



SDGine
for Healthy People and Cities

RESEARCH LINES



UNIVERSIDAD
POLITÉCNICA
DE MADRID

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RESEACH LINES DESCRIPTION

RESEARCH LINE 1A	
COMPANY	Telefónica I+D
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. José Ignacio Moreno Novella <i>Telecommunications Engineering School</i> <i>Telematic Systems Engineering Department</i>
PhD THESIS CO-SUPERVISOR (UPM)	Prof. Dr. Manuel Alvarez-Campana Fernández-Corredor <i>Telecommunications Engineering School</i> <i>Telematic Systems Engineering Department</i>
PhD THESIS TUTOR (COMPANY)	Mr. Rafael Cantó Palancar <i>Transport & IP Network Manager</i> Mr. Luis Miguel Contreras Murillo <i>Technology Expert at Global CTIO unit / Telefónica</i>
DESCRIPTION OF THE PhD THESIS PROJECT	<p>Title: Design of novel network functions, architectures and protocols based on programmable data planes.</p> <p>Currently 5G deployment is providing momentum to emerging technologies like software defined networks (SDNs), Network Function Virtualization (NFV) and Network Slicing (NS). In the next years programable data planes could provide the adoption by telecommunication sector of Protocol Independent Switch Architectures (PISA) as the common hardware platform to develop network specific elements as routers, switches, etc, based on programmable data planes which reduces the time to market of innovative functionalities.</p> <p>This PhD will focus on the evaluation of programable data planes and its capacity to support innovative network functionalities in a dynamic and efficient way. To support this goal, PhD will target three main topics:</p> <ul style="list-style-type: none"> - Evaluation of the State of the Art on programable data planes. Identification of architectures, protocols and processes involved. - Design of a methodology to develop new functionalities at data layer over a PISA platform based on programable data planes. - Identification, analysis and evaluation of relevant use cases for telecommunication operators in the deployment of advanced network elements. - Integration of developed solutions with existing ones to ensure smooth transition of operational networks <p>Keywords: Programable Data Planes, PISA, P4, DPDK, PROX, SmartNICs</p> <p><i>This work intends to contribute to SDG objectives on goal 9: Industry, Innovation and Infrastructures in addition to goal 4 quality education and goal 5 gender equality.</i></p>
TRAINING ACTIVITIES	<p>PhD student will be integrated in the RSTI-UPM research group activities, covering aspects related to advanced mobile network technologies (5G/6G), IoT and Cybersecurity.</p> <p>In this process, PhD will participate in meetings, seminars and research projects as well as dissemination activities. We expect that the candidate will actively publish his/her research work on conferences and journals of high impact. In addition, horizontal meetings to evaluate the progress of the work and identify relevant use cases and scenarios will be performed in coordination with Telefonica team.</p> <p>In particular we expect that PhD student will address journals on the level of IEEE (IEEE Communications, IEEE Wireless Communications) and attend conferences related with PISA, P4 or DPDK.</p>

SECONDMENT(S)	Student will have the opportunity to complete his/her training by short stays on selected sites according to the network of contacts maintained by RSTI-UPM and Telefonica.
REQUIREMENTS FOR CANDIDATES	Computer science: Master's degree or equivalent Electrical Engineering: Master's degree or equivalent Skills: Networking, Protocols, Mobile Wireless technologies, Virtualization, Programming English: Advanced / Proficiency (C1 / C2)

