) The impact of humidity and temperature on particulate matter environmental fate, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia; <a href="http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf">http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf</a></li><li>13. Svetlana Stanišić, Mirjana Perišić, Andreja Stojić, Andrej Šošćarić, Dušan Vudragović, Dimitrije Maletić, Gordana Jovanović (2021) The impact of gaseous pollutants on particulate matter distribution, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia; <a href="http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf">http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf</a></li><li>14. Nikola Stupar, Ana Vranić, Andreja Stojić, Gordana Vuković, Dušan Vudragović, Dimitrije Maletić, Marija Mitrović Dankulov (2021) Spatio-temporal analysis of mobility patterns in the city of Belgrade, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia; <a href="http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf">http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf</a></li><li>15. Gordana Jovanović, Svetlana Stanišić, Mirjana Perišić, Andrej Šošćarić, Marija Mitrović Dankulov, Ana Vranić, Andreja Stojić (2021) Environmental factors governing particulate matter distribution in an urban environment,</li></ol>

International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia; [http://cnntechno.com/docs/5\\_CNN\\_book\\_of\\_abstracts.pdf](http://cnntechno.com/docs/5_CNN_book_of_abstracts.pdf)

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

**4.2. Type of dissemination and communication activities\***

As results of the project were published at the international conferences CNN TECH Conference 2021 and 6th Conference on Mathematics in Engineering: Theory and Applications journal Information Sciences.

The relevant information on project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

**5. Ethical approvals (if applicable)**

	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

**5.1. If the ethical approval has not been obtained, please elaborate.**

N/A

**6. Additional information relevant for Project implementation (if needed)**

N/A

**7. Date and signature**

We hereby confirm that all information in the Quarterly Administrative Report is accurate.

Name and last name of the authorized person

1. \_\_\_\_\_ date \_\_\_\_\_  
 Leading SRO (stamp)

2. \_\_\_\_\_ date \_\_\_\_\_  
 Project PI

3. \_\_\_\_\_ date \_\_\_\_\_  
 SRO 1 (stamp)



## Annual Project Progress Report

### 1. General Information

1.1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Total Project budget:		
Project realization period (from dd/mm/yyyy to dd/mm/yyyy):	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Annual Report	

1.2. Project participants information		
1.2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)		
Name and last name of the PI:	Endre Pap	
Academic and research title of the PI:	Full professor	
SRO name:	University Singidunum	
SRO authorized person (legal representative) name and last name:	Milovan Stanišić	

1.2.2 Project Partners - Science and Research Organizations (SRO) *		
SRO name:	Institute of Physics Belgrade	
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević	

\*Copy this table as needed to provide information about all Partner SROs.

## 2. Annual Project Summary

### 2.1. Project and Progress Summary – brief description of annual project objectives, methodology, impact, and ambition with progress summary and achieved results for reporting period. \*

Within the reporting one-year period, the project team members were performing their tasks and all project activities have been successfully carried out in compliance with the proposal. Potential risks which could hinder the smooth implementation of the project have been identified and the related issues have been resolved. The computer cluster was purchased and installed into the existing PARADOX-IV high-performance infrastructure. Within research activities, project team members have accomplished and published on the project website The report on integrated datasets, The mathematical models of fuzzy spatial primitives, The class model of a complex planar fuzzy object and The specification of the software tool for managing complex planar fuzzy spatial models, which describe all research activities in details. The smooth coordination between team members has been ensured through online meetings, the financial and administrative issues were successfully managed, and the project impact was maximized through the website (<https://ai.ipb.ac.rs/>) and a campaign based on social networks, 14 conference papers, 4 journal papers and 8 book chapters in the Springer monograph Artificial Intelligence: Theory and Applications, dedicated to the results of ATLAS project. As can be concluded, the Project team has made efforts to offer distinct improvements in current research approach by providing theoretical foundations for effective spatial data and process modelling and dynamical decision making under uncertainty. As a result, we expect the ATLAS to provide the advance in AI science, facilitate the implementation of AI methods in data-driven research, and improve air pollution research and data access.

\*Recommended up to 250 words.

## 3. Project Implementation - Annual Overview

### 3.1 Project results overview

#### 3.1. Summary of the annual Project results (as foreseen in Project Description) - short narrative description of the Project Results developed in the first year of project implementation. \*

As foreseen in project description, data of publicly available air pollutant and meteorological data were obtained, preprocessed and made available online through an infrastructure for heterogeneous data storage that supports relational, key-value, document, and graph-oriented databases, as well as GIS extensions. The report Mathematical models of fuzzy spatial primitives was done presenting the theoretical foundation for advanced modelling of spatio-temporally-defined data and processes in ATLAS platform. Formal (mathematical and object) dynamical models for intelligent spatial modelling were developed and stored in the model repository, while research has also yielded new theoretical results for non-additive measures and corresponding integrals with applications in decision making. This established repository was designed to serve specific requirements of environmental science, in particular air quality control. A prototype version of the software tool for managing complex planar fuzzy spatial models (D4.2) (<http://pc80-53.ipb.ac.rs/>) was implemented with aim to integrate all services/tools/libraries into one software system for running machine learning virtual experiment. As a result of project activities and research, 4 technical reports, 14 conference papers, 4 journal papers and 8 book chapters have been published so far.

\*Recommended up to 250 words.

**3.1.1. In case of deviation or delay, please explain.**

If all results scheduled for reporting period are reached, enter N/A.\*

N/A

\*Recommended up to 250 words.

**3.2. Progress of the annual project activities for reporting period****3.2.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestone's title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	Computing cluster online	M6	Yes	/
2.	Workshops, open forums, and meetings on the ATLAS activities	M21	Yes	/

\* Based on milestones planned in Table 3.2d in the Project Description A (Approved Project Proposal - Project Description, in accordance with the Decision of the Managing Board) and Gantt Chart (Annex 3 of the Contract on the Project financing).

**3.2.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.2.d in the Project Description and Gantt Chart (Annex of the Contract on the Project financing).

If all milestones scheduled for reporting period are reached, enter N/A. Recommended up to 250 words.

N/A

**3.2.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Work package number *	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.1 - Project Management Plan	M1	Yes	/
2.	WP 1 - Coordination, Management, and Dissemination	D1.3.2 – Project website	M3	Yes	/
3.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M12	Yes	/

4.	WP 1 - Coordination, Management, and Dissemination	D1.3.1 - Communication Strategy and Action Plan	M12	Yes	/
5.	WP 2 - Data and Computing Facilities	D2.1.1 - Report on integrated datasets	M6	Yes	/
6.	WP 2 - Data and Computing Facilities	D2.2 - Supercomputer upgrade	M6	Yes	/
7.	WP 2 - Data and Computing Facilities	D2.1.2 - Database online	M8	Yes	/
8.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.1 - Technical report "Mathematical models of fuzzy spatial primitives"	M3	Yes	/
9.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.2 - Technical report "Class model of a complex planar fuzzy object"	M6	Yes	/
10.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.3 - Technical report "Specification of the software tool for managing complex planar fuzzy spatial models"	M9	Yes	/
11.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.4 - Conference papers	M9	Yes	/
12.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.5 - Journal papers	M15	Yes	/
13.	WP 4 - Computational Intelligence base: Software components	D4.1 - Software library of primitives for fuzzy spatial modelling	M6	Yes	/
14.	WP 4 - Computational Intelligence base: Software components	D4.2 - Software tool for managing complex planar fuzzy spatial models	M12	Yes	/
15.	WP 4 - Computational Intelligence base: Software components	D4.3 - Software library of primitives for advanced spatio temporal process modelling	M12	Yes	/
16.	WP 5 - Integrated platform	D5.1 - Data and information management layer	M3	Yes	/

17.	WP 5 - Integrated platform	D5.2 - Models repository	M6	Yes	/
18.	WP 5 - Integrated platform	D5.4 - Computation management infrastructure	M8	Yes	/
19.	WP 5 - Integrated platform	D5.5 - Presentation layer	M12	Yes	/
20.	WP 5 - Integrated platform	D5.7 - Published scientific papers	M20	Yes	/

\*Based on work packages presented in Table 3.2b in the Project Description A (Approved Project Proposal - Project Description, in accordance with the Decision of the Managing Board) and Gantt Chart (Annex 3 of the Contract on the Project financing).

\*\*Based on deliverables presented in Table 3.2c in the Project Description A (Approved Project Proposal - Project Description, in accordance with the Decision of the Managing Board) and Gantt Chart (Annex 3 of the Contract on the Project financing).

