COMILLAS-ICAI Engineering Research Projects (SPRING & SUMMER 2020) **27/11/2019**

RP_DEAC01	Low-cost sensor characterization for biomedical applications
RP_DEAC02	Evaluation of the perfornac of Narrowband Power Line Communication networks in different scenarios based on simulations
RP_DIE01	**NONE YET**
RP_DIM01	**NONE YET**
RP_DMA01	Programming the game: Binary Who is Who? For the improvement of the teaching of mathematical concepts
RP_DOI01	**NONE YET**
RP_DTC01	Exploring aplications of machine learning techniques to model space weather conditions
RP_IIT01	Optimization of the location of the electricity and hydrogen charging stations in Spain in the medium and long term
RP_IIT02	State of the Art of Brent and Natural Gas prices forecast models
RP_IIT03	Power generation and storage technologies prospective

LEGEND RP_

DEAC	Department of Electronics, Control and Communications
DIE	Department of Electrical Engineering
DIM	Department of Mechanical (and Materials) Engineering
DOI	Department of Industrial Organization
DTC	Department of Telematics and Computer Sciences
IIT	Institute for Research in Technology

RESEARCH PROJECT 2019-2020

Department/Area

Electronics, Automation, and Communications

Title/Name

Low-cost sensor characterization for biomedical applications

Abstract/Description

Passive RF (radiofrequency) sensors are very promising devices because they are low-cost, disposable, battery-free and fully passive (chipless). Moreover, they can be easily integrated with antennas to develop wireless or contactless sensors. The objective of the proposed project is the study of their response signals. The results will be used to develop industrial and bioengineering applications.

Prerequisites

Required	Electronic measurements
Recommended	It would be nice to have some knowledge of radiofrequency, but it can also be learnt through out the project.

Supervisor/Tutor

Name	Francisco Javier Herraiz Martínez
Email	fjherraiz@icai.comillas.edu

Structure

Format	Summer (intensive, preferably 8 weeks)
Workload	100 hours (4 ECTS)
Students	2

RESEARCH PROJECT 2019-2020

Department/Area

Electronics, Automation, and Communications

Title/Name

Evaluation of the performance of Narrowband Power Line Communication networks in different scenarios based on simulations

Abstract/Description

Narrow Band Power Line Communications (NB-PLC) are gaining importance as last mile technologies in Advanced Metering Infrastructures (AMI) mainly because they use as communication medium the low voltage cables, which are already there. However, low voltage cables also represent such a harsh communication medium, which suffers from frequency selectivity, continuous altered loads, Electro Magnetic Interference (EMI), and, above all, noise. As a result, much research has been carried out in this area in recent years to improve the performance of this kind of networks. Simulation tools are particularly important for this purpose, as they allow doing so minimizing risks, time and costs.

PoweRline Intelligent Metering Evolution (PRIME) is a NB-PLC standard widely used in Spain (e.g., by Iberdrola or Unión Fenosa), and with international projection. SimPRIME (https://www.iit.comillas.edu/jmatanza/SimPRIME/) is a PRIME network simulator based on MATLAB and OMNeT++ which has been widely used for evaluating different aspects of PRIME.

In this project, the students will perform simulations of PRIME networks in different scenarios and/or varying different PRIME parameters and will analyze obtained results to draw conclusions along the line of PRIME network performance. As part of this project, the students will get a deeper understating of how the communication protocol stack works and, in particular, about how the NBPLC PRIME technology works.

Prerequisites

Required	C++, scripting languages (e.g., Shell, Python, MATLAB)
Recommended	

Supervisor/Tutor

Name	Javier Matanza Domingo / Gregorio López López
Email	jmatanza@comillas.edu / gllopez@comillas.edu

Structure

Format	Summer (intensive, preferably 8 weeks)

Workload	100 hours (4 ECTS)
Students	2

RESEARCH PROJECT 2019-2020

Department/Area

Applied Mathematics

Title/Name

PROGRAMMING THE GAME: BINARY WHO IS WHO? FOR THE IMPROVEMENT OF THE TEACHING OF MATHEMATICAL CONCEPTS

Abstract/Description

The project consists in the programming of an adaptation of a classical board game, which has been named “Binary who is who?”

