Data Science with Python – Assignment #3

Assignment description

This assignment contains two tasks: (1) analysis of medical expenses data with linear regression, and (2) implementation of nearest neighbors in radius (NNR) classifier.

Task #1: linear regression analysis with medical insurance dataset

A dataset with individuals' medical expenses is attached to this task, as well as a jupyter notebook with questions. The task is to train a linear regression model for predicting the (continuous) value of medical expenses from multiple predictors. Explore the data, implement your solution, and answer the questions. Strive to make your code effective and elegant.

Comments:

(1) Note that there are multiple (valid) ways to solve the same question.

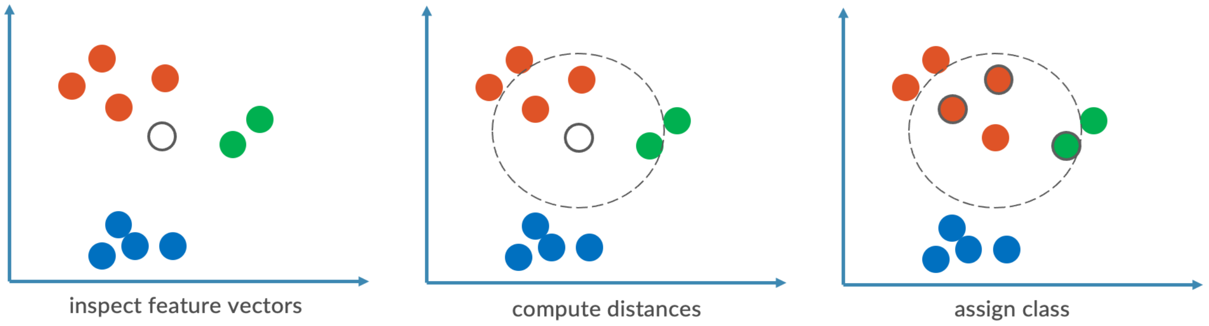
(2) Before solving the assignment, take few minutes to make sure you understand the data.

(3) Before submission: (1) restart kernel (right click → restart kernel) and make sure your solution works as expected; (2) clear all outputs (right click → clear all outputs).

Task #2: implementation of the NNR classifier

A nearest neighbors in radius (NNR) classifier is a variation of the KNN classifier we saw in the lecture, where instead of looking for the majority vote within K nearest neighbors of an instance, it inspects all instance's neighbors in a given radius and assigns it a label according to the majority vote in the radius.

Consider the below example: the new instance will be assigned the red label due to the majority of red instances in the dashed-line radius around it.



inspect feature vectors

compute distances

assign class

You are given two (independent) datasets, split into `training`, `validation` and `test` sets. The goal is to (1) find the optimal radius for a given dataset using the validation set, and (2) use this radius to assign labels on the test set, and (3) compute the final accuracy (done for you in the main).

```
def classify_with_NNR(data_trn: str, data_vld: str, df_tst: DataFrame) -> List:
    # implement this function
    ...
```

Comments:

(1) In the provided datasets: all columns but the last are features, the last column (class) is labels.

(2) Your code should work seamlessly on any dataset of the given structure (and split into three parts): do not hardcode any dataset-specific details (e.g., file or feature names, the number of classes). As a concrete example, the code should work on both datasets with the single change of names in the config.json file. The submission will be graded on different (unseen) dataset(s).

(3) Note that you are required to implement your own NNR version (and not invoke the RadiusNeighborsClassifier() classifier from sklearn). You can have a look at its implementation, but you may not find it very helpful. However, you can try it out on your data and compare the results.

(4) Implementation obtaining roughly 47% and 59% accuracy on the two test datasets: spotify_album_genre (six classes) and body_performance (four classes), respectively, can be considered a good achievement. However, the task will be graded on additional dataset(s).

(5) Make sure your code runtime doesn't exceed 3 minutes (it can run in less than a minute).

(6) The classifier should be implemented in PyCharm (similarly to assignment #1).

(7) Do not make any changes to the main() function.

Submission

Submit a single zip file – assignment3_ xxxxxxxxx_xxxxxxxxx.zip , where “xxxxxxxxx” stands for a student id. Please specify two student ids (your and your partner’s). It should include two files:

1. Your solution for task #1: `assignment3_task1.ipynb`
2. Your solution for task #2: a single `main.py` file with your solution for the task

Grading criteria include: correctness (the major part), code design, readability and documentation.

Good Luck!