**3.2.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

If all deliverables scheduled for reporting period are reached, enter N/A. **Recommended up to 250 words.**

N/A

### 3.3. Implementation plan

#### 3.3.1. Please shortly describe if project activities were implemented in line with approved project schedule – Gantt Chart \*

All project activities have been so far implemented in compliance with approved project schedule as described in Gantt Chart. During the first year, project activities to be carried out were split into 4 main WPs (WP2 to WP5), whilst coordination, management and dissemination were being addressed through WP1. As previously mentioned, the smooth coordination between team members has been ensured through online meetings and the financial and administrative issues were successfully managed. The WP2 is related to data deployment, population and operation, integration and combination of air pollution modelling results, as well as with equipment procurement. Regarding this, the computer upgrade has been purchased and integrated, while the related technical reports have been published and made publicly available on the project website. The implementation of WP3 activities was aimed at establishing a solid theoretical foundation for model-based spatio-temporal systems study and development of the decision-making models base, while the implementation of WP4 activities was related to the development of the software implementations supporting models defined in WP3. Finally, the implementation of WP5 activities was aimed at developing and integrating all components in the platform encompassing data and information management layer, computation management layer, and presentation layer so far. As described in the project proposal, the implementation represented a consistent intertwining of the most recent achievements and trends in spatio-temporal systems modelling and service-oriented computing. The potential risks which could hinder the smooth implementation of the project have been identified and the related issues have been resolved in due time.

### 3.4. Scientific publications

#### 3.4.1. Insert the full reference with the link of the publication.

Type of scientific publication*	DOI	Full reference	Publication status**
article in journal	doi: 10.1016/j.fss.2020.02.006	Mihailović, B., Pap, E., Štrboja, M., & Simićević, A. (2020). A unified approach to the monotone integral-based premium principles under the CPT theory. <i>Fuzzy Sets and Systems</i> , 398, pp. 78-97.	published
article in journal	doi: 10.1016/j.ijar.2020.03.010	Zhang, D. and Pap, E., (2020). Fubini theorem and generalized Minkowski inequality for the pseudo-integral. <i>International Journal of Approximate Reasoning</i> , 122, pp. 9-23.	published
article in journal	doi: 10.1016/j.envres.2020.110520	Stanišić, S., Perišić, M., Jovanović, G., Milićević, T., Romanić, S.H., Jovanović, A., Šošćarić, A., Udovičić, V. & Stojić, A. (2021) The PM2.5-bound polycyclic aromatic hydrocarbon behavior in indoor and outdoor environments, Part I: emission sources. <i>Environmental Research</i> , 110520.	published
article in journal	doi: 10.1088/1742-5468/abd30b	Vranić, A., Mitrović Dankulov, M. (2021) Growth signals determine the topology of evolving networks. <i>Journal of Statistical Mechanics: Theory and Experiment</i> 013405.	published
publication in conference/workshop	doi:10.15308/Sinteza-2020-3-7	Nešić, N., Vidović, M., Radosavljević, I., Mitrović, A., Obradović, Đ. (2020). An End to End Learning Approach for Distance Estimation Trained with Artificially Generated Stereo Images. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published
publication in conference/workshop	doi:10.15308/Sinteza-2020-8-13	Perišić, M., Jovanović, G., Vranić, A., Stanišić, S. (2020). Benzene Source Apportionment Using Bivariate Correlation and Regression Analyses. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published
publication in conference/workshop	doi:10.15308/Sinteza-2020-14-22	Petrović, J., Jovanović, M. (2020). Conversational Agents for Learning Foreign Languages a Survey. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published
publication in conference/workshop	doi:10.15308/Sinteza-2020-23-28	Stojić, A., Mustač, B., Jovanović, G. (2020). Explainable Machine Learning Prediction of PCB-138 Behavior Patterns in Edible Fish from Croatian Adriatic. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published
publication in conference/workshop	doi:10.15308/Sinteza-2020-29-34	Jovanović, G., Stanišić, S., Perišić, M. (2020). Multifractal Characteristics of Criteria Air Pollutant Time Series in Urban Areas. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published

publication in conference/workshop	doi:10.15308/Sinteza-2020-35-40	Stojić, A., Matek Sarić, M., Herceg Romanić, S. (2020). Shapley Additive Explanations of Indicator PCB-138 Distribution in Breast Milk. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published
publication in conference/workshop	doi:10.15308/Sinteza-2020-41-45	Stanišić, S., Perišić, M., Stojić, A. (2020). The Use of Innovative Methodology for the Characterization of Benzene, Toluene, Ethylbenzene and Xylene Sources in the Belgrade Area. Paper presented at Sinteza 2020 - International Scientific Conference on Information Technology and Data Related Research.	published
publication in conference/workshop		Dragić, Đ., Pap, E., Nedović, Lj. (2021) Agregacija fazi mera, The 6th Conference on Mathematics in Engineering: Theory and Applications, June 11-13th, Novi Sad, Serbia.	published
publication in conference/workshop	ISBN: 978-86-6060-077-8	Perišić, M., Stojić, A., Jovanović, G., Šošćarić, A., Maletić, D., Vudragović, D., Stanišić, S. (2021) The potential for forecasting the particulate matter levels in complex urban environment, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia.	published
publication in conference/workshop	ISBN: 978-86-6060-077-8	Stojić, A., Jovanović, G., Stanišić, S., Šošćarić, A., Vranić, A., Mitrović Dankulov, M., Perišić, M. (2021) The impact of humidity and temperature on particulate matter environmental fate, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia.	published
publication in conference/workshop	ISBN: 978-86-6060-077-8	Stanišić, S., Perišić, M., Stojić, A., Šošćarić, A., Vudragović, D., Maletić, D., Jovanović, G. (2021) The impact of gaseous pollutants on particulate matter distribution, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia.	published
publication in conference/workshop	ISBN: 978-86-6060-077-8	Stupar, N., Vranić, A., Stojić, A., Vuković, G., Vudragović, D., Maletić, D., Mitrović Dankulov, M. (2021) Spatio-temporal analysis of mobility patterns in the city of Belgrade, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia.	published
publication in conference/workshop	ISBN: 978-86-6060-077-8	Jovanović, G., Stanišić, S., Perišić, M., Šošćarić, A., Mitrović Dankulov, M., Vranić, A., Stojić, A. (2021) Environmental factors governing particulate matter distribution in an urban environment, International Conference of Experimental and Numerical Investigations and New Technologies - CNN TECH, 29 Jun – 02 July Zlatibor, Serbia.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Pap, E. (2021) Mathematical base for Artificial Intelligence, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Stojić, A., Mustać, B., Jovanović, G., Đinović Stojanović, J., Perišić, M., Stanišić, S., Herceg Romanić, S. (2021) Explainable machine learning prediction of PCB-138 behavior patterns in edible fish from Croatian Adriatic, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published

book chapter	doi: 10.1007/978-3-030-72711-6	Jovanović, G., Matek Sarić, M., Herceg Romanić, S., Stanišić, S., Mitrović Dankulov, M., Popović, A., Perišić, M. (2021) Patterns of PCB-138 occurrence in the breast milk of primiparae and multiparae using SHapley Additive exPlanations analysis, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Stanišić, S., Perišić, M., Jovanović, G., Maletić, D., Vudragović, D., Vranić, A., Stojić, A. (2021) What information on volatile organic compounds can be obtained from the data of a single measurement site through the use of artificial intelligence? in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Obradović, Đ., Konjović, Z., Pap, E., Šoštarić, A. (2021) The Linear Fuzzy Space: Theory and Applications, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Pap, E., Nedović, Lj., Ralević, N. (2021) Image fuzzy segmentation using aggregated distance functions and pixel descriptors, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Nešić, N., Vidović, M., Radosavljević, I., Mitrović, A., Obradović, Đ. (2021) A generative model for the creation of large synthetic image datasets used for distance estimation, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
book chapter	doi: 10.1007/978-3-030-72711-6	Stanišić, N., Radojević, T., Stanić, N. (2021) Appraisal of Apartments in Belgrade using Hedonic Regression: Model Specification, Predictive Performance, Suitability for Mass Appraisal, and Comparison with Machine Learning Methods, in monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence.	published
publication in conference/workshop		Radosavljević, I., Obradović, Đ., Konjović, Z., Mitrović, A., Gavrić, S., Vidović, M., Nešić, N. (2021) Experiment-driven system for machine learning based research management. 11th International Conference on Information Society and Technology – ICIST 2021, Mar 7-10, Kopaonik, Serbia.	published

Important note: state only publications that were referenced and accepted within the project Quarterly Administrative Reports.

\* Type of scientific publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.



3.5. Open research data				
3.5.1. Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.				
DOI	Title with short description (specify the data in terms of size, structure, format, to whom the dataset is accessible, is it primary or secondary data, what are the terms of use etc.)	Is the data set openly accessible?	Is the data set reusable?	If the dataset is linked to a publication, specify the DOI of the publication
/				

3.6. Intellectual property rights resulting from the project (if applicable to this project)				
3.6.1. Insert all necessary information regarding intellectual property rights				
Type of IP Rights	Date of the application	Official title of the application	Has the IPR protection been awarded?	If available, official publication number of award of protection
/				

3.7. Ethical approvals (if applicable)					
	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
	/				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

3.8. Environmental and social management
3.8.1. Please describe project impact on environment. In case that your research involves the use of elements that may cause harm to humans, environment, to animals or plants, if your research has negative impact to any vulnerable individuals or groups, if the new or old equipment is not disposed properly, if project implementation includes discharge of wastewater and/or requires environmental protection measures, if existing employees of the SRO(s) are not regularly registered for pension and disability insurance, or in case your project has any other environmental and social management effects, please shortly describe relevant environmental and social management. Otherwise, state N/A.
N/A

## 4. Scientific Impact – Annual Overview

### 4.1. Please describe scientific impact of project activities and results in the first year of project implementation

The project activities in the first year of implementation contributed to AI science development, offered the fundamental advance in AI theoretical foundations and bridged the gap in the current knowledge and approach to modelling of spatial data and spatial processes. As regards environmental science, project results facilitated the implementation of AI methods in data-driven environmental research, thus improving air pollution research and data access. As a result of project activities and research, 4 technical reports, 14 conference papers, 4 journal papers and 8 book chapters have been published so far. The project activities in the first year have also enabled project team members, especially younger ones, to develop new competences, skills and approaches, while in the second year of project we expect the publicly available relevant scientific data to be ready for use by researchers from the country, the region, and the rest of the world, which could contribute to strengthening academic cooperation and internationalization within the field of higher education institutions, institutes, and other beneficiary institutions/parties.