Prerequisites

Required	Manage of some programming language, as Matlab or C
Recommended	Knowledge of a programming language to create online games (game programming)

Supervisor/Tutor

Name	Javier Rodrigo
Email	jrodrigo@comillas.edu

Structure

Format	Summer (intensive, preferably 8 weeks)
Workload	100 hours (4 ECTS)
Students	2

RESEARCH PROJECT 2019-2020

Department/Area

Telematics/CompSc

Title/Name

Exploring aplications of machine learning techniques to model space weather conditions

Abstract/Description

According to NASA definition the “Activity on the Sun’s surface creates a type of weather called **space weather**. The Sun is really far away—about 93 million miles (150 million kilometers)—from Earth. However, space weather can affect Earth and the rest of the solar system. At its worst, it can even damage satellites and cause electrical blackouts on Earth! (https://spaceplace.nasa.gov/spaceweather/en/). This research project will explore the possible application of machine learning techniques such as for example convolutional neural networks for modelling some space weather characteristics. The first focus of attention of the project will be the geomagnetic activity, but other are possible.

Prerequisites

Required	R or Python knowledge
Recommended	Neural networks

Supervisor/Tutor

Name	Miguel A. Sanz-Bobi
Email	masanz@comillas.edu

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available
Workload	100 hours (4 ECTS)
Students	2

RESEARCH PROJECT 2019-2020

Department/Area

Institute for Research in Technology

Title/Name

Optimization of the location of the electricity and hydrogen charging stations in Spain in the medium and long term

Abstract/Description

This project aims to design an optimization model in the long-term able to optimize the locations of electricity and hydrogen charging stations for Spain, considering, among others, the precise or statistical location of current stations, the hourly traffic density and the degree of penetration of the electrical and hydrogen vehicles. A previous phase of literature revision will be needed to determine how other research works have addressed this problem.

Prerequisites

Required	Design of Linear Mathematical Programing models
Recommended	Spanish

Supervisor/Tutor

Name	Francisco Alberto Campos Fernández and José Villar
Email	acampos@comillas.edu

Structure

Format	Semester (extensive, 15 weeks)
Workload	200 hours (8 ECTS)
Students	4

Department/Area

Institute for Research in Technology

Title/Name

State of the Art of Brent and Natural Gas prices forecast models

Abstract/Description

The purpose of this project is to carry out a review of the state of the art of price forecast models that allow to estimate the Brent and Natural Gas prices. This will help in compiling not only the main modeling approaches but also the most relevant levers in the Brent and Natural Gas prices formation.

Prerequisites

Required	
Recommended	

Supervisor/Tutor

Name	Francisco Alberto Campos Fernández and José Villar
Email	acampos@comillas.edu

Structure

Format	Semester (extensive, 15 weeks)
Workload	200 hours (8 ECTS)
Students	2

Department/Area

Institute for Research in Technology

Title/Name

Power generation and storage technologies prospective

Abstract/Description

The purpose of this project is to review the most promising current and expected technologies that could contribute to a future decarbonized generation mix, with the objective to gather essential technical data as well as investment and operation current and expected costs. This analysis will be used to propose simple dispatch models to contribute to the generation mix, as well as to assess their contribution to firm capacity. The technologies should include different technological approaches to solar thermal, batteries, wave power, h2 based thermal generation (combined cycles conversion or new turbines), carbon capture and sequestration, etc.

Prerequisites

Required	
Recommended	

Supervisor/Tutor

Name	Francisco Alberto Campos Fernández and José Villar
Email	jose.villar@inesctec.pt

Structure

Format	Semester (extensive, 15 weeks)
Workload	200 hours (8 ECTS)
Students	2