**Letter Recognition**

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**Abstract:**

gives a brief paragraph on the main target of the project, and the achievement of the

project

**1 Introduction**

We aim to apply some multi-classifiers on the data set and get the best accuracy to make a model that can predict output according to our fetchers after applying (MLP, Random Forest, SVM) we found that the best accuracy we get in SVM and Random Forest we get in the SVM and get in Random Forest. On the other hand, we aim to apply MLP with different activation functions and optimization techniques.

**2 Dataset**

Dataset: <https://www.kaggle.com/nishan192/letterrecognition-using-svm>

Our dataset is related to letter recognition for letters from A to Z for 26 letter our dataset contains of 20,000 instances based on 16 features where x-box horizontal position of box means the horizontal of letter , y-box vertical position of box means the vertical of the letter, width is width of the box (integer),high is the height of box (integer), onpix means the total number on pixels (integer),x-bar mean x of on pixels in box (integer),y-bar mean y of on pixels in box (integer),x2bar mean x variance (integer),y2bar mean y variance (integer), xybar mean x y correlation (integer), x2ybr mean of x \* x \* y (integer),xy2br mean of x \* y \* y (integer), x-ege mean edge count left to right (integer), xegvy correlation of x-ege with y (integer), y-ege mean edge count bottom to top (integer), yegvx correlation of y-ege with x (integer)w divide our dataset into test and train where the test was 70% and train was 30%.