\*Recommended up to 250 words.

## 5. Project Management Information - Annual Overview

### 5.1. Project management information – please describe the overall program management, team performance, collaboration among team members and partner institutions (management of scientific, administrative, and financial tasks and dissemination and visibility activities).

During the first year of project activities, management of financial and administrative issues of the project and the consortium was in line with the standards, the smooth coordination between project team members and across activities was ensured, the high level engagement of SROs across all activities of the project was coordinated successfully, and the effective campaign of communication, dissemination, and engagement activities ensured maximized impact of the project output.

We have been working on a coherent, long-term communication strategy for knowledge management, entailing the development of several communication tools tailored to communicate the project highlights, raise and maintain the interest and awareness of the targeted audience, including research communities, academia, policy-makers, as well as other direct and indirect stakeholders and beneficiaries. The effective dissemination of the project was actively pursued throughout the first year of duration across all its activities, entailing 4 peer-reviewed scientific papers in relevant journals, 8 book chapters and 14 conference papers with conclusions and recommendations that will provide comprehensive information on the ATLAS findings relevant for the scientific community, the public and policymakers, as well as social media and other resources including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>) that can generate interest by communicating public benefits of the ATLAS and its findings.

\*Recommended up to 250 words.

## 6. Risk Management – Annual Overview

6.1. Risk management in the first year of project implementation - methodology risks, timing, milestones and deliverables, participants and scientific institutions, procurement, budgetary issues, and other risks.			
Type of risk*	Category**	Describe in detail the risks and the risk management actions, applied mitigation measures, undertaken actions and their results. Were the measures successful? What was the result of these actions? If the risks still apply, state expected time frame of the risk mitigation. What are the possible implications to project implementation if the risks are not resolved?	Risk level***
Methodology risk	Foreseen risk	<p>The methodology risks were related to bad performing computational intelligence methods and the uncertainties in air pollution modelling, however, the mitigation measures proposed in the Project description were adequate and the risk has been successfully overcome.</p> <p>After elimination and improvement of non-adequate methods, the technical report “Class model of a complex planar fuzzy object” was successfully done.</p> <p>After new theoretical results for non-additive measures and corresponding integrals were obtained, with applications in decision making, the report Mathematical models of fuzzy spatial primitives was successfully done.</p> <p>After the problematic data were excluded from further analyses by preprocessing and verification of the raw data, the Report on integrated datasets was successfully done.</p> <p>The aforementioned risks do not apply anymore, but if the issues were not resolved, it could endanger the success of the Project or the results quality.</p>	High
Work packages, deliverables and milestones	Foreseen risk	<p>The possible risk was related to a malfunction of the high-performance computer. In case the issue was registered, the Project team would have to rely on a smaller number of computing processors, however, no equipment malfunction was observed.</p> <p>The possible risk was also related to difficulties in delivery of platform or other milestones and deliverables. However, the mitigation measures proposed in the Project description were adequate and the flexibility has been built into the timing of the delivery ensuring minimum impact of potential delays. The aforementioned risks could endanger the success of the Project or the results quality and they apply during the Project lifespan, but the mitigation measures proposed in the Project description will be regularly implemented.</p>	Medium
Procurement	Foreseen risk	<p>The possible risk was related to the fact that the planned equipment could be unavailable on the market or not delivered on time. However, the IPB team has experience in sourcing this type of equipment and reliable market estimate, so the planned equipment was delivered on time. The aforementioned risk does not apply anymore, but if the issue was not resolved, it could endanger the success of the Project or the results quality.</p>	Low

Members of the project team and SROs	Foreseen risk	The possible risk was related to difficulties in coordination among and within WPs, and tasks delivery. However, WP coordinators brought the best practices regarding coordination among WPs and team members, and the risk has been successfully overcome. The aforementioned risk does not apply anymore, but if the coordination and management would not be functional and effective, it could endanger the success of the Project or the results quality.	Low
Members of the project team and SROs	Unforeseen risk	The unforeseen risk was related to the use of maternity leave, due to which the engagement of the Project team member Gordana Jovanović had to be redistributed so that the remaining months are transferred to another member of the Project team. By the end of the third quarter, Project team PI had not received approval from the Science Fund of the Republic of Serbia for the planned replacement, but finally the employment of a member of the project team Gordana Jovanović was transferred to Mirjana Perišić during the fourth quarter of the Project and the risk has been successfully overcome.	Low
The Covid-19 imposed pandemic	Unforeseen risk	Unforeseen risks were associated with the Covid-19 pandemic. Some scientific conferences planned for 2020 have been cancelled, and some have been held online this year. The international conference Sinteza, planned in Q2 at Singidunum University, was held online using Microsoft Teams Live Event software. Also, due to the pandemic, the study trip of the project participant from the Institute of Physics was not accomplished, so the planned funds will be redirected to some other category through the budget rebalance. Team meetings were held online during the first year of the project, so the risk was partly overcome.	Medium
Budgetary issues – the complexity of the administrative procedures	Unforeseen risk	The unforeseen risk was related to the delay in receiving budget funds. The first payment was used for ordering the necessary equipment to prevent that delay hugely affect the realization of the Project activities. During the fourth quarter, thanks to effective communication between the project PI and the employees in The Science Fund, all the circumstances that led to delays in the disbursement of funds were overcome. All budget funds which were late in the previous period arrived so that the second year of the Project is entered without payment delay. As the risk still applies, the Project team PI will regularly contact the Fund of Science regarding the financial issues and attempt to find the way to overcome the circumstances and financial difficulties. Furthermore, the Project team will try to better predict the future circumstances related to the budget in order to prevent that administration procedures and communication with Fund instances affect the realization of the Project activities.	Medium

\* Type of risk: methodology risks, timing, milestones and deliverables, participants and scientific institutions, procurement, budgetary issues, and other risks.

\*\* Categories: foreseen risk and unforeseen risk.

\*\*\*Risk level: high, medium, low.

<b>6.2. Risk management in the second year of project implementation - methodology risks, timing, milestones and deliverables, participants and scientific institutions, procurement, budgetary issues, and other risks.</b>		
Type of risk*	Describe the possible risks, risk management actions that will be undertaken and their desired results and applicable mitigation measures. What are the possible implications to project implementation if the risks are not to be resolved?	Risk level **

Work packages, deliverables and milestones	<p>The possible risk is related to a malfunction of the high-performance computer. In case the issue is registered, the Project team will have to rely on a smaller number of computing processors.</p> <p>The possible risk is also related to difficulties in delivery of platform or other milestones and deliverables. However, the flexibility has been built into the timing of the delivery ensuring minimum impact of potential delays. The aforementioned risks could endanger the success of the Project or the results quality and they apply during the Project lifespan, but the mitigation measures proposed in the Project description will be regularly implemented.</p>	Medium
Budgetary issues – the complexity of the administrative procedures	<p>The unforeseen risk is related to the delay in receiving budget funds. As the risk still applies, the Project team will try to better predict the future circumstances related to the budget in order to prevent that administration procedures and communication with Fund instances affect the realization of the Project activities.</p> <p>Some budget items were not fully realized due to the constraints created in the circumstances of the COVID-19 pandemic, so the remaining funds will be redirected to other categories within the budget rebalance.</p>	Medium

\* Type of risk: methodology risks, timing, milestones and deliverables, participants and scientific institutions, procurement, budgetary issues, and other risks.

\*\*Risk level: high, medium, low.

