MATHEMATICS, COMPUTER SCIENCES, STATISTICS

Director prof. Matteo Focardi

TITLE OF THE SCHOLARSHIP	Mathematical models and methods for image processing for diagnosis in agriculture and for building energy surveys			
PRINCIPAL INVESTIGATOR	GIANLUCA VINTI			
SUMMARY OF THE RESEARCH TOPIC	The topic of the research concerns mathematical models for the processing of digital images with applications both in agriculture and for the energy surveys of buildings. More in detail, the project has its theoretical basis on Approximation Theory and its applications to Signal and Image Processing, while the most applied part will be aimed at processing both optical and thermographic images for green thematic applications in the energy field (mainly aimed at buildings) and agriculture. The proposed project, although based on mathematical bases, has an interdisciplinary nature, involving mathematical, informatics, energy and environmental issues. To achieve the desired results, optical and infrared images obtained from cameras/thermal imaging cameras on drones will also be used.			
ACTION	PERIOD IN THE PRIVATE SECTOR (months)	RESEARCH PERIOD ABROAD (months)	INTERVIEW DATE	LANGUAGE OF THE INTERVIEW
GREEN	9	No	04/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	Food choice and global health			
PRINCIPAL INVESTIGATOR	MICHELA BACCINI			
SUMMARY OF THE RESEARCH TOPIC	Food production and consumption affect the environment through different mechanisms, inducing direct and indirect negative consequences on human health. Quantitative evaluations of these impacts at a local and a global level under actual and future hypothetical scenarios are needed in order to inform policies and develop effective communication plans aimed at enhancing food literacy in the population. Within this project, we will review the quantitative literature about this broad topic, develop methods for impact assessment and uncertainty evaluation to address specific questions in this context (e.g. impact of intensive livestock farming or food waste on climate, air pollution and human health), and explore community perception about these themes through sentiment analysis.			
ACTION	PERIOD IN THE PRIVATE SECTOR (months)	RESEARCH PERIOD ABROAD (months)	INTERVIEW DATE	LANGUAGE OF THE INTERVIEW
GREEN	6	No	04/11/2021	Italian

TITLE OF THE SCHOLARSHIP	Innovative 3D techniques for marine environmental monitoring through drone swarms
PRINCIPAL INVESTIGATOR	CARLOTTA GIANNELLI
SUMMARY OF THE RESEARCH TOPIC	The continuous growth of cutting-edge technologies promotes the development of autonomous and intelligent systems for the support of environmental monitoring and protection. In this reference setting, the variety of numerical and computational models involved in the design of autonomous vehicles should provide suitable solutions in the different steps of the control process. The research fellowship is devoted to the development of 3D innovative techniques designed to integrate modern computational methods with flexible modeling and approximation schemes to properly coordinate drone swarms in aquatic environments. The geometrical and numerical properties of the developed schemes will be exploited to comply with the input data stream and obtain optimal solutions for the automatic tracing of the environmental conditions, while simultaneously providing information on the marine fauna and flora.

ACTION	PERIOD IN THE PRIVATE SECTOR (months)	RESEARCH PERIOD ABROAD (months)	INTERVIEW DATE	LANGUAGE OF THE INTERVIEW
GREEN	6	No	04/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	How to reduce the digital divide among older people: an approach based on offline social networks
PRINCIPAL INVESTIGATOR	BRUNO ARPINO
SUMMARY OF THE RESEARCH TOPIC	In a country like Italy where the percentage of older people is constantly increasing, the development of digital services aimed at this segment of the population is of growing interest for businesses, public administration and society. However, the "digital divide" between older people and the young remains strong. The topic of the project is to study how to reduce the digital divide by exploiting the "offline" family and social networks in which older people are inserted. More specifically, we will analyze: 1) the development and effectiveness of apps shared between older people and members of their family or the social network; 2) the role of apps dedicated to "proxy users" (users through which older people can access digital technologies) in guaranteeing access to products and services by the older population; 3) the effectiveness of group digital literacy modalities involving family members or social network members. The effectiveness of these solutions will be examined with regard to their usability and also in relation to health and well-being outcomes.

ACTION	PERIOD IN THE PRIVATE SECTOR (months)	RESEARCH PERIOD ABROAD (months)	INTERVIEW DATE	LANGUAGE OF THE INTERVIEW
INNOVATION	6	6	04/11/2021	Italian/English