More info about: <https://archive.ics.uci.edu/ml/datasets/Letter+Recognition>

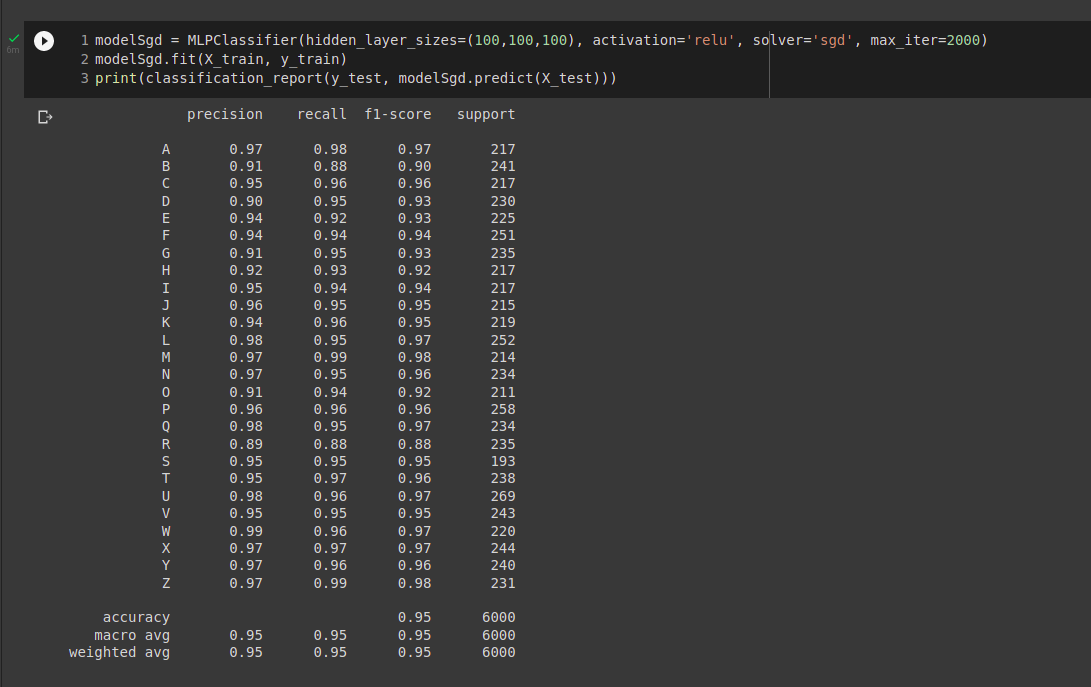
**3 Experimental Results**

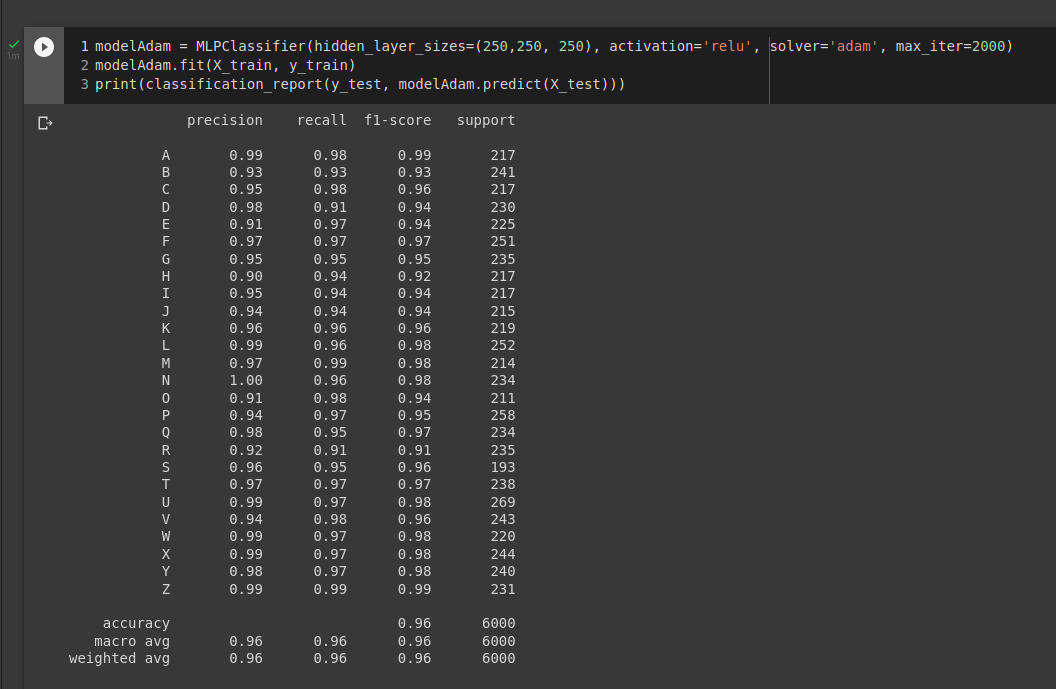
***MLP***

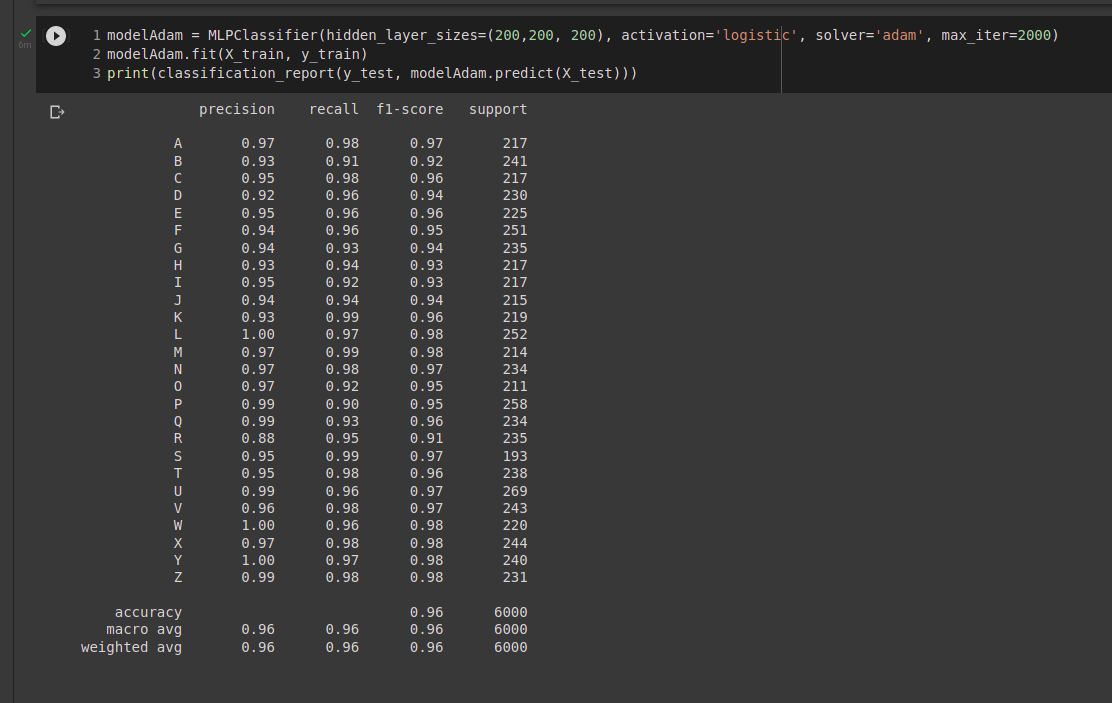
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Classifier | Activation Function | Optimization | No Of Iterations | No Of Hidden layers | No Of  preceptrons | Accuracy | Precision | Recall |
| MLP | Relu | sgd | 2000 | 3 | 100 | 0.95 | 0.95 | 0.95 |
| MLP | Relu | adam | 2000 | 3 | 250 | 0.96 | 0.96 | 0.96 |
| MLP | logistic | adam | 2000 | 3 | 200 | 0.96 | 0.96 | 0.96 |