## 7. Promotion, Publicity, and Visibility – Annual Overview

7.1. Project promotion, publicity, and visibility	
Type of dissemination and communication activities*	Link (if available)
<ol style="list-style-type: none"> <li>1. The ATLAS project was presented by Andreja Stojić within the national presentation of the Horizon 2020 project on April 22nd (National Initiatives for Open Science – NI4OS).</li> <li>2. The ATLAS PI, prof. Endre Pap has signed the contract with Springer international scientific publisher regarding the contribution of project participants in the monograph Artificial Intelligence: Theory and Applications, Springer series – Studies in Computational Intelligence. The Springer monograph Artificial Intelligence: Theory and Applications is an up-to-date collection of knowledge in AI and environmental research, dedicated to the results of ATLAS project.</li> <li>3. The PI, prof. Pap and project participant A. Stojić were keynote speakers in the plenary session of the International scientific conference on information technology and data related research, held on October 17th 2020, in Belgrade. One of the conference sessions was dedicated to the artificial intelligence and the ATLAS project.</li> <li>4. The project PI, prof. Endre Pap and Andreja Stojić were guests on Sputnjik Srbija, and they were talking about the role of PARADOX supercomputer in the ATLAS project.</li> <li>5. Andreja Stojić was guest at Vrt Fizike, a dedicated serial produced by the Institute of Physics Belgrade, and two radio station broadcasts, talking about the artificial intelligence, air pollution and the ATLAS project.</li> <li>6. The relevant information on project was presented to the wider audience via Project website.</li> <li>7. The relevant information on project was presented to the wider audience via Researchgate.</li> <li>8. The relevant information on project was presented to the wider audience via Instagram.</li> <li>9. The relevant information on project was presented to the wider audience via Facebook.</li> <li>10. The relevant information on project was presented to the wider audience via LinkedIn.</li> </ol>	<ol style="list-style-type: none"> <li>1. <a href="http://media.rcub.bg.ac.rs/wp-content/uploads/wp-uploads/2021/04/07-Andreja-Stojic.mp4">http://media.rcub.bg.ac.rs/wp-content/uploads/wp-uploads/2021/04/07-Andreja-Stojic.mp4</a></li> <li>2. <a href="https://www.springer.com/gp/book/9783030727109">https://www.springer.com/gp/book/9783030727109</a></li> <li>3. <a href="https://sinteza.singidunum.ac.rs/">https://sinteza.singidunum.ac.rs/</a></li> <li>4. <a href="https://www.youtube.com/watch?v=yND8umpCAdc&amp;feature=emb_share&amp;fbclid=IwAR13xWmetl15Yyyxjy7GzJynUH7g-nG4hw2rTPqwxot-XDcBHyUWwwpi6pl">https://www.youtube.com/watch?v=yND8umpCAdc&amp;feature=emb_share&amp;fbclid=IwAR13xWmetl15Yyyxjy7GzJynUH7g-nG4hw2rTPqwxot-XDcBHyUWwwpi6pl</a></li> <li>5. <a href="https://www.youtube.com/watch?v=nZGd2HqyPh4">https://www.youtube.com/watch?v=nZGd2HqyPh4</a>, <a href="https://www.emisijaeureka.rs/post/eureka-64-masinsko-ucenje-i-kvalitet-vazduha">https://www.emisijaeureka.rs/post/eureka-64-masinsko-ucenje-i-kvalitet-vazduha</a>, and <a href="https://www.buzzsprout.com/708018/6399268">https://www.buzzsprout.com/708018/6399268</a></li> <li>6. <a href="https://ai.ipb.ac.rs/">https://ai.ipb.ac.rs/</a></li> <li>7. <a href="https://www.researchgate.net/project/ATLAS-Project-2020">https://www.researchgate.net/project/ATLAS-Project-2020</a></li> <li>8. <a href="https://www.instagram.com/atlas_project_2020/">https://www.instagram.com/atlas_project_2020/</a></li> <li>9. <a href="https://www.facebook.com/ATLAS-Project-2020-123071872871429">https://www.facebook.com/ATLAS-Project-2020-123071872871429</a></li> <li>10. <a href="https://www.linkedin.com/company/atlas-project-2020">https://www.linkedin.com/company/atlas-project-2020</a></li> </ol>

\*Organisation of a conference, organisation of a workshop, press release, non-scientific and non-peer reviewed publications (popularised publications), exhibition, flyers, training, social media, website, communication campaign (e.g. radio, TV), participation to a conference, participation to a workshop, participation to an event other than a conference or workshop, video/film, brokerage event, pitch event, trade fair, the type of audience reached and other.

## 8. Annual Financial Overview

8.1. Annual Financial Overview		
8.1.1. An integral part of this report is Annual Financial Progress Report, which form is separately attached in Excel format. Information provided in this report should be in line with the approved budget and approved realised costs.		
Total amount received for the reporting period in EUR*	Project realised cost for the reporting period in EUR**	Unspent funds at the end of the first year in EUR (deviation)***
122.533.38 €	117.335.86 €	5.197.52 €

\*Total amount received for all SROs in total.

\*\* Total amount of realised costs for all SROs in total.

\*\*\* Unspent funds at the end of the first year should be equal to total amount received for the reporting period lowered for project realised costs for the reporting period.

8.1 2. Briefly describe financial management of the project in the first year of implementation, total amount planned by the approved project budget vs amount spent, all deviations and challenges that were encountered related to the financial aspects of the project management. *
<p>The total amount received for the project during the first year was 122,533 EUR, while the project realized costs were 117,336 EUR. Unspent funds – the positive deviation for the reporting period is 5,197 EUR. During the first year of the ATLAS project, 16 members of the project team were engaged, and fees for researchers amounted to a total of 90,638 EUR (item Personnel). The Project plan included the purchase of equipment, and the budget item Equipment (upgrade of the existing equipment of PARADOX supercomputer) in the amount of EUR 31,963 was successfully realized. The main deviations in project costs occurred within the items Travel (700 EUR), Conference and Publications (2,237 EUR), and Dissemination (2,118 EUR). Due to the COVID-19 pandemic, there were no opportunities for project participants from the Institute of Physics to realize the planned trips to the international workshop (during the Q4). The remaining funds within the item Travel will be redirected to some other categories through the budget rebalance. Project participants from Singidunum University attended international conferences online, and the remaining funds will be redirected for the further conferences (in the second year of the project). The international conference at Singidunum University planned for dissemination of the project results was also organized online, and the intended funds were partially spent on publishing the monograph (proofreading and preparation for publishing) and the rest redirected for the purchasing of printed editions of the monograph Artificial Intelligence: Theory and Applications. Minimal deviations in the categories Equipment and Consumables are a consequence of delays in the public procurement procedure in the Institute of Physics Belgrade, or differences in the exchange rate during the ordering of computer equipment. The rest of the funds will be spent within the same categories during the second year of the project.</p>

**Date and signature**

We hereby confirm that all information in the Annual Report is accurate.

**Name and last name of the authorized person**

1. \_\_\_\_\_

Leading SRO (stamp)

\_\_\_\_\_

date

2. \_\_\_\_\_

Project PI

\_\_\_\_\_

date

3. \_\_\_\_\_

SRO 1 (stamp)

\_\_\_\_\_

date



### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q5	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Svetlana Stanišić	Full professor	US
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.
During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.
NO

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

Milestone title – insert milestone name*		Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M15	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a milestone is reached, enter N/A.

N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

Tasks/activities*		Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 – Coordination Progress Report	M15	Yes	/
2.	WP 3 - Computational Intelligence base: Theoretical foundations	D3.5 – Journal papers	M15	Yes	/
3.	WP 4 - Computational Intelligence base: Software components	D4.4 - Software tool for managing complex spatio-temporal process models	M14	Yes	/
4.	WP 4 - Computational Intelligence base: Software components	D4.5 - Software implementations of ranking indices	M15	No	M18
5.	WP 5 - Integrated platform	D5.3 - Virtual experiment	M15	Yes	/
6.	WP 5 - Integrated platform	D5.6 - Knowledge base and collaboration infrastructure	M14	Yes	/

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

The software components of the basic ranking indices for models' rankings are implemented for precise data, while the implementations of fuzzy ranking indices are not finished yet. The reason for this deviation from the plan is the perceived need for more sophisticated ranking mechanisms in the case of spatially-temporally determined data capable of including temporal inaccuracies. It is expected that it would be realized by the end of the Q6 (M18).

**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the Q5, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project.  
 As a result of the project research during the Q5, one conference paper was presented at the Theoretical and Foundational Problems in Information Studies, and one scientific paper was published in the scientific journal Fuzzy Sets and Systems.

During the research phase Q5, significant research efforts were focused on further software implementation of the ATLAS platform with the aim of establishing an infrastructure for experimental design and production. Two significant results have been achieved. The first is the integration of the Jupyter platform and the ATLAS platform. The second is the integration of the Atlas platform and Apache Spark™ multi-language engine for executing data engineering, data science, and machine learning on single-node machines or clusters.

**3.6. Project deviations (recommended up to 250 words)** – In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.

In the previous period, the PI of the ATLAS project sent a proposal for the budget rebalance, so a response from the Science Fund is expected. If the rebalance is accepted, there will be significant changes in the purpose of budget funds by the end of the project.

3.7. Project risks			
3.7.1.a. Foreseen risks - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.			
Risk No.	Description of risk	Work Packages/Tasks concerned	Risk-mitigation measures (As in Project Description)
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	Relatively scarce theoretical research results in the field of evaluation of machine learning models in conditions of inaccuracy and uncertainty affect the quality of ranking indices. The efforts are in progress that investigate comparison and suitability of the indices.
3.	Methodology risk	WP 4 - Computational Intelligence base: Software components	Mechanisms for binding rather diverse software components are necessary. Risk-mitigation measures here are exceptionally careful design and/or selection of the software components and virtualization.

