ML PROJECT

BANK MARKETING

Student:

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MILESTONE

Motivation

- **Problem**: Predict if the client will subscribe (yes/no) a term deposit
- **Dataset**: The data is related with direct marketing campaigns of a Portuguese banking institution

The dataset was updated in 2014 but the issue is still relevan: the sell of bank/financial product via telephone. It is a common way to sell products. The analysis of this dataset has the goal to create a program that could predict a sale and validate the results.

Method

Data Set Information

The data is related with direct marketing campaigns of a Portuguese banking institution. The marketing campaigns were based on phone calls. Often, more than one contact to the same client was required, to access if the product (bank term deposit) would be ('yes') or not ('no') subscribed.

Dataset url: https://archive-beta.ics.uci.edu/ml/datasets/bank+marketing

My dataset has named "bank-additional-full.csv" with 41188 examples and 20 features (plus the target one).

Dataset structure

Input variables:
# bank client data:
1 - **age** (numeric)
2 - **job** : type of job (categorical: "admin.","blue-collar","entrepreneur","housemaid","management","retired","self-employed","services","student","technician","unemployed","unknown")
3 - **marital** : marital status (categorical: "divorced","married","single","unknown"; note: "divorced" means divorced or widowed)
4 - **education** (categorical: "basic.4y","basic.6y","basic.9y","high.school","illiterate","professional.course","university.degree","unknown")
5 - **default**: has credit in default? (categorical: "no","yes","unknown")
6 - **housing**: has housing loan? (categorical: "no","yes","unknown")
7 - **loan**: has personal loan? (categorical: "no","yes","unknown")
# related with the last contact of the current campaign:
8 - **contact**: contact communication type (categorical: "cellular","telephone")
9 - **month**: last contact month of year (categorical: "jan", "feb", "mar", ..., "nov", "dec")
10 - **day_of_week**: last contact day of the week (categorical: "mon","tue","wed","thu","fri")
11 - **duration**: last contact duration, in seconds (numeric). Important note: this attribute highly affects the output target (e.g., if duration=0 then y="no"). Yet, the duration is not known before a call is performed. Also, after the end of the call y is obviously known. Thus, this input should only be included for benchmark purposes and should be discarded if the intention is to have a realistic predictive model.

# other attributes:
12 - **campaign**: number of contacts performed during this campaign and for this client (numeric, includes last contact)
13 - **pdays**: number of days that passed by after the client was last contacted from a previous campaign (numeric; 999 means client was not previously contacted)
14 - **previous**: number of contacts performed before this campaign and for this client (numeric)
15 - **poutcome**: outcome of the previous marketing campaign (categorical: "failure","nonexistent","success")
# social and economic context attributes
16 - **emp.var.rate**: employment variation rate - quarterly indicator (numeric)
17 - **cons.price.idx**: consumer price index - monthly indicator (numeric)
18 - **cons.conf.idx**: consumer confidence index - monthly indicator (numeric)
19 - **euribor3m**: euribor 3 month rate - daily indicator (numeric)
20 - **nr.employed**: number of employees - quarterly indicator (numeric)

Output variable (desired target):
21 - **y** - has the client subscribed a term deposit? (binary: "yes","no")

Columns that I could use and relevat to the analysis are: age, job, marital, default, housing, loan, campaign, previous, poutcome, emp-var.rate, cons.price.idx, cons.conf.idx.

The last column (“y”) is the target to predict. It’s a simple binary choice: yes or no based on possibile subscribtion of the term deposit.

Cleaning Dataset

The dataset need an alteration to obtain a “cvs” file without column separation, with comma delimiter between data and without blank space. It’ll be checked to delete all null row or any problem.

ML Algorithms to perform

Algorithms to perform:

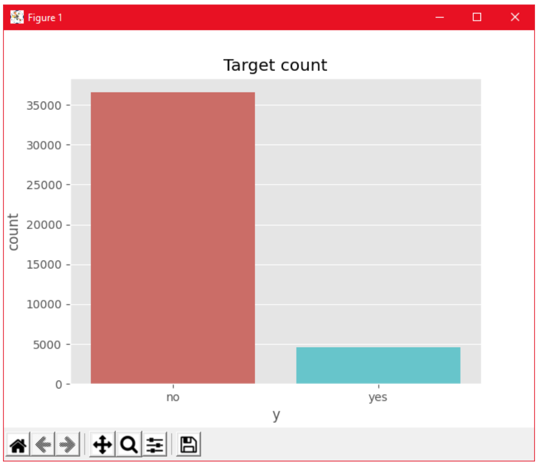
- Logistic regression
- Neural network for classification
- Decision tree classifier