**References**

<https://www.kaggle.com/nishan192/letterrecognition-using-svm>

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***Random Forest Classifier***

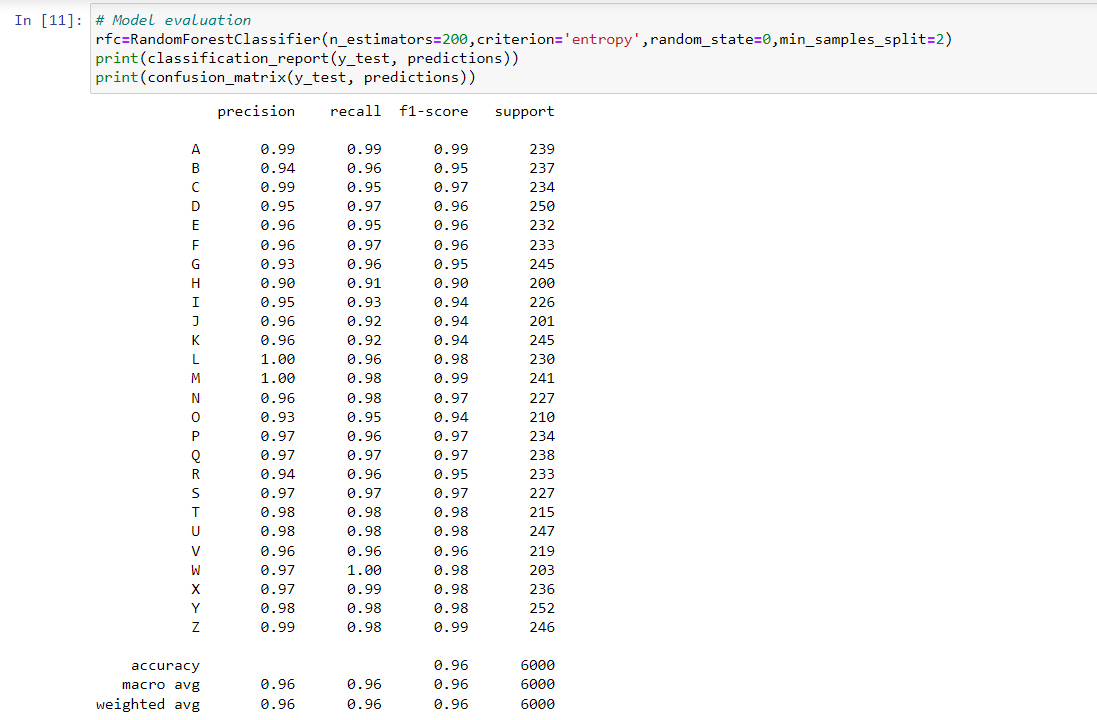
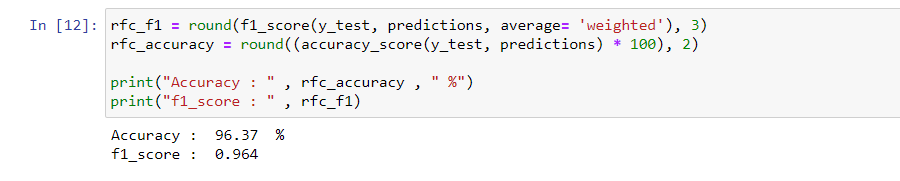
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| --- | --- | --- | --- | --- | --- | --- |
| Classifier | criterion | n\_estimators | Accuracy | Precision | Recall | F1- score |
| Random Forest | entropy | 200 | 96.37% | 0.96 | 0.96 | 0.964 |
| Random Forest | entropy | 250 | 95.75% | 0.96 | 0.96 | 0.958 |
| Random Forest | gini | 200 | 95.67% | 0.96 | 0.96 | 0.957 |
| Random Forest | gini | 250 | 95.95% | 0.96 | 0.96 | 0.96 |