3.7.1.b. Status of risk mitigation measures			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The measures proposed in Project description were adequate.

3.7.2.a. Unforeseen Risks – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).			
Risk No.	Description of risk	Work Packages/Tasks concerned	Proposed risk-mitigation measures
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during the fifth quarter of the project.

3.7.2.b. Status of risk mitigation measures (for unforeseen risks)			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.

3.8. Publishable summary* – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.
<p><b>English</b> (up to 250 words)</p> <p>During the fifth quarter of the ATLAS project, the coordination between SRO members and across activities was intensified through technical meetings that take place three times per week, aimed at further development of the AI theoretical base and, particularly, its application to ATLAS platform. As a result of the project, one research conference paper was presented at the Theoretical and Foundational Problems in Information Studies, and one scientific paper was published in the scientific journal <i>Fuzzy Sets and Systems</i>.</p> <p>The Jupyter platform, which is fully integrated with ATLAS platform, provides an infrastructure for flexible and rich interactive design of experiments. In addition, integration of the Atlas platform and Apache Spark™ engine enables execution of the machine learning tasks on single-node machines or clusters.</p> <p><b>Serbian</b> (up to 250 words)</p> <p>Tokom petog kvartala ATLAS projekta intenzivirana je komunikacija učesnika projekta putem tehničkih sastanaka koji se održavaju tri puta nedeljno u cilju daljeg razvoja teorijske osnove veštačke inteligencije i njihove primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su na međunarodnoj konferenciji <i>Theoretical and Foundational Problems in Information Studies</i>, a jedan rad je publikovan u časopisu <i>Fuzzy Sets and Systems</i>.</p> <p>Jupiter platforma, koja je u potpunosti integrisana sa ATLAS platformom, pruža infrastrukturu za fleksibilan i bogat interaktivni dizajn eksperimenata. Pored toga, integracija Atlas platforme i Apache Spark™ endžina omogućava izvršavanje zadataka mašinskog učenja na mašinama sa jednim čvorom ili klasterima.</p>

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

4. Dissemination*
<p><b>4.1. Scientific publications</b> – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.</p> <ol style="list-style-type: none"> <li>1. E. Pap, Pseudo-analysis as a tool of information processing, Proceedings conference Theoretical and Foundational Problems in Information Studies (TFP), Online, 12–19 September 2021. <a href="http://tipis.com">http://tipis.com</a></li> <li>2. D. Zhang, R. Mesiar, E. Pap, Pseudo-integral and generalized Choquet integral, <i>Fuzzy Sets and Systems</i>, <a href="https://doi.org/10.1016/j.fss.2020.12.005">https://doi.org/10.1016/j.fss.2020.12.005</a></li> </ol>

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

4.2. Type of dissemination and communication activities*
<p>The relevant information on project was presented to the wider audience via social networks, including the Project website (<a href="https://ai.ipb.ac.rs/">https://ai.ipb.ac.rs/</a>), Researchgate (<a href="https://www.researchgate.net/project/ATLAS-Project-2020">https://www.researchgate.net/project/ATLAS-Project-2020</a>), Instagram (<a href="https://www.instagram.com/atlas_project_2020/">https://www.instagram.com/atlas_project_2020/</a>), Facebook (<a href="https://www.facebook.com/ATLAS-Project-2020-123071872871429">https://www.facebook.com/ATLAS-Project-2020-123071872871429</a>) and LinkedIn (<a href="https://www.linkedin.com/company/atlas-project-2020">https://www.linkedin.com/company/atlas-project-2020</a>).</p>

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

5. Ethical approvals (if applicable)					
	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval

Science Fund of the Republic of Serbia  
Quarterly Administrative Report

1.	N/A				
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\*List all documentation (approvals, decisions etc.) required by relevant laws.

<b>5.1. If the ethical approval has not been obtained, please elaborate.</b>
N/A

<b>6. Additional information relevant for Project implementation (if needed)</b>
N/A

<b>7. Date and signature</b>
We hereby confirm that all information in the Quarterly Administrative Report is accurate.
<b>Name and last name of the authorized person</b>
1. _____ date _____ Leading SRO (stamp)
2. _____ date _____ Project PI
3. _____ date _____ SRO 1 (stamp)

### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q6	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Svetlana Stanišić	Full professor	US
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US
Ana Vranić	Research assistant	IPB

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.
During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.

NO

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestone title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M18	Yes	/
2.	M4.1 - Functional verification of the software components	M16	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a milestone is reached, enter N/A.

N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 – Coordination Progress Report	M18	Yes	/
2.	WP 1 - Coordination, Management, and Dissemination	D1.3.1 - Communication Strategy and Action Plan	M18	Yes	/
3.	WP 4 - Computational Intelligence base: Software components	D4.5 - Software implementations of ranking indices	M18	Yes	/
4.	WP 4 - Computational Intelligence base: Software components	D4.6 - Software implementations of the hybrid probabilistic-possibilistic utility model	M16	Yes	/

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

Deliverable D4.5 - Software implementations of ranking indices (in WP 4 - Computational Intelligence base: Software components), remaining from the previous period, was realized during of the Q6.

**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the Q6, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project. As a result of the project research during the Q6, two conference papers was presented at the Eighth International WEBIOPATR Workshop & Conference Particulate Matter: Research and Management, and four scientific papers were published, two in the scientific journals Fuzzy Sets and Systems, one in journal Mathematics, and one in Chemosphere. During the research phase Q6, significant research efforts were focused on further software implementation of the ATLAS platform with the aim of establishing an infrastructure for experimental design and production.

<p><b>3.6. Project deviations (recommended up to 250 words)</b> – In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.</p>
<p>In the previous period, the budget rebalance proposal was accepted by the Science Fund, but the disbursement of funds was not realized during Q6. Due to the delay in payment from Science Fund, salaries and fees were not paid to the team members, nor was the planned equipment ordered (approved by the budget revision).</p>

<b>3.7. Project risks</b>			
<b>3.7.1.a. Foreseen risks</b> - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.			
<b>Risk No.</b>	<b>Description of risk</b>	<b>Work Packages/Tasks concerned</b>	<b>Risk-mitigation measures (As in Project Description)</b>
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	Relatively scarce theoretical research results in the field of evaluation of machine learning models in conditions of inaccuracy and uncertainty affect the quality of ranking indices. The efforts are in progress that investigate comparison and suitability of the indices.
3.	Methodology risk	WP 4 - Computational Intelligence base: Software components	Mechanisms for binding rather diverse software components are necessary. Risk-mitigation measures here are exceptionally careful design and/or selection of the software components and virtualization.

<b>3.7.1.b. Status of risk mitigation measures</b>			
<b>Risk No.</b>	<b>Did the risk occur?</b>	<b>Did you apply risk mitigation measures?</b>	<b>If the risk still applies, describe the next steps for risk mitigation.</b>
1.	Yes	Yes	The measures proposed in Project description were adequate.

<b>3.7.2.a. Unforeseen Risks</b> – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).			
<b>Risk No.</b>	<b>Description of risk</b>	<b>Work Packages/Tasks concerned</b>	<b>Proposed risk-mitigation measures</b>
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during Q6.
2.	Budgetary issues	WP 1 - Coordination, Management, and Dissemination/ D1. – Project Management Plan	Delay in receiving budget funds. The project team will make an attempt to better predict the future circumstances related to the budget.



3.7.2.b. Status of risk mitigation measures (for unforeseen risks)			
Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.
2.	Yes	Yes	The project team PI contacted the Fund of Science regarding the financial issues and attempt to find the way to overcome the circumstances and financial difficulties.

3.8. Publishable summary* – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.
<p><b>English</b> (up to 250 words)</p> <p>During the Q6 of the ATLAS project, the coordination between SRO members and across activities was intensified through technical meetings that take place three times per week, aimed at further development of the AI theoretical base and, particularly, its application to ATLAS platform. As a result of the project, two conference papers was presented at the Eighth International WEBIOPATR Workshop &amp; Conference Particulate Matter: Research and Management, and four scientific papers were published, two in the scientific journals Fuzzy Sets and Systems, one in journal Mathematics, and one in Chemosphere.</p> <p>The Jupyter platform, which is fully integrated with ATLAS platform, provides an infrastructure for flexible and rich interactive design of experiments. In addition, integration of the Atlas platform and Apache Spark™ engine enables execution of the machine learning tasks on single-node machines or clusters.</p>
<p><b>Serbian</b> (up to 250 words)</p> <p>Tokom šestog kvartala ATLAS projekta održavana je redovna komunikacija učesnika projekta putem tehničkih sastanaka koji se održavaju tri puta nedeljno u cilju daljeg razvoja teorijske osnove veštačke inteligencije i njihove primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su na međunarodnoj konferenciji <i>Eighth International WEBIOPATR Workshop &amp; Conference Particulate Matter: Research and Management</i>, dva rada su publikovana u časopisu <i>Fuzzy Sets and Systems</i>, jedan u časopisu <i>Mathematics</i> i jedan u <i>Chemosphere</i>.</p> <p>Jupiter platforma, koja je u potpunosti integrisana sa ATLAS platformom, pruža infrastrukturu za fleksibilan i bogat interaktivni dizajn eksperimenata. Pored toga, integracija Atlas platforme i <i>Apache Spark™</i> endžina omogućava izvršavanje zadataka mašinskog učenja na mašinama sa jednim čvorom ili klasterima.</p>