RESEARCH LINE 1B	
COMPANY	Telefónica I+D
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. Manuel Alvarez-Campana Fernández-Corredor <i>Telecommunications Engineering School</i> <i>Telematic Systems Engineering Department</i>
PhD THESIS CO-SUPERVISOR (UPM)	Prof. Dr. José Ignacio Moreno Novella <i>Telecommunications Engineering School</i> <i>Telematic Systems Engineering Department</i>
PhD THESIS TUTOR (COMPANY)	Mr. Rafael Cantó Palancar <i>Transport & IP Network Manager</i> Mr. Luis Miguel Contreras Murillo <i>Technology Expert at Global CTIO unit / Telefónica</i>
DESCRIPTION OF THE PhD THESIS PROJECT	<p>Title: Intent based programable data planes for disaggregated architectures.</p> <p>Currently, 5G deployment is providing momentum to emerging technologies like software defined networks (SDNs), Network Function Virtualization (NFV) and Network Slicing (NS). In the next years programable data planes could provide the adoption by telecommunication sector of Protocol Independent Switch Architectures (PISA) as the common hardware platform to develop network specific elements as routers, switches, etc, based on programable data planes which reduces the time to market of innovative functionalities.</p> <p>This PhD will focus on the evaluation of programable data planes and its capacity to support innovative network functionalities in a dynamic and efficient way. To support this goal, PhD will target three main topics:</p> <ul style="list-style-type: none"> - Evaluation of the State of the Art on programable data planes. Identification of architectures, protocols and processes involved. - Design of a methodology to develop new functionalities at data layer over a PISA platform based on programable data planes. - Identification, analysis and evaluation of relevant use cases for telecommunication operators in the deployment of advanced network elements. - Integration of developed solutions with existing ones to ensure smooth transition of operational networks <p>Keywords: Programable Data Planes, PISA, P4, DPDK, PROX, SmartNICs</p> <p><i>This work intends to contribute to SDG objectives on goal 9: Industry, Innovation and Infrastructures in addition to goal 4 quality education and goal 5 gender equality.</i></p>
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	<p>meetings to evaluate the progress of the work and identify relevant use cases and scenarios will be performed in coordination with Telefonica team.</p> <p>In particular we expect that PhD student will address journals on the level of IEEE (IEEE Communications, IEEE Wireless Communications) and attend conferences related with PISA, P4 or DPKD.</p>
SECONDMENT(S)	<p>Student will have the opportunity to complete his/her training by short stays on selected sites according to the network of contacts maintained by RSTI-UPM and Telefonica.</p>
REQUIREMENTS FOR CANDIDATES	<p>Computer science: Master's degree or equivalent Electrical Engineering: Master's degree or equivalent Skills: Networking, Protocols, Mobile Wireless technologies, Virtualization, Programming English: Advanced / Proficiency (C1 / C2)</p>

RESEARCH LINE 2A	
COMPANY	Repsol
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. Alberto Mozo <i>Computer Systems Engineering School</i> <i>Computer Systems Department</i>
PhD THESIS CO-SUPERVISOR (COMPANY)	Dr. José Antonio Martín <i>Advisor, Advanced Mathematics</i> <i>Repsol Technology Lab</i>
DESCRIPTION OF THE PhD THESIS PROJECT	<p>The main objective of this PhD thesis is the integration and adaptation of the latest trends in deep learning to the analysis of time series sensor data. Using a more specific approach, this objective can be divided into several specific goals:</p> <ol style="list-style-type: none"> 1. Pre-training models on unlabeled sensor datasets through self-supervised learning, as it is done with text and images. 2. Apply transfer learning to bring the knowledge of pre-trained models into downstream sensor-related tasks such as anomaly detection, classification or clustering, and compare their performance with standalone trained models. 3. Create methods to visualize and interpret the predictions of the trained models, from the big picture of analysing the top errors to the analysis of the interactions between neurons in the model. 4. Improve the robustness of model predictions with sensor data using techniques for uncertainty quantification in deep neural networks, such as MonteCarlo Dropout or deep ensembles. 5. Improve the quality of sensor data through deep learning based missing value imputation techniques. 6. Development of a software platform to showcase the results of the aforementioned objectives.
TRAINING ACTIVITIES	<p>The successful applicant will work in a multi-disciplinary team of computer scientists and other engineers at Universidad Politécnica de Madrid and Repsol. The candidate is also expected to attend all schools and training events organized within the company and the research group he/she works on during the PhD. Participation in outreach activities will be a part of duties too. More specifically, some of the training activities that the project will undertake include:</p>