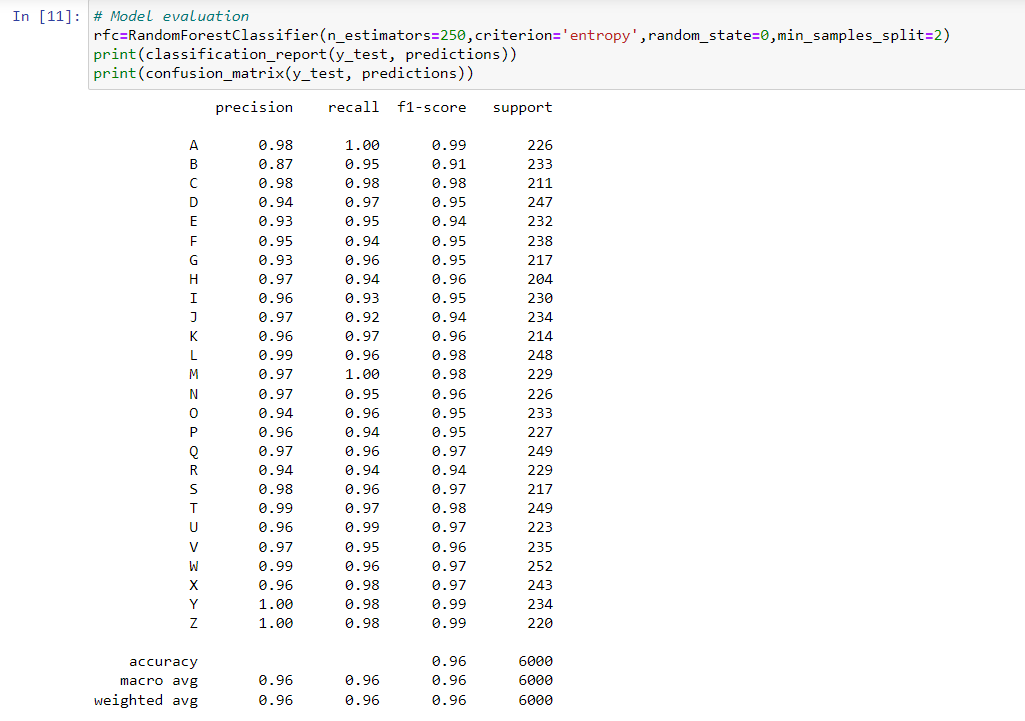
**References:** <https://www.kaggle.com/rahulvv/nb-and-rf-models-99-accuracy>