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

4. Dissemination*
<p><b>4.1. Scientific publications</b> – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.</p> <ol style="list-style-type: none"> <li>Zhang, D., &amp; Pap, E. (2022). Generalized pseudo-integral Jensen's inequality for <math>((\oplus 1, \otimes 1), (\oplus 2, \otimes 2))</math>-pseudo-convex functions. <i>Fuzzy Sets and Systems</i>, 430, 126-143.</li> <li>Pap, E. (2021). Four Types of Fixed-Point Theorems for Multifunctions in Probabilistic Metric Spaces. <i>Mathematics</i>, 9(24), 3212.</li> <li>Zhang, D., Mesiar, R., &amp; Pap, E. (2022). Jensen's inequality for Choquet integral revisited and a note on Jensen's inequality for generalized Choquet integral. <i>Fuzzy Sets and Systems</i>, 430, 79-87.</li> <li>Stojić, A., Jovanović, G., Stanišić, S., Herceg Romanić, S., Šoštarić, A., Udovičić, V., Perišić, M., Milićević, T. (2022). The PM2.5-bound polycyclic aromatic hydrocarbon behavior in indoor and outdoor environments, part II: explainable prediction of benzo [a] pyrene levels. <i>Chemosphere</i>, 289, 133154.</li> <li>Perišić, M. (2021). The hybrid computational approach in revealing particulate matter related processes, 8th International WeBIOPATR Workshop &amp; Conference Particulate Matter: Research and Management, Decembar 1<sup>st</sup> 2021, Belgrade, Serbia.</li> <li>Jovanović, G., Stanišić, S., Perišić M., Šoštarić, A. and Stojić, A. (2021). Key factors governing particulate matter environmental fate in an urban environment, 8th International WeBIOPATR Workshop &amp; Conference Particulate Matter: Research and Management, Decembar 1<sup>st</sup> 2021, Belgrade, Serbia.</li> </ol>

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

**4.2. Type of dissemination and communication activities\***  
 The relevant information on project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

5. Ethical approvals (if applicable)					
	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

**5.1. If the ethical approval has not been obtained, please elaborate.**  
 N/A

**6. Additional information relevant for Project implementation (if needed)**  
 N/A

**7. Date and signature**  
 We hereby confirm that all information in the Quarterly Administrative Report is accurate.

Name and last name of the authorized person

1. \_\_\_\_\_ date \_\_\_\_\_  
 Leading SRO (stamp)

2. \_\_\_\_\_ date \_\_\_\_\_  
 Project PI

3. \_\_\_\_\_ date \_\_\_\_\_  
 SRO 1 (stamp)

### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 31/08/2022
Reporting period:	Q7	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Svetlana Stanišić	Full professor	US
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US
Ana Vranić	Research assistant	IPB

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.
During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.

NO

**3. Progress on implementation and results achieved**

**3.1. Milestones** - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Milestone title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M21	Yes	/
2.	M5.1 - Launch of the ATLAS platform	M21	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

**3.2. If a milestone is not reached, please explain** – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a milestone is reached, enter N/A.

N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M21	Yes	/
2.	WP 1 - Coordination, Management, and Dissemination	D1.3.1 - Communication Strategy and Action Plan	M20	Yes	/
3.	WP 5 - Integrated platform	D5.7 - Published scientific papers	M20	No	/

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

The papers planned for the Q7 were published earlier, and we expect one or two more publications by the end of the project.

**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the Q7, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project.

As a result of the project research during the Q7, two conference papers were presented, one at First Serbian International Conference on Applied Artificial Intelligence, and second at The Eleventh International Conference on Intelligent Systems and Applications - INTELLI 2022.

During the research phase Q7, significant research efforts were focused on further software implementation of the ATLAS platform with the aim of establishing an infrastructure for experimental design and production. An important part of those efforts is related to the development of new services and user interface intended for the automation of routine operations in machine learning experiments.

**3.6. Project deviations (recommended up to 250 words)** – In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.

During the Q7 funds for the Q6, which were delayed due to the budget rebalance, were paid too. Subsequently the planned equipment was procured. The papers planned for the Q7 were published earlier, and we expect one or two more publications by the end of the project.

**3.7. Project risks**

**3.7.1.a. Foreseen risks** - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.

Risk No.	Description of risk	Work Packages/Tasks concerned	Risk-mitigation measures (As in Project Description)
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	Relatively scarce theoretical research results in the field of evaluation of machine learning models in conditions of inaccuracy and uncertainty affect the quality of ranking indices. The efforts are in progress that further investigate comparison and suitability of the indices.
3.	Methodology risk	WP 4 - Computational Intelligence base: Software components	Mechanisms for binding rather diverse software components are necessary. Risk-mitigation measures here are exceptionally careful design and/or selection of the software components and virtualization.

**3.7.1.b. Status of risk mitigation measures**

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The measures proposed in Project description were adequate.

**3.7.2.a. Unforeseen Risks** – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).

Risk No.	Description of risk	Work Packages/Tasks concerned	Proposed risk-mitigation measures
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during Q7.

**3.7.2.b. Status of risk mitigation measures (for unforeseen risks)**

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.

**3.8. Publishable summary\*** – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.

**English** (up to 250 words)

During the Q7 of the ATLAS project, the coordination between SRO members and across activities was intensified through technical meetings that take place three times per week, aimed at further development of the AI theoretical base and, particularly, its application to ATLAS platform. As a result of the project, two conference papers were presented at the First Serbian International Conference on Applied Artificial Intelligence, and at The Eleventh International Conference on Intelligent Systems and Applications - INTELLI 2022. The project PI attended a conference INTELLI 2022 in Venice and on that occasion had a successful communication with colleagues dealing with similar scientific research topics around the world.

The Jupyter platform, which is fully integrated with ATLAS platform, provides an infrastructure for flexible and rich interactive design of experiments. In addition, integration of the Atlas platform and Apache Spark™ engine enables execution of the machine learning tasks on single-node machines or clusters.

**Serbian** (up to 250 words)

Tokom sedmog kvartala ATLAS projekta održavana je redovna komunikacija učesnika projekta putem tehničkih sastanaka koji se održavaju tri puta nedeljno u cilju daljeg razvoja teorijske osnove veštačke inteligencije i njihove primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su na međunarodnim konferencijama *First Serbian International Conference on Applied Artificial Intelligence*, i *The Eleventh International Conference on Intelligent Systems and Applications - INTELLI 2022*. Rukovodilac projekta profesor Endre Pap prisustvovao je konferenciji *INTELLI 2022* u Veneciji, i tom prilikom ostvario uspešnu komunikaciju sa kolegama koji se bave sličnim naučno istraživačkim temama širom sveta.

Jupiter platforma, koja je u potpunosti integrisana sa ATLAS platformom, pruža infrastrukturu za fleksibilan i bogat interaktivni dizajn eksperimenata. Pored toga, integracija Atlas platforme i *Apache Spark™* endžina omogućava izvršavanje zadataka mašinskog učenja na mašinama sa jednim čvorom ili klasterima.

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

**4. Dissemination\***

**4.1. Scientific publications** – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.

1. Endre Pap, Đorđe Obradović, Zora Konjović, Ivan Radosavljević (2022). Linear Fuzzy Space Based Framework for Air Quality Assessment. *INTELLI 2022: The Eleventh International Conference on Intelligent Systems and Applications*, Venice, Italy, from May 22, 2022 to May 26, 2022, pp: 22-26. ISBN: 978-1-61208-977-5
2. Andreja M. Stojić, Mirjana D. Perišić, Gordana P. Jovanović, Svetlana M. Stanišić (2022). Artificial intelligence in revealing air pollution related processes. *SICAA: 1st Serbian International Conference on Applied Artificial Intelligence*, Kragujevac, Serbia, May 19-20, 2022.