	<ul style="list-style-type: none"> - Schools and workshops aimed to create a multidisciplinary background and train the ESR to work in multidisciplinary teams. - Training at UPM aimed to improve soft skills and extend knowledge in complementary disciplines. - Conferences and workshops outside UPM, even when the ESR does not present any research work, as long as the topic of the conference is related to the project. - Participation in the organization of training and dissemination events organised by the supervisors.
SECONDMENT(S)	<p>The successful candidate will undertake two secondments of 3-6 months during the project. The first one will take place during the second year of the project, with the Application Platforms and Software Systems Research Lab led by Itai Segall in Nokia Bell Labs, Murray Hill, NJ, USA. This research group has experience in the application of machine learning and deep learning techniques in real world industries. The second secondment, to be held during the third year of the project, would be carried out at Leiden Institute of Advanced Computer Science (LIACS), Leiden, The Netherlands, under the supervision of Prof. Thomas Bäck. The research LIACS is one of the top institutes in Computer Science in Europe, and has a leading experience in Artificial Intelligence (e.g. Evolutionary Computation, Natural Computing, etc.) and its application to Industry.</p> <p>Please note that the description of these secondments is tentative and can change during the course of the project.</p>
REQUIREMENTS FOR CANDIDATES	<p>All qualified candidates irrespective of gender or nationality are welcome to apply as long as they meet the following conditions:</p> <ul style="list-style-type: none"> - Academic degree in Computer Science or a related field (earned at the date of recruitment). - Background in machine learning, computational intelligence and/or data mining. A master's degree or any other official qualification on these topics will be a plus. - Very strong programming skills, in languages such as R, Python, Java or C++. - Excellent spoken and written command of English is required. <p>We are looking for a talented and highly motivated candidate. He/she must have an independent and well-structured working style, as well as the ability to work in a team.</p> <p>Applicants will be required to meet the Marie Skłodowska-Curie Early-Stage Researcher eligibility criteria. In particular, at the time of appointment they should be within the first four years of their research career, have not been awarded a doctoral degree, and should not have resided in the host country (Spain) for more than 12 months in the last three years immediately before the appointment. Researchers are normally required to undertake transnational mobility (i.e., move from one country to another) when taking up the appointment.</p>

RESEARCH LINE 2B	
COMPANY	Repsol
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. Juan C. Dueñas <i>Telecommunications Engineering School</i> <i>Telematic Systems Engineering Department</i>
PhD THESIS CO-SUPERVISOR (COMPANY)	Dr. José Antonio Martín Hernández <i>Advisor, Advanced Mathematics</i> <i>Repsol Technology Lab</i>
DESCRIPTION OF THE PhD THESIS PROJECT	Reinforcement Learning for proactive management of industrial networks and services. OBJECTIVES <ul style="list-style-type: none"> - Internet of Things – Industry 4.0: efficient and reliable networks and services. - Proactive management of network and services by predicting models. - Predictive models able to extract both isolated management events and events chains. - Converting predictive models into agent-based simulation models. - Optimization of management operations by means of Reinforcement Learning on simulated networks and services.
TRAINING ACTIVITIES	Methodology of Science -course Instituto de Ciencias de la Educación UPM. Seminars in transversal training Escuela Internacional de Doctorado-UPM (https://blogs.upm.es/eidoctorado/)
SECONDMENT(S)	Queen Mary University of London & Data Centric Engineering Programme. The Alan Turing Institute LIME (Learning-based reactive Internet Engineering) project. Richard G. Clegg, Steve Uhlig, Alan Turing Institute, Queen Mary University, London.
REQUIREMENTS FOR CANDIDATES	MSc in Computer Networks, Data Science, Computer Science or alike Skills: analytical capabilities, problem solving, self-management, initiative, communication Background: maths and statistics, data analytics, Python programming

