PhD SCHOLARSHIP APPLICATION

Division / Business Area: ICT / OPTIMA
Building / Province: Derio 700 / Bizkaia

SCHOLARSHIP DESCRIPTION

Title:	**New Hybrid Models for Machine Learning (Shallow and Deep Learning) and Stream Mining for the Operation and Maintenance of Energy Assets and Energy Efficiency.**
Brief description:	The aim of the scholarship is to deepen knowledge of data analytic and optimisation techniques to capture and exploit new data based knowledge. Essentially, the thesis will focus on the domain known as Digital Energy or Energy Digitalisation process, for which data analytics plays a major role for various specific applications, such as the monitoring, identification of the condition, modelling of the ageing and predictive maintenance of machines, and optimisation of the operation with energy infrastructure efficiency criteria. To do so, research will be carried out in the fields of data analytics, such as soft sensing, synthetic data generation based on digital twins, prediction of the emergence of faults based on data driven or hybrid models or energy efficiency in intensive energy consuming infrastructures, among others. In particular, the thesis will revolve around the design and implementation of new models that identify cause-effect relations based on indirect or virtual sensor measures, new models of predictive maintenance and efficient operation of energy assets based on descriptive and predictive techniques that learn from real measured data, synthetic data generated via digital models.
Detailed description:	The doctoral scholarship falls within the framework of Big Data, a concept referring to the set of techniques, methods, models and architectures oriented to obtain knowledge from large data volumes and interpret their value. This set of data analysis models are the "brain" which infers data knowledge, either to discover patterns and existing relations between its variables, forecast future values of one or several variables, or prescribe actions to be implemented according to the values recorded by those variables during a specific period. For an engineer, data analytics is a field where creativity and technical challenge meet. This is currently generating a 'research fever' around the creation of new descriptive, predictive and prescriptive models, with proposals combining bio-inspired algorithms, machine learning and distributed computing. Recently, data analysis in Big Data systems has become known and started to be successfully applied to several sectors such as: Telecommunications (fraud detection; digital platform offer pairing; or resource optimisation in networks); Banking (portfolio optimisation); or Health (prediction of illnesses). However, this technology is practically incipient in the energy domain, which is undergoing a severe digitalisation process. This fact is leading to a sharp increase in demand

for models and functionalities based on Big Data. In spite of its inherent value, energy consumption and generation data collected at industrial plants, wind farms and other infrastructures has unique characteristics, generated in real time, subject to unforeseeable (but detectable) changes, which may be vital for security, and the way of accessing and handling is usually very restricted. The volume of data in this environment will continue to grow exponentially as a result of the progressive instrumentation and digitalisation of intensive energy consumption and generation infrastructures.

In this context, the doctoral thesis will address various lines of research related to energy efficiency in large infrastructures, with particular emphasis on the following aspects:

- Multi-parameter real-time monitoring of energy infrastructures and detection of atypical patterns which may be symptoms of early operation failures. To achieve this, the thesis will contemplate the design of data analytics models with incremental learning and diversity mechanisms for learning problems with demanding requirements in terms of computing times and any derived in the data pattern (e.g.: detection of data flow anomalies).

- Prediction of faults through Deep Learning models, as well as task planning algorithms for renewable energy integration in the plant energy mix.

- Automatic construction of in-depth neuronal computing models for soft sensing of equipment or energy infrastructures, and the creation of hybrid models (simulative/predictive) for the design of more reliable digital twins.

In any case, the candidate shall be given sufficient flexibility to propose research lines of his/her own interest which are in line with the leit motiv of the thesis (energy efficiency and operation & maintenance of energy infrastructures).

The candidate will be backed by high level TECNALIA teams, such as REG (Research Excellence Group) ICT OPTIMA Big Data, the Digital Energy Transversal Platform (Energy and ICT Divisions) and the Operation and Maintenance TRT (Technologically Relevant Team) (Industry Division).

REQUIREMENTS

Degree and specialisation:	Computer Engineering (Computer Science and Artificial Intelligence Science), Physics, Mathematics, Telecommunications Engineering, Electrical Engineering
Languages:	Intermediate-advanced level of English Spanish (fluent)
IT skills:	Python, R, MATLAB, Latex
The following will be a plus:	Proactivity, critical analysis skills and teamworking. Ability to generate result-oriented applied science. The following will be a plus: candidates with previous training in the thesis topics (at Master's or similar level), and in particular machine learning models and neural computing models.

Further information and applications: http://bit.ly/2J3i9I9