Erasmus+ Research Placements

in *Computer Science*:

2021/2022

(January – May 2022)

List of research projects:

Project no.	*Title*
1	Machine/|Deep Learning for Big Data Analytics Applied to Engineering, Healthcare, Social care, or Social media
2	Responsible Artificial Intelligence: chatbots for academic VLEs
3	Aviation Obstacle Avoidance
4	Applications of Quantum Activation Functions and Neural Networks for Text Classification and Sentiment Analysis
5	Big Data Analytics and Visualisation using Virtual Reality and Data Augmentation

Project number	1
Project Title	Machine/|Deep Learning for Big Data Analytics Applied to Engineering, Healthcare, Social care, or Social media
Project outline	Big Data resources are currently increasingly present and require innovative contributions and validations of Machine Learning algorithms. The project aims to study and implement various Machine Learning and Applied Statistics algorithms, and validate them on either public benchmark data sets, or from Artificial Intelligence Research (AIRe) Group resources, Advanced Automotive Analytics (AAA) or Computing Enterprise Centre resources collected from our research or industry partners (particularly in domains such as automotive industry, healthcare or social care, social media). Topics can range from data quality on public resources on Covid-19 national records, to electronic patient records, automotive big data, and social media. Part of the AIRe group, these research-oriented projects will benefit from potential collaborations with a multidisciplinary team of academic staff, post-doctoral researchers and PhD students from Computer Science and Engineering departments and possibly with industry or healthcare representatives, as applicable.
Activities involved	• Current research literature and s/w solutions review. • Scrum meetings with the academic staff; weekly reports. • Design and implementation of a prototype validated on benchmark data sets. Documentation writing. Potential research paper co-authorship.
Deliverables	• Report on extensive literature review. Prototype using Python, Weka, KNIME, Tableau and/or other relevant software for data processing and visualisation. Validation using Case Studies. Weekly progress reports. User Documentation. Final Report. Potential for a research publication for innovative solutions and results
Prerequisites	• *Programming and problem solving, enthusiasm;* • *Previous experience in statistics, data analytics, machine learning & data mining may be a bonus though is not compulsory.* • *Familiarity or interest in Python, R, Tableau, Java will constitute a plus.* • *Can be also done remotely TBC.*
Level:	Undergraduate and Postgraduate
Recognition	The participant will receive a certificate of participation at the end
Places available	4
Funding	Selected students will receive an Erasmus+ Grant

Project number	2
Project Title	Responsible Artificial Intelligence: chatbots for academic VLEs
Project outline	The project is hosted by the Artificial Intelligence Research (AIRe) Group, and will research and test computation measurements for AI tools (mainly chatbots) in academic VLES – e.g. academic delivery of existing modules with Canvas.

	The project may also use of social media data mining to understand and leverage advanced statistical and qualitative metrics and social aspects to AI tools and algorithms. These include ethics and efficiency of chatbots, efficiency and explainability of Machine Learning algorithms involved in decision support.
Activities involved	To review and analyse the current AI market and identify the providers of AI measuring tools for the responsible AI dimensions such as efficiency, explainability, ethics etc. To develop chatbot prototypes for a specified problem and run qualitative and quantitative evaluations of the AI tools. To test the system against case studies. To document the literature review, chatbot construction, metrics, experiments and case studies.
Deliverables	1. weekly progress reports. 2. s/w prototype or scripts. 3. the project report, including introduction on current approaches, review on methods to be used, description of the problem to be studied, and deployment, user and maintenance documentation.
Prerequisites	*Suitable for any student who has studied Software Development, Programming, AI and Machine Learning. Interest or expertise in Python, R, Tableau and Java are a plus.* *Can be also done remotely.*
Level:	Undergraduate and Postgraduate
Recognition	The participant will receive a certificate of participation at the end
Places available	1
Funding	Selected students will receive an Erasmus+ Grant

Project number	3
Project Title	Aviation Obstacle Avoidance
Project outline	Ground-based obstacles such as transmission towers and electricity power lines pose a significant risk to low-flying aircraft, particularly those engaged in application of pesticides and fertilisers for agricultural purposes. The objective is to use GPS positioning on a mobile device to match the location, direction and speed of an aircraft with obstacles which pose a collision risk, and provide voice-based warnings via bluetooth connection so a pilot headset. The rules to determine a collision risk will need to be prototyped and refined using in-flight testing until obstacle proximity can be matched with various flight manoeuvres to provide warnings in the appropriate priority sequence and in sufficient time to enable avoidance actions to be taken.
Activities involved	Current literature and s/w solutions review. Scrum meetings with the academic and industry staff; weekly reports. Design, implementation and testing of a prototype. Documentation writing
Deliverables	Project Specifications, Design Diagrams, Prototype on suitable mobile device(s) - lPhone or iPad or Android phone or Android tablet with bluetooth connectivity. Weekly progress reports. Report on the literature review; User Documentation; Final Report.