RESEARCH LINE 3A	
COMPANY	Repsol
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. Manuel Rodríguez Hernández <i>Industrial Engineering School</i> <i>Chemical and Environmental Engineering Department</i>
PhD THESIS CO-SUPERVISOR (COMPANY)	Dr. Rafael Roldán Mesa <i>Repsol S.A.</i>
DESCRIPTION OF THE PhD THESIS PROJECT	Simulation model for the Syngas Generation process in an e-fuels production scheme. Hybridization with SMR models, SMR H2 with the complete scheme. The thesis project will be focused on the development of a rigorous model of the whole Syngas Generation Unit (SGU) including the CO2 conversion in RWGS, recycles of Tail Gas from FT and purifications of streams. This model can be used for the design of a pilot/demo/industrial unit or facility in a future as well as for monitoring the unit operation. In fact, it will be a digital twin of the actual physical process that will allow to optimize the operation parameters in order to minimize carbon emissions and production costs. Basically, the thesis project will have two main phases, the first one devoted to the development of the process model and the second one devoted to the lifecycle assessment.

TRAINING ACTIVITIES	Webinars and conferences related to: <ul style="list-style-type: none"> - Synthesis of fuels and chemicals using syngas as raw material, - Purification and gas separation technologies. - Chemical engineering software simulation tools
SECONDMENT(S)	Tentative. External institutions with experience in: <ul style="list-style-type: none"> - simulation and optimization (like Imperial College of London) - syngas production, and F-T (like Norwegian University of Science and Technology – Norway) A (at least) three months stay in (at least) one external institution is expected
REQUIREMENTS FOR CANDIDATES	Degree (MSc, ...): MSc in Chemical Engineering, Industrial Engineering or Chemical Engineering Skills: <ul style="list-style-type: none"> - Languages: English: B2+ minimum. C1 will be valued. - Teamwork - Alliances generation - Proactivity and initiative - Flexibility - Leadership - Simulation, Catalysis and Chemical Engineering fundamental. - Interest to develop an R&D career. - Public communication & presentation skills Background <ul style="list-style-type: none"> - 1 or 2 years of experience will be valued

RESEARCH LINE 12A	
COMPANY	Optiva Media
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. José Manuel Menéndez García <i>Telecommunications Engineering School Signals, systems and radio communications department</i>
PhD THESIS CO-SUPERVISOR (COMPANY)	Dr. Iñaki Martínez Sarriegui <i>Head of Research & Innovation at Optiva Media</i>
DESCRIPTION OF THE PhD THESIS PROJECT	<p>Content consumption habits are changing, with increasingly demanding consumers that require total control of what, when and where they consume, and with old (linear TV) and new (VoD, streaming) paradigms coexisting.</p> <p>This favours the emergence of new technological and business actors, creating an overwhelming collection of available contents, growing every day with the addition of new series and films in an increasing offer of platforms and streaming services.</p> <p>In this context, actual techniques for content search and indexation fail at providing high-level semantic capabilities, especially in textual documents when capturing the intention and/or the underlying narrative structure. The result is a huge amount of information and metadata inaccessible to automatic processing and ‘unembraceable’ by humans.</p> <p>The most direct consequence of this is that <i>end-users spend more than 30 minutes a day</i> deciding what to watch on TV, and frequently ending in selecting a content that doesn’t fit their interests or their actual mood, and that will usually be later discarded.</p> <p>While for most people this generates only some discomfort and the obvious feeling of wasting their time, in people with mental conditions like depression it could lead to anxiety episodes and other more severe complications derived from idling and, especially, for ending with the</p>

