This project is 25% of the semester's grade. The project must be individual work and must not be copied or shared. Any tendency to cheat/copy evidence will lead to a 0 mark for the assignment. Submit both the report and the notebook files after compressing them.

There are two provided data sets, Data\_train.csv and Data\_test.csv, as shown below.

Table

Description automatically generated

If the visualization of train data is made, the coordinates (x, y) are non-linear. To build a linear parametric model, the train data needs to be transformed into a new space where the linearity needs to be confirmed.

Task 0: Naïve Logistic Regression [5 pts]

Make a logistic regression and report the accuracy.

Task 1: Train Data Transformation [30 pts]

Perform the pre-processing to transform the original data into a new feature space by doing feature engineering so the features are linear in the new space. Confirm four assumptions required for a linear classifier.

Task 2: Linear Parametric Classification [10 pts]

Implement logistic regression model using Scikit-learn. Using the GridSearchCV, optimize the model.

1. Make a logistic regression model. Report the weights and the accuracy of the model.
2. Using the GridSearchCV at various 100 values from to , build a logistic regression model. Visualize how the model accuracy behaviors. Then report the best model. If the accuracy is 100%, then the model is overfitted. In this case, the model should be regularized.
3. Using the best model, classify the test data set.

Task 3: Transformation using Kernel Method [20 pts]

Kernelize the original to a Kernel space using five different valid Kernel functions. Then repeat Task 2.

Task 4: Non-parametric KNN Classification [15 pts]

1. Classify the original data with *K* values from 1 to 200. Then report the accuracy with visualization.
2. Repeat step 1 with the final train data sets from Tasks 1 and 3.

Report: [20 pts]

Write a report summarizing the work. In the report, all steps must be explicitly explained with visualizations.