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

**4.2. Type of dissemination and communication activities\***

The relevant information on project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

**5. Ethical approvals (if applicable)**

	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

<b>5.1. If the ethical approval has not been obtained, please elaborate.</b>
N/A

<b>6. Additional information relevant for Project implementation (if needed)</b>
N/A

<b>7. Date and signature</b>
We hereby confirm that all information in the Quarterly Administrative Report is accurate.
<p>Name and last name of the authorized person</p> <p>1. _____ date _____ Leading SRO (stamp)</p> <p>2. _____ date _____ Project PI</p> <p>3. _____ date _____ SRO 1 (stamp)</p>

### Quarterly Administrative Report

1. Program and Project information		
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI	
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes	
The Project acronym:	ATLAS	
Project realization period:	Start date: 01/09/2020	End date: 30/11/2022
Reporting period:	Q8	

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Dimitrije Maletić	Senior research associate	IPB
Dušan Vudragović	Research assistant	IPB
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Research associate	IPB
Svetlana Stanišić	Full professor	US
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Aleksandra Mitrović	Teaching assistant	US
Nebojša Nešić	Teaching assistant	US

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.
During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.
NO



3. Progress on implementation and results achieved				
3.1. Milestones - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.				
	Milestone title – insert milestone name*	Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M24	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

3.2. If a milestone is not reached, please explain – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing). If a milestone is reached, enter N/A.				
N/A				

3.3. Deliverables - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.					
	Tasks/activities*	Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M24	Yes	/
2.	WP 1 - Coordination, Management, and Dissemination	D1.3.3 - Dissemination report	M23	No	/
3.	WP 2 - Data and Computing Facilities	D2.3 - Results database online	M22	No	/
4.		Final Report	M24	No	/

3.4. If a deliverable is not reached, please explain - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

As a consequence of the pandemic COVID 19 and a few administrative circumstances, the implementation of some activities of the ATLAS project have been delay. The Science Fund of the Republic of Serbia has approved an extension of project duration for 3 months, during which the deliverables D1.3.3 and D2.3 will be fulfilled, and Final Report submitted.

3.5. Project results (recommended up to 250 words) – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the Q8, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project.

As a result of the project research during the Q8 one scientific paper was published in international journal Fuzzy Sets and Systems.

During the Q8 research phase, the improvement of the ATLAS platform continued with the aim of establishing an infrastructure for experimental design and production. An important part of those efforts is related to the development of new services and user interfaces intended for automating routine operations in machine learning experiments. Also, pilot study of the dependence of pollutant concentrations on environmental conditions were carried out, which achieved proof of concept.

3.6. Project deviations (recommended up to 250 words) – In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.

As a consequence of the pandemic COVID 19 and a few administrative circumstances, the implementation of some activities of the ATLAS project have been delayed. The Science Fund of the Republic of Serbia has approved an extension of project duration for 3 months, during which the deliverables D1.3.3 and D2.3 will be fulfilled, and Final Report submitted.

<b>3.7. Project risks</b>			
<b>3.7.1.a. Foreseen risks</b> - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.			
<b>Risk No.</b>	<b>Description of risk</b>	<b>Work Packages/Tasks concerned</b>	<b>Risk-mitigation measures (As in Project Description)</b>
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	Relatively scarce theoretical research results in the field of evaluation of machine learning models in conditions of inaccuracy and uncertainty affect the quality of ranking indices. The efforts are in progress that further investigate comparison and suitability of the indices.
3.	Methodology risk	WP 4 - Computational Intelligence base: Software components	Mechanisms for binding rather diverse software components are necessary. Risk-mitigation measures here are exceptionally careful design and/or selection of the software components and virtualization.

<b>3.7.1.b. Status of risk mitigation measures</b>			
<b>Risk No.</b>	<b>Did the risk occur?</b>	<b>Did you apply risk mitigation measures?</b>	<b>If the risk still applies, describe the next steps for risk mitigation.</b>
1.	Yes	Yes	The measures proposed in Project description were adequate.

<b>3.7.2.a. Unforeseen Risks</b> – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).			
<b>Risk No.</b>	<b>Description of risk</b>	<b>Work Packages/Tasks concerned</b>	<b>Proposed risk-mitigation measures</b>
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during Q8.

<b>3.7.2.b. Status of risk mitigation measures (for unforeseen risks)</b>			
<b>Risk No.</b>	<b>Did the risk occur?</b>	<b>Did you apply risk mitigation measures?</b>	<b>If the risk still applies, describe the next steps for risk mitigation.</b>
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.

<b>3.8. Publishable summary*</b> – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.
<b>English</b> (up to 250 words) During the Q8 of the ATLAS project, the coordination between SRO members and across activities was intensified through technical meetings that take place three times per week, aimed at further development of the AI theoretical base and,

particularly, its application to ATLAS platform. As a result of the project, scientific paper was published in international journal Fuzzy Sets and Systems.

Developed services for spatio-temporal fusion of measured data on the state of air quality with contextual data that include meteorological data, data on people's mobility, data on the Covid pandemic and data on stock market movements, significantly facilitate work and provide an opportunity for the development of complex air quality models in different contexts. Also, pilot study of the dependence the pollutant concentrations of environmental conditions were carried out, which achieved proof of concept.

**Serbian** (up to 250 words)

Tokom sedmog kvartala ATLAS projekta održavana je redovna komunikacija učesnika projekta putem tehničkih sastanaka koji se održavaju tri puta nedeljno u cilju daljeg razvoja teorijske osnove veštačke inteligencije i njihove primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su u međunarodnom časopisu Fuzzy Sets and Systems.

Razvijeni servisi za prostorno-vremensku fuziju merenih podataka o stanju kvaliteta vazduha sa kontekstnim podacima koji obuhvataju meteorološke podatke, podatke o mobilnosti ljudi, podatke o Covid pandemiji i podatke o kretanju na berzama, značajno olakšavaju rad i pružaju mogućnost za razvoj složenih modela kvaliteta vazduha u različitim kontekstima. Takođe, sprovedena je pilot studija o zavisnosti koncentracija zagađujućih materija od uslova životne sredine, čime je postignuta potvrda koncepta.

\*This summary should clearly explain the key features of the Project to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

**4. Dissemination\***

**4.1. Scientific publications** – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.

1. Zhang, D., Mesiar, R. and Pap, E., 2022. Jensen's inequalities for standard and generalized asymmetric Choquet integrals. Fuzzy Sets and Systems.

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

**4.2. Type of dissemination and communication activities\***

The relevant information on project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

**5. Ethical approvals (if applicable)**

	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.

**5.1. If the ethical approval has not been obtained, please elaborate.**

N/A

**6. Additional information relevant for Project implementation (if needed)**

N/A



Quarterly Administrative Report

1. Program and Project information	
Name of the Program:	Program for Development of Projects in the Field of Artificial Intelligence - AI
Name of the Project:	Artificial Intelligence Theoretical Foundations for Advanced Spatio-Temporal Modelling of Data and Processes
The Project acronym:	ATLAS
Project realization period:	Start date: 01/09/2020   End date: 30/11/2022
Reporting period:	Q9

2. Project participants information	
2.1. Principal Investigator (PI) and Lead Science and Research Organization (SRO)	
Name and last name of the PI:	Endre Pap
Academic and research title of the PI:	Full professor
SRO name:	University Singidunum
SRO authorized person (legal representative) name and last name:	Milovan Stanišić

2.2.* Project Partners - Science and Research Organizations (SRO)	
SRO name:	Institute of Physics Belgrade
SRO authorized person (legal representative) name and last name:	Aleksandar Bogojević

\*Copy this table as needed to provide information about all Partner SROs.

2.3. Members of the project team		
Name, last name*	Academic and research title**	Science and Research Organization (SRO) Acronym
Zora Konjović	Full professor	US
Andreja Stojić	Senior research associate	IPB
Đorđe Obradović	Associate Professor	US
Nemanja Stanišić	Full professor	US
Mirjana Perišić	Senior research associate	IPB
Svetlana Stanišić	Full professor	US
Ivan Radosavljević	Teaching assistant	US
Mladen Vidović	Teaching assistant	US
Gordana Jovanović	Senior research associate	IPB

2.4. Project team performance
Are the project team members performing their roles and tasks in line with the approved Project Proposal (as presented in the Project Description, Gantt Chart, Budget and other project documentation)? Is the cooperation between team members adequate? If NO, elaborate.
The project team members were performing their roles and tasks in line with the approved Project Proposal, as presented in the Project Description, Gantt Chart, Budget and other project documentation. The cooperation between team members was adequate.
During the reporting period, were there any unforeseen circumstances requiring a change in any of the team members, including the PI? (This includes a change of job or contract of a team member, or a change in the research or academic title, longer-term absence like parental leave, inability to work or any other relevant change.) If YES, elaborate.
NO

3. Progress on implementation and results achieved
3.1. Milestones - Short description of milestones achieved during the reporting period, with reference to the Project Description and Gantt Chart.

Milestone title – insert milestone name*		Delivery month (Mx) from Gantt Chart	Milestone reached	If not reached, enter estimated month (Mx)
1.	M1.1 - Workshops, open forums, and meetings on the ATLAS activities	M27	Yes	/
2.	M5.1 - Launch of the ATLAS platform	M27	Yes	/

\*Based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).

<p><b>3.2. If a milestone is not reached, please explain</b> – based on milestones planned in Table 3.3 in the Project Description and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).                  If a milestone is reached, enter N/A.</p>
N/A

**3.3. Deliverables** - Short description of deliverables achieved during the reporting period, with reference to the Project Description and Gantt Chart.

