Team members:

Name	UBIT id
Astrid Gomes	ASTRIDYV
Mansi Wagh	MANSIWAG
Rasita Pai	RASITASH

Notes:

Stubs changed for following functions:

- WCSS(Clusters,centriods_use)
- KNN(X_train,X_test,Y_train,N)
- SklearnVotingClassifier(X_train,Y_train,X_test,Y_test)
- SklearnVotingClassifier(X_train,Y_train,X_test,Y_test)

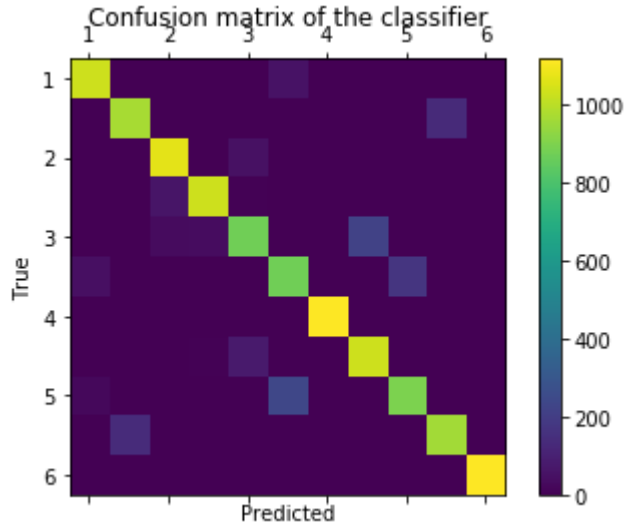
New Functions added:

- VisualizationConfusionMatrix(Y_test, y_pred):
- GridSearchCV_hp_tuning(X_train, X_test, y_train, y_test):

Confusion matrix visualizations:

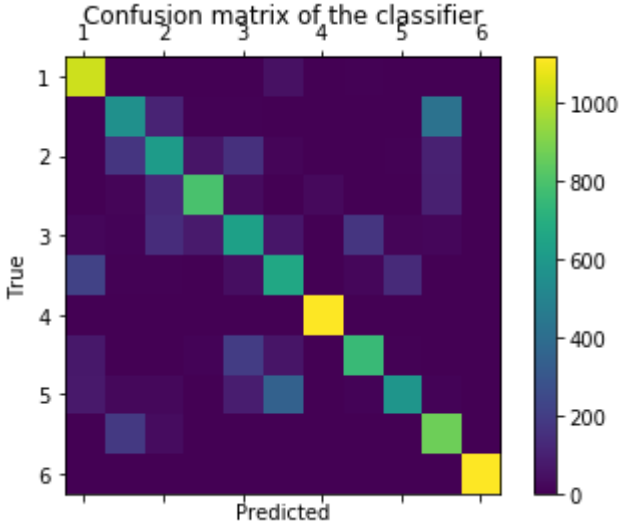
For SVM:

```
[[1032    0    0    0    0   55    0    0    3    0    0]
 [   1  973    0    0    0    0    0    0    0  132    0]
 [   0    0 1072    0   52    0    0    0    0    0    0]
 [   0    0   63 1034    5    0    0    0    0    0    0]
 [   0    0   32   38  875    0    0  220    0    0    0]
 [  44    0    0    0    0  876    0    0  171    0    0]
 [   0    0    0    0    0    0 1117    0    0    0    0]
 [   0    0    0    5   79    0    0 1031    0    0    0]
 [  24    4    0    0    0  237    0    0  897    0    0]
 [   0  138    0    0    0    0    0    0    0  961    0]
 [   0    0    0    0    0    0    0    0    0    0 1116]]
```



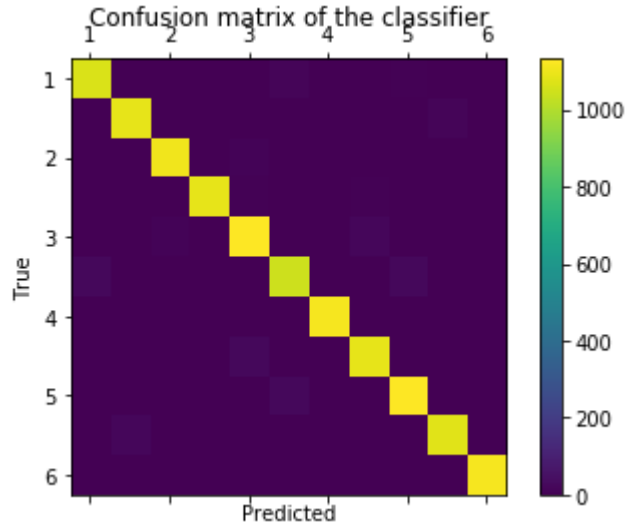
For Logistic Regression:

```
[[1032    0    0    0    1   49    0    5    3    0    0]
 [   1  561  110    7    5    0    0    0    0  422    0]
 [   0  172  612   63  155   14    0    0    5  103    0]
 [   0   14  129  797   34    0   29    0    0   99    0]
 [  20   11  143   80  637   67    0  172   17   18    0]
 [ 220    5    8    0   40  665    0   19  134    0    0]
 [   0    0    0    0    0    0 1117    0    0    0    0]
 [  72    1    3   13  197   65    0  757    6    1    0]
 [  76   24   23    1   88  349    0    9  582   10    0]
 [   0  187   37    3    0    0    0    0    0  872    0]
 [   0    0    0    0    0    0    0    0    0    0 1116]]
```



