Computer Science Department
CS675 – Introduction to Data Science (CRN: 76747)
Fall 2021

Project #2 / Due 10-Nov-2021

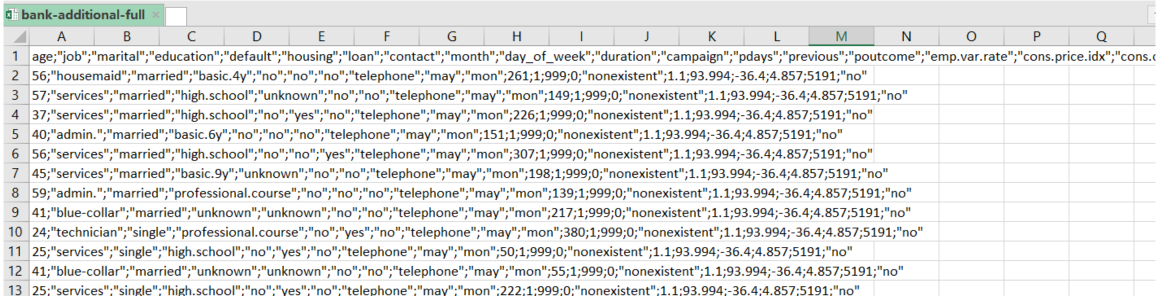
The goal of this assignment is to understand the 'power' of various Machine Learning Classification algorithms applied into a dataset. By contrasting these very well-diverse and widely used models within Machine Learning space. The end goal is to find the 'best' algorithm to do the job in quest.

Write up **Python/R code** snippets that will device **6 different classification algorithms** on the same dataset. Namely, apply the following ML models:
1- **Logistic Regression** (LR)
2- **Naive Bayes** (NB)
3- **K-Nearest Neighbors** (KNN)
4- **Decision Tree** (DT)
5- **Random Forest** (RF)
6- **XGBoost Algorithm** (XGB)

You should download the following Bank dataset: **Bank Marketing Data Set**
The data is related with direct marketing campaigns (phone calls) of a Portuguese banking institution. The classification goal is to predict if the client will subscribe a term deposit (variable y).
https://archive.ics.uci.edu/ml/datasets/Bank+Marketing

There are four (4) datasets, you should get only one (1), the 'bank-additional-full.csv' with 41,188 records.
https://archive.ics.uci.edu/ml/machine-learning-databases/00222/
Download the 'bank-additional.zip' file and extract the 'bank-additional-full.csv' file.
Read details of what the variable/features mean.

Here is what the file looks like:



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1  age;"job";"marital";"education";"default";"housing";"loan";"contact";"month";"day_of_week";"duration";"campaign";"pdays";"previous";"poutcome";"emp.var.rate";"cons.price.idx";"cons.
2  56;"housemaid";"married";"basic.4y";"no";"no";"no";"telephone";"may";"mon";261;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
3  57;"services";"married";"high.school";"unknown";"no";"no";"telephone";"may";"mon";149;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
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5  40;"admin.";"married";"basic.6y";"no";"no";"no";"telephone";"may";"mon";151;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
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8  59;"admin.";"married";"professional.course";"no";"no";"no";"telephone";"may";"mon";139;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
9  41;"blue-collar";"married";"unknown";"unknown";"no";"no";"telephone";"may";"mon";217;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
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11 25;"services";"single";"high.school";"no";"yes";"no";"telephone";"may";"mon";50;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
12 41;"blue-collar";"married";"unknown";"unknown";"no";"no";"telephone";"may";"mon";55;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
13 25;"services";"single";"high.school";"no";"yes";"no";"telephone";"may";"mon";222;1;999;0;"nonexistent";1.1;93.994;-36.4;4.857;5191;"no"
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Perform various Machine Learning activities in order to complete the following tasks along with their output. All work should be done and submitted in a single **Jupyter Notebook.**
1- **Prep the data** in order to be ready to be fed to ML models.
2- Split the source dataset into **training** and **test** datasets at a 70%/30% ratio.
3- Run all algorithms with default values and report their **model performance** on the following metrics:

- Accuracy
- Precision
- Recall
- F1 Harmonic Mean

4- Generate **Classification Report** (for each model) including: Confusion Matrices, ROC Curves, and AUCs.
5- Extra points, rerun some of the models by **tuning** some **hyperparameters**.