Tasks/activities*		Deliverable name**	Delivery month (Mx) from Gantt Chart	Achieved Deliverable	If not achieved, enter estimated delivery month (Mx)
1.	WP 1 - Coordination, Management, and Dissemination	D1.2 - Coordination Progress Report	M23	Yes	/
2.	WP1 - Coordination, Management, and Dissemination	D1.3.3 - Dissemination report	M27	Yes	/
3.	WP 2 - Data and Computing Facilities	D2.3 - Results database online	M27	Yes	/
4.	Work Package 5 - Integrated platform	D5.3 - Virtual experiment	M27	Yes	/
5.	Work Package 5 - Integrated platform	D5.5 - Presentation layer	M27	Yes	/
6.		Final Report	M24	No	M28 (45 days after the end of the project)

**3.4. If a deliverable is not reached, please explain** - based on deliverables presented in Table 3.4 in the Project Description document and Gantt Chart (Annex 1 and Annex 3 of the Contract on the Project financing).  
 If a deliverable is reached, enter N/A.

The Science Fund of the Republic of Serbia has approved an extension of the project duration for 3 months, during which the deliverables D1.3.3 and D2.3 are fulfilled. The Final Report will be submitted 45 days after the end of the project lifespan.

**3.5. Project results (recommended up to 250 words)** – brief summary of the Project progress (briefly describe performed project tasks, activities and results relevant for the current reporting period).

During the Q9, the administrative issues of the project and consortium were managed in line with the standards. The smooth coordination between SRO members and across activities was established and online meetings were organized on a regular basis, supporting the development of the AI theoretical base and its application within the ATLAS project.

As a result of the project research during Q9, one scientific paper in the International Journal on Advances in Intelligent Systems, and one scientific monograph in Studies in Systems, Decision and Control were published.

During the Q9 research phase, the improvement of the ATLAS platform continued with the aim of establishing an infrastructure for experimental design and production. An important part of those efforts is related to developing new services and user interfaces intended to automate routine operations in machine learning experiments. Also, a pilot study of the dependence of pollutant concentrations on environmental conditions was carried out, which achieved proof of concept.

**3.6. Project deviations (recommended up to 250 words)** – In case of any deviation/discrepancy from the Project Description (Annex 1 of the Contract on the Project financing), briefly describe reasons for its occurrence and appropriate further steps. In case of no deviations/discrepancies, enter N/A.

As a consequence of the pandemic COVID 19 and a few administrative circumstances, the implementation of some activities of the ATLAS project has been delayed. The Science Fund of the Republic of Serbia has approved an extension of the project duration for 3 months, during which the deliverables D1.3.3 and D2.3 are fulfilled, and the Final report will be submitted 45 days after the end of the project lifespan.

**3.7. Project risks**

**3.7.1.a. Foreseen risks** - the risks identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing) – for the current reporting period.

Risk No.	Description of risk	Work Packages/Tasks concerned	Risk-mitigation measures (As in Project Description)
1.	Members of the project team and SROs	WP 1 - Coordination, Management, and Dissemination	The WP coordinators brought the best practices regarding coordination among WPs and team members.
2.	Methodology risk	WP 3 - Computational Intelligence base: Theoretical foundations	Relatively scarce theoretical research results in the field of evaluation of machine learning models in conditions of inaccuracy and uncertainty affect the quality of ranking indices. Efforts are in progress that further investigate the comparison and suitability of the indices.
3.	Methodology risk	WP 4 - Computational Intelligence base: Software components	Mechanisms for binding rather diverse software components are necessary. Risk-mitigation measures here are exceptionally careful design and/or selection of the software components and virtualization.

**3.7.1.b. Status of risk mitigation measures**

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The measures proposed in the Project description were adequate.

**3.7.2.a. Unforeseen Risks** – describe all the additional risks that were NOT initially identified in Table 3.5 in the Project Description (Annex 1 of the Contract on the Project financing).

Risk No.	Description of risk	Work Packages/Tasks concerned	Proposed risk-mitigation measures
1.	The Covid-19 imposed pandemic	WP 1 - Coordination, Management, and Dissemination/ D3.1. - Communication Strategy and Action Plan.	The team meetings have been held online during Q9.

**3.7.2.b. Status of risk mitigation measures (for unforeseen risks)**

Risk No.	Did the risk occur?	Did you apply risk mitigation measures?	If the risk still applies, describe the next steps for risk mitigation.
1.	Yes	Yes	The meetings have been supported by the application of the Microsoft Teams software.

**3.8. Publishable summary\*** – description (up to 250 words) of the activities and significant results achieved by the project in the reporting period in both English and Serbian.

**English** (up to 250 words)

During the Q9 of the ATLAS project, the coordination between SRO members and across activities was intensified through technical meetings that take place three times per week, aimed at further development of the AI theoretical base and, particularly, its application to the ATLAS platform. As a result of the project, a scientific paper and one monograph were published in International Journal on Advances in Intelligent Systems and Studies in Systems, Decision and Control.

Developed services for Spatio-temporal fusion of measured data on the state of air quality with contextual data that include meteorological data, data on people's mobility, data on the Covid pandemic and data on stock market movements, significantly facilitating work and providing an opportunity for the development of complex air quality models in different contexts. Also, a pilot study of the dependence on the pollutant concentrations of environmental conditions was carried out, which achieved proof of concept.

**Serbian** (up to 250 words)

Tokom devetog kvartala ATLAS projekta održavana je redovna komunikacija učesnika projekta putem tehničkih sastanaka koji se održavaju tri puta nedeljno u cilju daljeg razvoja teorijske osnove veštačke inteligencije i njihove primene za potrebe istraživanja. Rezultati istraživanja, sprovedenih u okviru projekta, objavljeni su jednom radu u međunarodnom časopisu *International Journal on Advances in Intelligent Systems*, kao i u monografiji u okviru serije Springerove serije publikacija pod nazivom *Studies in Systems, Decision and Control*.

Razvijeni servisi za prostorno-vremensku fuziju merenih podataka o stanju kvaliteta vazduha sa kontekstnim podacima koji obuhvataju meteorološke podatke, podatke o mobilnosti ljudi, podatke o Covid pandemiji i podatke o kretanju na berzama, značajno olakšavaju rad i pružaju mogućnost za razvoj složenih modela kvaliteta vazduha u različitim kontekstima. Takođe, sprovedena je pilot studija o zavisnosti koncentracija zagađujućih materija od uslova životne sredine, čime je postignuta potvrda koncepta.

\*This summary should clearly explain the project's key features to a non-scientific audience. The Publishable summary for the current reporting period should not consist of more than 250 words. It should focus on achievements to date and how these will generate impact. The Publishable summary can be used by the Science Fund of the Republic of Serbia for promoting and demonstrating the value and impact of the Project.

**4. Dissemination\***

**4.1. Scientific publications** – Insert the full reference with the link of the publication: article in journal, publication in conference/workshop, book/monograph, book chapter etc.

1. Regular Non-Additive Multimeasures. Fundaments and Applications in Systems and Studies in Systems, Decision and Control. Edited by Alina Gavriluț and Endre Pap, Volume 448, <https://doi.org/10.1007/978-3-031-11100-6> (M11)
2. Pap, E., Konjović, Z., Obradović, Đ. and Radosavljević, I., 2022. A Unified Air Quality Assessment Framework Based on Linear Fuzzy Space Theory. *International Journal on Advances in Intelligent Systems*

\*Please keep in mind that only activities that are properly labelled according to promotion, publicity and visibility rules as stated in the Contract of the Project financing will be accepted as Project results. As additional documentation, please submit a copy of the main pages of all publications.

**4.2. Type of dissemination and communication activities\***

The relevant information on the project was presented to the wider audience via social networks, including the Project website (<https://ai.ipb.ac.rs/>), Researchgate (<https://www.researchgate.net/project/ATLAS-Project-2020>), Instagram ([https://www.instagram.com/atlas\\_project\\_2020/](https://www.instagram.com/atlas_project_2020/)), Facebook (<https://www.facebook.com/ATLAS-Project-2020-123071872871429>) and LinkedIn (<https://www.linkedin.com/company/atlas-project-2020>).

\*List only activities directly linked to the Project like the organization of a conference, workshop, press release, website, social media, training etc. Provide the website/social media link for this reporting period. As additional documentation, please submit visibility activities supporting documentation (e.g. workshop materials, pictures, promotion materials etc.).

**5. Ethical approvals (if applicable)**

	Ethical approval*	Period covered by the ethical approval	Issuing authority	State which SRO is covered by the ethical approval	State which work package/task is covered by the ethical approval
1.	N/A				

\*List all documentation (approvals, decisions etc.) required by relevant laws.





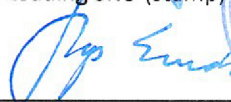
5.1. If the ethical approval has not been obtained, please elaborate.  
N/A

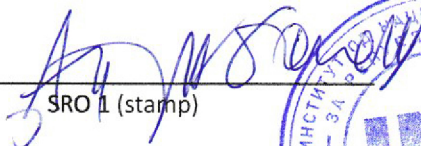

6. Additional information relevant for Project implementation (if needed)  
N/A

7. Date and signature  
We hereby confirm that all information in the Quarterly Administrative Report is accurate.

Name and last name of the authorized person

1.   \_\_\_\_\_  
Leading SRO (stamp) date

2.  \_\_\_\_\_  
Project PI date

3.   \_\_\_\_\_  
SRO 1 (stamp) date