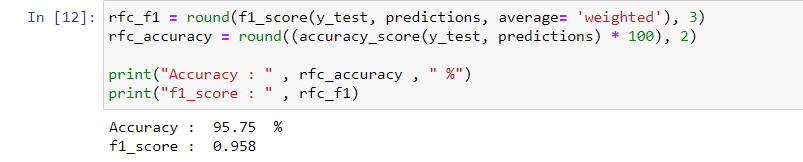
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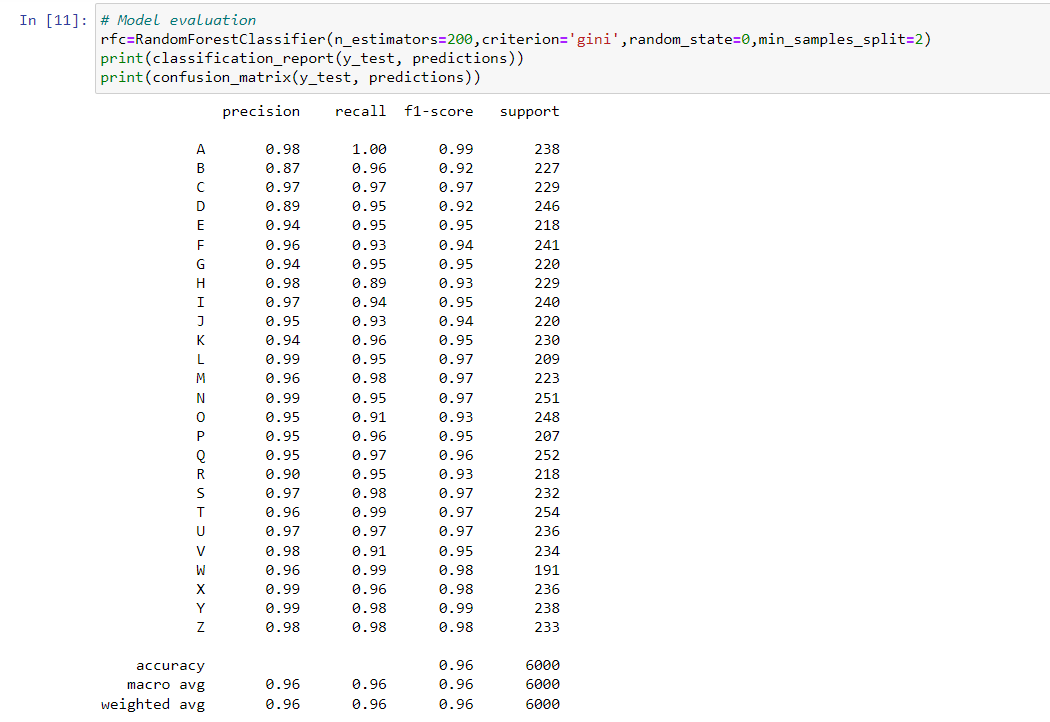
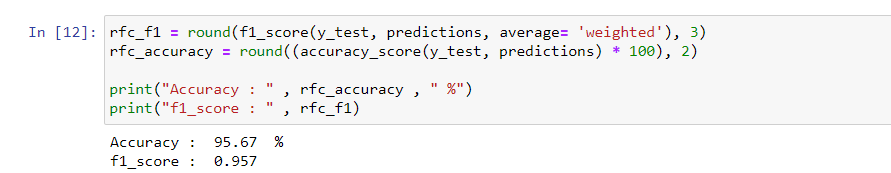
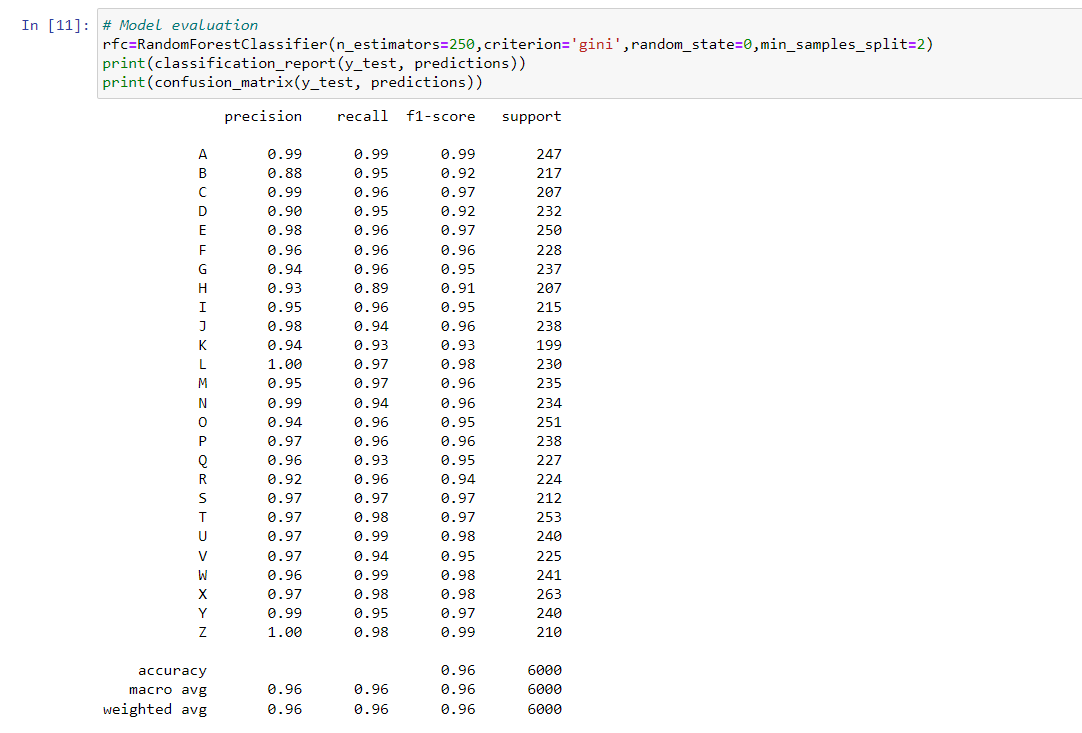
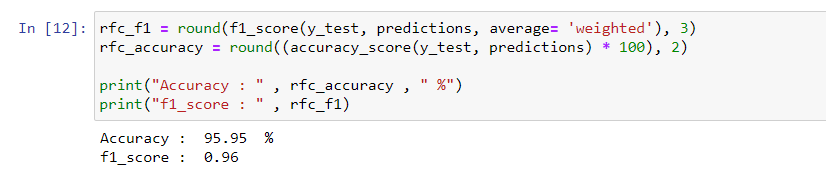
<https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html>