INFORMATION ENGINEERING

Director prof. Fabio Schoen

TITLE OF THE SCHOLARSHIP	**Advanced Machine Learning Approaches for in vehicle driving assistance and predictive vehicle maintenance**			
PRINCIPAL INVESTIGATOR	FABIO SCHOEN			
SUMMARY OF THE RESEARCH TOPIC	The proposed research aims at introducing advanced methodologies in order to significantly increase the safety of the driver and other agents (other vehicles and pedestrians). This will be accomplished through the prevention of risky behavior by the driver and the prediction of onboard breakdowns and malfunctions. Advanced machine learning methods, computer vision, sensor fusion, anomaly detection will be used. The large bandwidth of 5G connections will be exploited to send large amounts of diagnostic data (OBD-II), GPS and videos, useful for training machine learning models, using both labeled data and self-supervised learning techniques.			
ACTION	**PERIOD IN THE PRIVATE SECTOR (months)**	**RESEARCH PERIOD ABROAD (months)**	**INTERVIEW DATE**	**LANGUAGE OF THE INTERVIEW**
GREEN	12	No	03/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	**Fleet management methods of e-vehicle, with machine learning techniques, explainable artificial intelligence and IoT, for the reduction of maintenance costs and environmental impact**			
PRINCIPAL INVESTIGATOR	PAOLO NESI			
SUMMARY OF THE RESEARCH TOPIC	We are observing a progressive growth of electric vehicles and their types, models and in particular of their use in fleets of rental vehicles or for city use for the use of operators, and therefore also of the related problems. These, having to manage significant numbers of vehicles, can control their evolution and maintenance, based on driving conditions, routes, and also the very structure of the mechanics and electronics of the vehicle. The primary objectives are the reduction of downtime for maintenance, and the reduction of unexpected failures that lead to emergency interventions, but also the management of refills, the identification of components that can fail, the profiling of periodic maintenance. These requests can be satisfied by developing Ai and XAI algorithms on the large amounts of data that are available. At the same time, the semantic modelling of the structures involved such as the vehicle itself, the maintenance processes, the roads travelled, the type of behaviour can guide and accelerate the learning processes. The study will exploit the infrastructure of www.Snap4City.org and the data of the DISIT lab unifi.			
ACTION	**PERIOD IN THE PRIVATE SECTOR (months)**	**RESEARCH PERIOD ABROAD (months)**	**INTERVIEW DATE**	**LANGUAGE OF THE INTERVIEW**
GREEN	6	No	03/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	**What-if analysis methods for responding to unexpected environmental and non-environmental events, with explainable artificial intelligence and IoT techniques, to increase the resilience of urban and rural systems.**
PRINCIPAL INVESTIGATOR	PAOLO NESI
SUMMARY OF THE RESEARCH TOPIC	What-If analysis solutions have to cope with highly complex situations of city scenarios addressing unexpected events to increase resilience. The solutions have to be capable to compute multiple predictions and simulations about city evolution such as environmental variables, public transport, parking, people flow, commercial areas, etc. The approaches take into account data which are static, historical, real-time/dynamic, and forecasting information, in a functional model, on which the processes (simulations, predictions, data transformations) are integrated with business logic and user interaction. Despite the large literature of What-If analysis its complexity for managing actual cases of progressively computed results is far to be covered by solutions and tools. So that the classic prediction models cannot be used, since they have a limited performance to cope with unplanned events that have to be managed in a short time. Other relevant aspects to be addressed are the performance indicators to assess the results. The study is going to exploit the www.Snap4City.org infrastructure and data of the DISIT lab at Unifi.

ACTION	**PERIOD IN THE PRIVATE SECTOR (months)**	**RESEARCH PERIOD ABROAD (months)**	**INTERVIEW DATE**	**LANGUAGE OF THE INTERVIEW**
GREEN	8	No	03/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	**Power quality improvement in electrical networks for resilience and energy transition**
PRINCIPAL INVESTIGATOR	FRANCESCO GRASSO
SUMMARY OF THE RESEARCH TOPIC	The project involves the development of methodologies, systems, instruments and devices for power flow control and electrical energy storage. Through these assets, it is possible to maximize renewable energy production and usage, reducing the dependence on fossil fuels and greenhouse gasses emissions. The Ph.D. student will acquire advanced knowledge and practical competence in the field of renewable energy communities (REC) and UVAM (Unità Virtuali Abilitate Miste), Smart Grids, Power Quality, distributed energy generation from renewable sources, distribution and transmission of electric power, energy storage and electric mobility applications.

ACTION	**PERIOD IN THE PRIVATE SECTOR (months)**	**RESEARCH PERIOD ABROAD (months)**	**INTERVIEW DATE**	**LANGUAGE OF THE INTERVIEW**
GREEN	6	No	03/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	**Environmental, electrical safety, performance and electromagnetic compatibility qualification and impact on the power supply network of the battery recharging systems of electric vehicles**
PRINCIPAL INVESTIGATOR	CARLO CAROBBI
SUMMARY OF THE RESEARCH TOPIC	Due to the transformation of the mobility from fossil to electric energy, there will be a mass diffusion of electric vehicle charging systems. These systems have energy conversion devices capable of highly efficient management of the power required to transfer in a short time the required amount of charge. A significant impact is expected on the conducted electromagnetic environment (quality of the energy supplied by the power network) and on the radiated environment (electric and magnetic fields) due to the undesired electromagnetic emissions from the recharging systems. The project plans to quantify, through the measurement and test equipment available to the proponents, the impact of the recharging systems on the electromagnetic environment and to model the mechanisms of generation of the unwanted emissions to identify solutions for their containment while preserving the expected performance and safety requirements.

ACTION	PERIOD IN THE PRIVATE SECTOR (months)	RESEARCH PERIOD ABROAD (months)	INTERVIEW DATE	LANGUAGE OF THE INTERVIEW
GREEN	6	No	03/11/2021	Italian/English

TITLE OF THE SCHOLARSHIP	**Smart distributed sensing for management, monitoring and forecasting of power production and distribution in highly renewable-penetrated systems**
PRINCIPAL INVESTIGATOR	GABRIELE MARIA LOZITO / FRANCESCO GRASSO
SUMMARY OF THE RESEARCH TOPIC	The core of the PhD program is the power flow study in Smart grid systems of the latest generation, featuring distributed generation from renewable sources. The candidate will develop competencies in the field of data acquisition and management from arrays of sensors for power flow measurement, assessment of produced power from renewable sources, forecasting of load profiles and management of storage systems. Individual competencies will involve sensor interfacing, management of acquired data and post-processing through machine learning techniques. The study will involve a practical application of field data through a private company partnership.

ACTION	PERIOD IN THE PRIVATE SECTOR (months)	RESEARCH PERIOD ABROAD (months)	INTERVIEW DATE	LANGUAGE OF THE INTERVIEW
GREEN	6	No	03/11/2021	Italian/English