Call for a PhD Position: Artificial Intelligence for the Optimization of Electric Vehicle Autonomy and Integration into the Smart Grid

Context:

This PhD is part of the European project OPEVA (*OPtimization of Electric Vehicle Autonomy*) composed of almost 40 partners in Europe (France, Belgium, Italy, Czechia, Netherlands, Portugal, Turkey, Austria, and Germany) that aims for innovation on aggregating information from the vehicle, not only from the battery but also from other internal sensors and behaviors, to create a model of performance and consumption specific to the individual vehicle and its driver. It aims to optimize the individual driving episode using the out-vehicle data such as state of the road, weather, charging station location and occupancy etc. that are collated from the back-end systems. OPEVA will further address the challenges associated with the communication between the vehicle and the infrastructure to gather data from the back-end systems. It aims for innovation in the use of recharging stations and related applications. It further aims to achieve better understanding on what the battery and its constituent cells are really doing during real world use for an improved battery management system. Finally, the project covers the driver-oriented human factors for optimizing the electrical vehicle usage. The economic factors, legal and ethical aspects, societal and environmental factors will be taken into consideration in the OPEVA methods for a higher acceptance and the awareness of the society regarding these developments.

PhD objectives:

The research area of the PhD is vehicle-to-grid integration (V2G) and should ensure that the power system can be proactively prepared for the electric load of urban EVs while exploring the charging flexibility that EVs can provide through smart and scalable charging infrastructure. The aim is to develop and implement intelligent management framework techniques using state of the art artificial intelligence algorithms for addressing major challenges that arise in the deployment and management of EVs in residential and commercial levels (fleet management). The outcomes will be to produce new applied research utilizing AI in EV management and V2G resource optimization and, thus, contribute in reducing greenhouse gas emissions. The two main following objectives will be addressed during this PhD but a detailed PhD plan will be developed with the supervisors, based on the candidate profile, within the first two months after enrolment:

- Energy-efficient dynamic routing: Energy-efficient low-complexity multi-objective routing algorithms will be developed considering both internal (e.g., SoC, SoH, driver profile, vehicle type) and external factors (e.g., weather conditions, road profile, traffic information, limited availability of charging infrastructure, type of the charging stations, etc.). AI-based learning techniques (split between cloud and onboard processing) will be developed to consider multiple factors in the routing decisions.
- Improved EV grid integration: Improving EV grid integration to reduce waiting time by novel V2G interactions and smart charging management strategies, and systems for more secure and effective integration of a large volume of electric vehicles into power grid planning and operation. One of the approaches is to design and locate charging infrastructures equipped with renewable energy production in order to meet users' expectations in an uncertain environment related to the transportation demand, the renewable energy production and electricity peaks and also to inform and guide EV to the available and most appropriate charging infrastructure.

Keywords: V2G, AI, Machine learning, Energy, Electric Vehicle, optimization, routing, Smart Grid.

Expected Profile:

Candidates must satisfy most of the following qualifications:

- Strong skills in optimization and machine learning
- The ability to work effectively with data and applied statistics
- Communication protocols and security
- General knowledge of power systems operation and/or electric vehicles
- Experience in presenting results in technical reports and scientific papers

Candidates must have all of the following qualifications:

- Excellent grades in your master program
- Dedicated person with desire to learn is an essential quality
- Strong programming skills (MATLAB and/or Python) and Application development.
- Ability to work in a project team and take responsibility for own research goals
- Excellent in communicating and reporting in English

PhD location: This PhD will take place in the premises of DRIVE Lab @ Nevers part of the University of Burgundy (Nevers, France).

Expected starting date: January / February 2023.

Contacts: Sidi Mohammed Senouci and El-Hassane Aglzim, University of Burgundy, Nevers.

How to Apply:

Application process (deadline December 16th, 2022)

The following documents are required:

- CV,

- motivation letter,

- statement of research experience and interests,

- transcripts and

- (at least) two reference letters

as attachments of an email, whose subject will be "Application for PhD position at DRIVE", which must be addressed to Sidi Mohammed Senouci (sidi-mohammed.senouci@u-bourgogne.fr) and El-Hassane Aglzim (el-hassane.aglzim@u-bourgogne.fr).

Web links of research articles authored by the applicant or the internship report are welcome to be included, too.