	<p>selection by discard of a content that could be harmful in psychological terms.</p> <p>In this doctoral thesis, we propose addressing this problem by means of the work in two areas: <u>Conceptual Content Modelling</u> and <u>User Profiling</u>, the outcomes of which will be combined to create an advanced recommendation framework for a ‘safe’ TV experience for people suffering from mental conditions, ultimately contributing to their wellbeing.</p>
LIST OF TRAINING ACTIVITIES	<ul style="list-style-type: none"> - Doctoral courses at UPM - Dedicated training on Digital and Pay TV at Optiva Media with technical support from the GATV-UPM. - AWS AI-ML tools webinars and specific company courses at Optiva Media - Attendance at International Artificial Intelligence conferences related to the thesis project like AIME, AIAI; with active participation on practical workshops. - Short stays of the student in institutions of recognised prestige in the field of the doctoral thesis.
SECONDMENT(S)	<p>Tentative</p> <ul style="list-style-type: none"> - Computational Intelligence Group, Vrije Universiteit (Netherlands) <ul style="list-style-type: none"> o https://cs.vu.nl/ci/ - Digital Health & Wellbeing Group, Fondazione Bruno Kessler (Italy) <ul style="list-style-type: none"> o https://www.fbk.eu/en/digital-healthwellbeing/ - Fraunhofer FOKUS (Germany) <ul style="list-style-type: none"> o https://www.fokus.fraunhofer.de/en/fokus/research-topics/ai - LIAAD, Artificial Intelligence and Decision Support Centre of the INESC TEC (Portugal) <ul style="list-style-type: none"> o https://www.inesctec.pt/en/centres/liaad#intro - Centre for Research & Technology Hellas (Atenas, Grecia) <ul style="list-style-type: none"> o https://www.certh.gr/root.en.aspx
REQUIREMENTS FOR CANDIDATES	<ul style="list-style-type: none"> - Degree (MSc, ...) <ul style="list-style-type: none"> o MSc in Statistics, applied mathematics, Computer Science or related discipline. - Skills <ul style="list-style-type: none"> o Strong problem-solving skills o Ability to communicate complex data in a simple, actionable way. o Ability to work independently and with team member from different backgrounds. o A drive to learn and master new technologies and techniques. - Background <ul style="list-style-type: none"> o Proficient with one or more programming languages, preferably Python and/or C++ o Knowledge of a variety of ML techniques: NLP, clustering, decision tree, ANN, DL, RNN, ... o Pattern recognition and predictive modelling experience o Knowledge of cloud infrastructures like AWS and their AI tools and services

RESEARCH LINE 12B	
COMPANY	Optiva Media
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. Carlos Á. Iglesias <i>Intelligent Systems Group</i> <i>Telematic Systems Engineering Department</i> <i>Telecommunications Engineering School</i>
PhD THESIS CO-SUPERVISOR (COMPANY)	Dr. Iñaki Martínez Sarriegui <i>Head of Research & Innovation at Optiva Media</i>
DESCRIPTION OF THE PhD THESIS PROJECT	<p>Title: Exploiting Knowledge Graphs for Improving Mental Wellbeing at Home through Content-based Recommendations</p> <p>The PhD thesis aims at researching on personalized content recommendation algorithms for selecting videos. One of the goals of the projects is reducing users' frustration when selecting videos and contribute to user personal well-being. To this end, the project will explore the usage of Knowledge-Graph based Recommendation Systems.</p> <p>The PhD thesis will be developed in a combined academic and industrial settings, from an industry-driven perspective.</p> <p>Candidates are expected to publish in highly refereed journals and conferences. The grant will support a research stay of 3 months.</p>
SECONDMENT(S)	The hosting research centre of the research stay will be decided during the PhD studies. Some potential hosting research centres are University of Torino (Italy), University of Minho (Portugal), Fondazione Bruno Kessler (Italy), and Open University (UK).
REQUIREMENTS FOR CANDIDATES	<p>Degree: Master's degree in computer science or other relevant disciplines.</p> <p>Skills: Python, Pandas, Scikit-Learn, Linked Data Technologies.</p> <p>Background: Artificial Intelligence, Machine learning, Natural Language processing.</p> <p>Strong motivation to do research on data management and doing interdisciplinary research.</p> <p>Communication skills and teamwork.</p>