**Screenshots:**







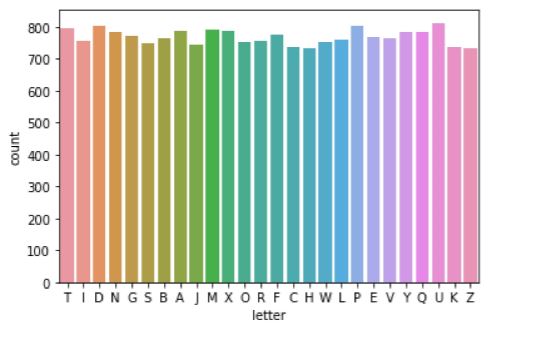


***SVM***

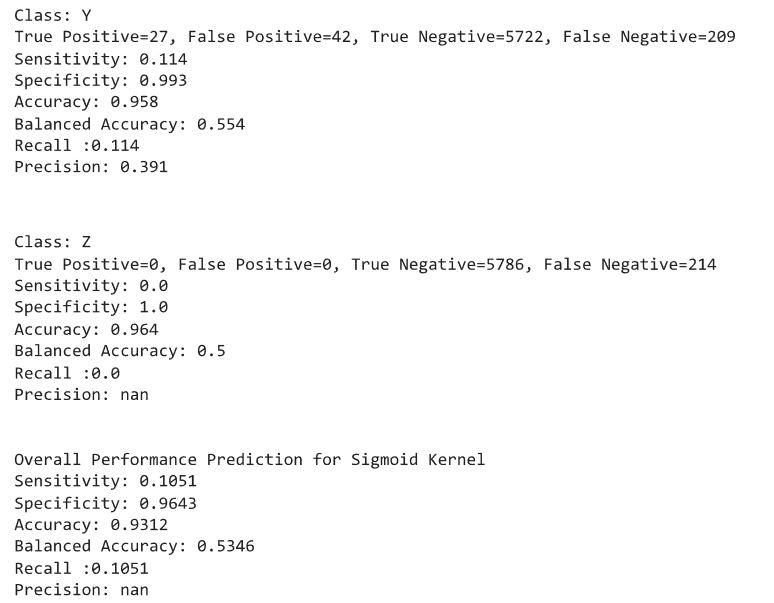
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Classifier | Kernel | Sensitivity | Accuracy | Precision | Recall | Specificity |
| SVM | Sigmoid | 0.1051 | 93.12% | - | 0.1051 | 0.9643 |
| SVM | Linear | 0.8102 | 98.54% | 0.8184 | 0.8102 | 0.9924 |
| SVM | polynomial | 0.9457 | 99.58% | 0.9461 | 0.9457 | 0.9978 |
| SVM | rbf | 0.929 | 99.45% | 0.9305 | 0.929 | 0.9972 |