Preliminary experiments

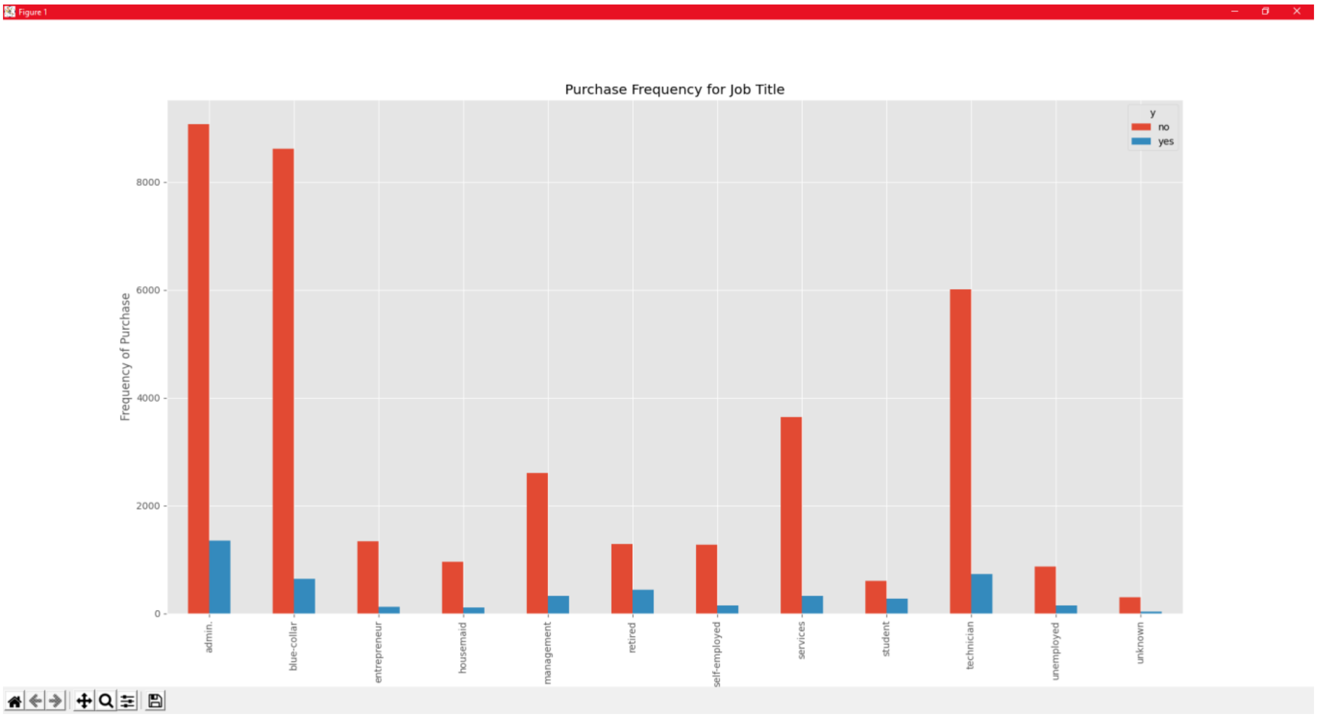
I create the cleaning_dataser.py to check and clean the dataset. I found some problems that need to be fixed. The first function replace the symbol “ with nothing because every cell had that char, this create a problem during the read of csv file. Than, for the same reason, I replaced the ; with ,. Another replace involve the name of the index because the comma create problem, than I replace it with _ (for example: emp.var.rate -> emp_var_rate).
The second function check the missing value and null value.
The last two things are encoder and drop. With encoder I replace the string with an encoder label, with drop I remove all the columns useless. At the end I saved the dataset into the “dataset.csv”.
Now I started some analysis:

- Target count:
  no 36548
  yes 4640

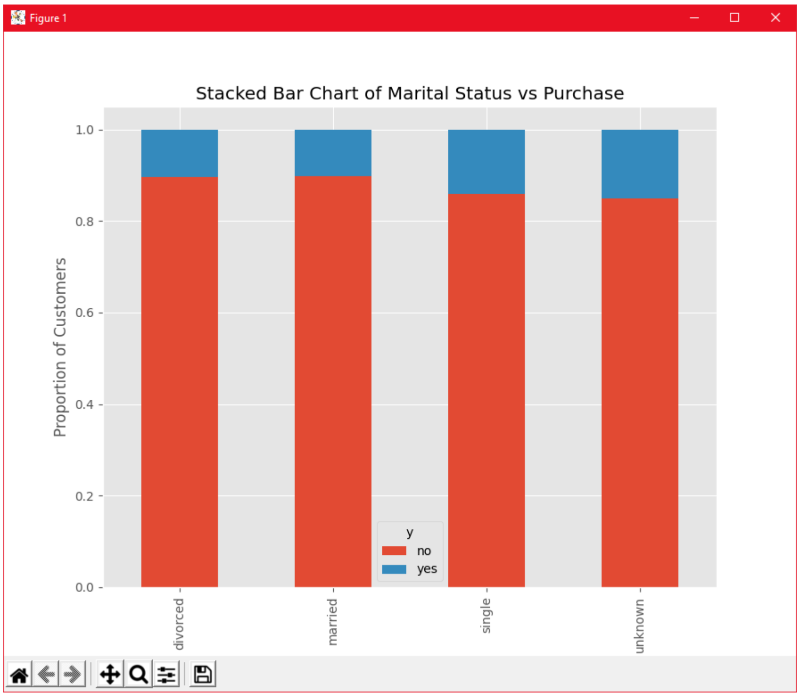
  Percentage of no subscription is 88.73458288821988
  Percentage of subscription 11.265417111780131



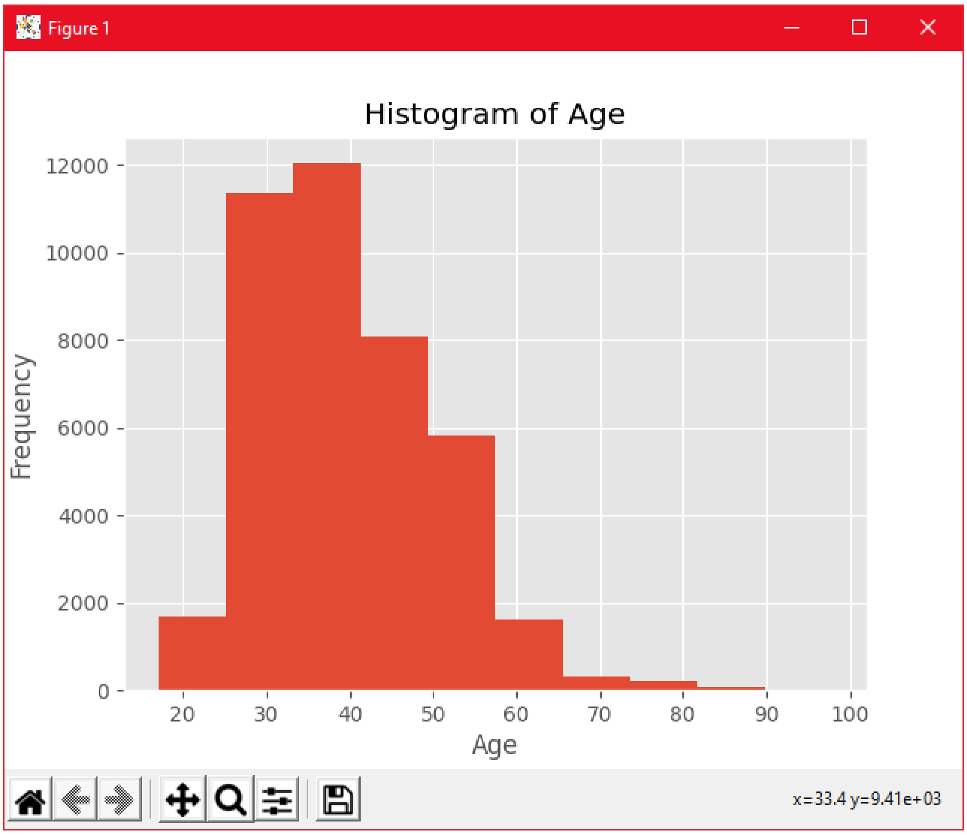
- Purchase frequency for job title, the frequency depends a great deal on the job title.



- Marital status: does not seem a strong predictor for the outcome variable.



- Most of the customers of the bank in this dataset are in the age range of 30–40.



Next steps

I’ll run the following algorithms:

- Logistic regression
- Neural networks
- Decision Tree