**UNIVERSIDADE DE AVEIRO**
**DEPARTAMENTO DE ELECTRÓNICA TELECOMUNICAÇÕES E INFORMÀTICA**

**Machine Learning - 2018/19**

# PROJECT 1

Each group of two students will work on one project topic.
If you prefer to work on a project not listed below, make a short description of the problem and the data and discuss it with the instructor.

## I. PROJECT GOAL

The goal of the project is to apply suitable machine learning algorithms that have learned in the class (for classification or regression) to model the training data and evaluate the accuracy of the models on testing data. Apply un-regularized and regularized cost functions and compare the performance of the ML algorithms using cross validation approach. Tune the ML algorithm parameters (e.g. lambda, ANN hidden layer units, etc.) to optimize their performance.
Represent the results in graphical or table formats, make analysis and conclusions.

## II. PROJECT PROPOSALS

1. **Machine Learning approach for Equalization of Fiber Optic Channels** (decode Quadrature Amplitude Modulated (QAM) signals transported over an optic link):
   (see more details in file QAM_project.pdf)

   a) **64-QAM classification**. Artificial Neural Network (ANN) nonlinear equalizer. Classification of the 64 QAM transmitted symbols from the noisy signals obtained by the receiver.

   b) **64-QAM regression**. Artificial Neural Network (ANN) as a regression model to recover the 64 QAM transmitted symbols from the noisy signals obtained by the receiver.

   c) **16-QAM classification**. Classification of the 16 QAM transmitted symbols from the noisy signals obtained by the receiver. Comparison between ANN, SVM and Logistic regression classifiers.

   d) **16-QAM regression**. ANN as a regression model to recover the 16 QAM transmitted symbols from the noisy signals obtained by the receiver.

2. **ML approach to build regression models for pilot plants available in the control lab of DETI:**
   (see more details in files RT010.pdf, RT030.pdf, RT040.pdf, RT050.pdf, RT060.pdf)

   a) **Pilot Plant RT010**. Perform tests with RT010 Water Level Control System to collect input (voltage) and output (water level) data and build a regression model.

   b) **Pilot Plant RT030**. Perform tests with RT030 Air Pressure Control System to collect input (voltage) and output (pressure) data and build a regression model.

c) **Pilot Plant RT040**. Perform tests with RT040 Temperature Control System to collect input (voltage) and output (temperature) data and build a regression model.

d) **Pilot Plant RT050.** Perform tests with RT050 Motor Velocity Control System to collect input (voltage) and output (rotational velocity) data and build a regression model.

e) **Pilot Plant RT060.** Perform tests with RT060 Position Control System to collect input (voltage) and output (position) data and build a regression model.

## III. PROJECT ASSESMENT (25 % of the final grade)

1. **Report (70%).** The project work is evaluated based on the submitted report ( IEEE Latex format). The work done by each student has to be explicitly specified. The pdf and Latex files of the report plus the programs to implement the algorithms are sent in a compressed format having the following name: P1_ML2018_XXXXX_YYYYY (where XXXXX and YYYYY need to be substituted by the student numbers of each student.

2. **Oral presentation (30%)** of the work done for 15 min. during the class on 2018).