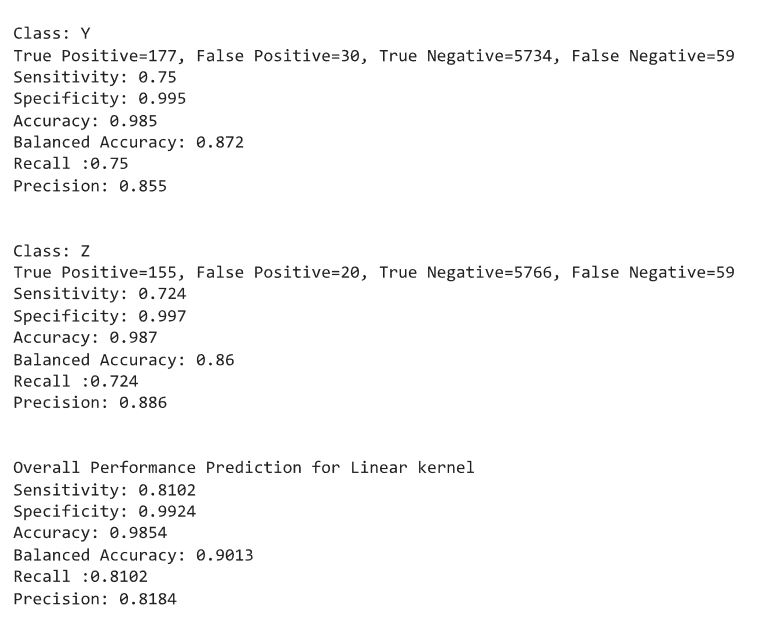
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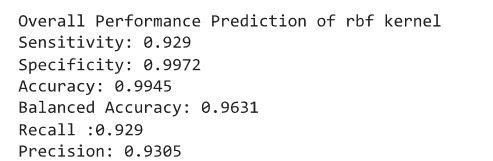
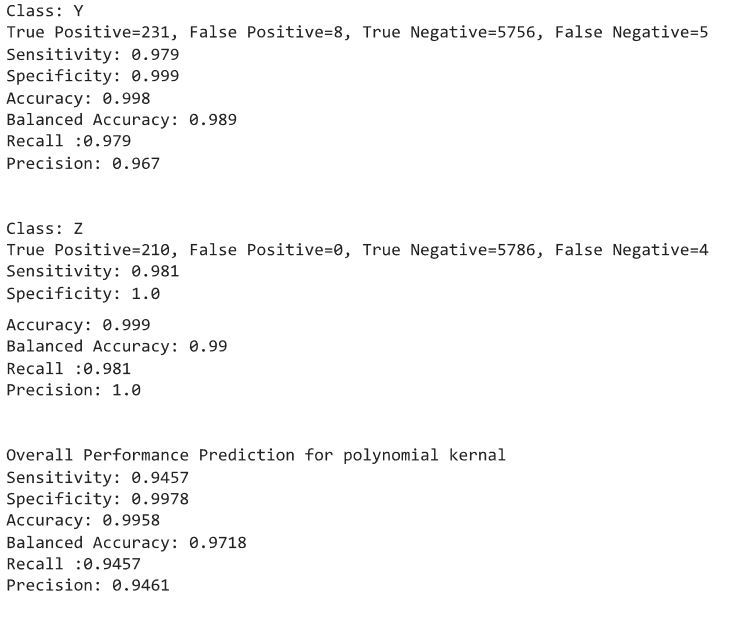
**Visualization of the dataset**



**Linear Kernel Sigmoid Kernel Output**





******Polynomial Kernel Output Rbf Kernel Outpu**