Prerequisites	*Enthusiasm to work with SMEs; previous experience in mobile programming, APIs and/or machine learning & data mining may be a bonus though is not compulsory. Familiarity or interest in Swift, Java, Python will constitute a plus.*
Level:	Undergraduate and Postgraduate
Recognition	The participant will receive a certificate of participation at the end
Places available	2
Funding	Selected students will receive an Erasmus+ Grant

Project number	4
Project Title	Applications of Quantum Activation Functions and Neural Networks for Text Classification and Sentiment Analysis
Project outline	This open topic research project is hosted by the Artificial Intelligence Research (AIRe) Group, and will research and test aims to build on the current published work on Quantum Activation Functions used in Recurrent and Convolutional Neural Networks: Luca Parisi, Daniel Neagu, Renfei Ma, Felician Campean (2021) Quantum ReLU activation for Convolutional Neural Networks to improve diagnosis of Parkinson's Disease and COVID-19, Expert Systems with Applications, 115892, ISSN 0957-4174, https://doi.org/10.1016/j.eswa.2021.115892 The project expected extended literature review on Quantum Machine Learning, text categorisation and sentiment analysis with Long-Short Term Memory (LSTM), recurrent neural networks for text classification with multi-task learning, Quantum Perceptron, Recurrent Quantum Neural Networks, and their implementation preferably in Python: Quantum Neural Networks (QNN) in Python (https://github.com/XanaduAI/quantum-neural-networks); QNN in PyTorch (https://github.com/qiuchili/qnn_torch); Quantum Edward tool for QNN for supervised learning (https://github.com/artiste-qb-net/Quantum_Edward); Various LSTM codes for sentiment analysis (https://github.com/wabyking/TextClassificationBenchmark) A number of applications expected to be experimented will use open data (medical imaging, medical records, social media). Functionalities can include: critical analysis of data, semisupervised and supervised learning, critical analysis or results and machine learning models..
Activities involved	Current research literature, applicable open data resources, s/w solutions review. Scrum meetings with the AIRe academic staff and industry representatives (if applicable); weekly reports.
Deliverables	Project specifications and requirements, design, implementation, testing and deployment of a prototype. Documentation writing.
Prerequisites	*problem solving, programming, enthusiasm for industry-based projects; understanding of database systems, UX and cloud technologies is a plus. mobile application development is a bonus but is not compulsory.*
Level:	Undergraduate and Postgraduate
Recognition	The participant will receive a certificate of participation at the end
Places available	1
Funding	Selected students will receive an Erasmus+ Grant

Project number	5
Project Title	Big Data Analytics and Visualisation using Virtual Reality and Data Augmentation
Project outline	This open topic research project is hosted by the Artificial Intelligence Research (AIRe) Group, and will research and test aims to build on the current published work on novel clustering algorithms using similarities to interpret physical properties of data: Csenki, A., Neagu, D., Torgunov, D. et al. Proximity Curves for Potential-Based Clustering. J Classif 37, 671–695 (2020). https://doi.org/10.1007/s00357-019-09348-y The project will build on previous work for 2D and 3D visualisation using Python, Unity3D and Oculus Rift. Gamification, Virtual Reality and Augmentation are currently increasingly applied to serious Data Mining and Visualisation applications in various domains such as Engineering and Healthcare. The project aims to create a prototype of a virtual reality environment to visualise various benchmark data sets made available publicly, from Artificial Intelligence Research (AIRe) Group, Advanced Automotive Analytics (AAA) or from our research partners (such as automotive industry, healthcare or social care) augmented with expert information (e.g. about their use and faults) in an interactive way. Part of the AIRe group, these projects will benefit of collaborations with a multidisciplinary team of academic staff, post-doctoral researchers and PhD students from Computer Science and Engineering departments and possibly with industry representatives.
Activities involved	Current literature and s/w solutions review. Scrum meetings with the academic staff; weekly reports. Design, implementation and testing of a prototype on benchmark data sets. Documentation writing.
Deliverables	Project Specifications, Design Diagrams, Prototype using Oculus Rift, Oculus Rift-ready desktops in the Computing Enterprise Centre or similar computational devices, Unity3D, R, Python or other relevant software code for data processing and visualisation. Weekly progress reports. Report on the literature review; User Documentation; Final Report. Potential for a research publication for innovative solutions and results.
Prerequisites	*problem solving, programming, enthusiasm for industry-based projects; understanding of database systems, UX and cloud technologies is a plus. mobile application development is a bonus but is not compulsory.*
Level:	Undergraduate and Postgraduate
Recognition	The participant will receive a certificate of participation at the end
Places available	1
Funding	Selected students will receive an Erasmus+ Grant