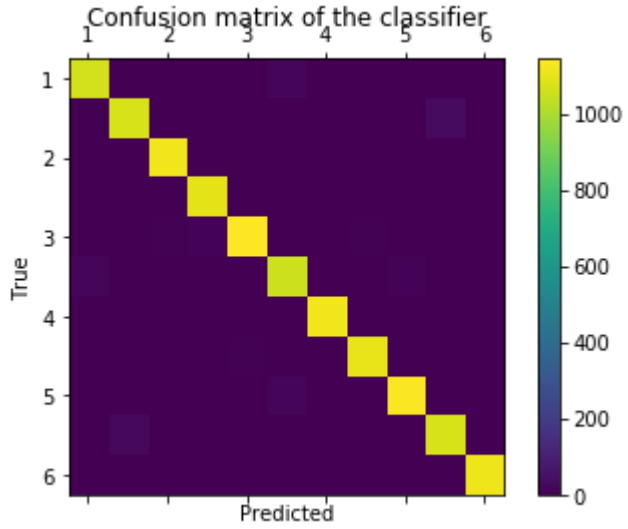
For Decision Tree:

```
[[1068    0    0    0    0   16    0    0    6    0    0]
 [   0 1089    0    0    0    0    0    0    1   16    0]
 [   1    0 1108    1   13    0    0    1    0    0    0]
 [   0    0    2 1089    6    0    0    5    0    0    0]
 [   0    0   12    4 1128    0    0   21    0    0    0]
 [  23    0    0    0    0 1044    0    0   24    0    0]
 [   0    0    0    0    0    0 1117    0    0    0    0]
 [   0    0    1    0   24    0    0 1090    0    0    0]
 [   3    1    0    0    0   26    0    0 1132    0    0]
 [   0   19    0    0    1    0    0    0    0 1079    0]
 [   0    0    0    0    0    0    0    0    0    0 1116]]
```



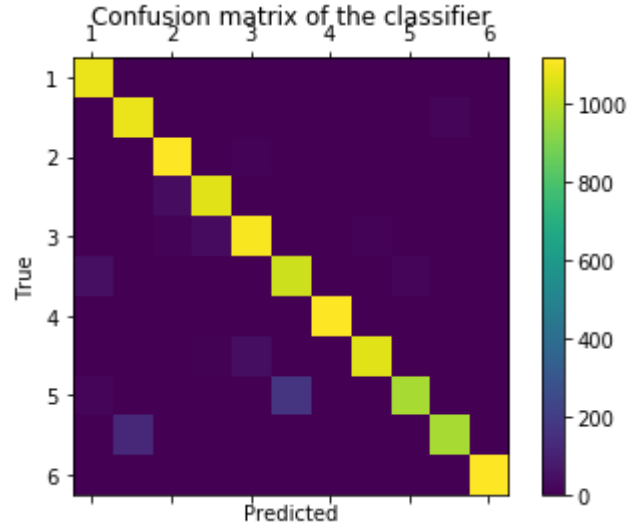
For Knn:

```
[[1067    0    0    0    0   22    0    0    1    0    0]
 [   0 1072    0    0    0    1    0    0    0   33    0]
 [   1    0 1119    1    2    1    0    0    0    0    0]
 [   0    0    4 1094    3    0    0    1    0    0    0]
 [   1    0    5   11 1143    0    0    5    0    0    0]
 [  19    0    1    0    0 1055    0    3   13    0    0]
 [   0    0    0    0    0    0 1117    0    0    0    0]
 [   1    0    0    1    7    1    0 1105    0    0    0]
 [   2    0    1    0    1   22    0    0 1135    1    0]
 [   0   23    0    0    0    0    0    0    0 1076    0]
 [   0    0    0    0    0    0    0    0    0    0 1116]]
```



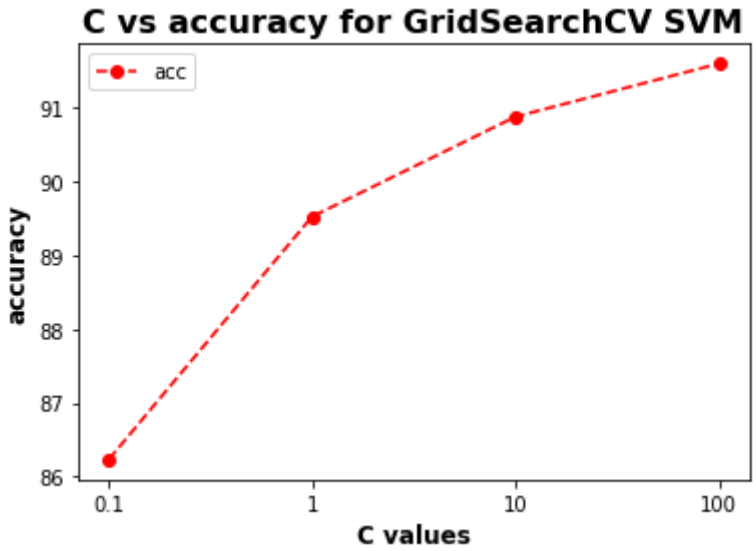
For ensemble model:

```
[[1086    0    0    0    0    4    0    0    0    0    0]
 [   1 1086    0    0    0    0    0    0    0   19    0]
 [   0    0 1115    0    9    0    0    0    0    0    0]
 [   0    0   35 1066    1    0    0    0    0    0    0]
 [   0    1   10   33 1108    0    0   13    0    0    0]
 [  46    0    0    0    0 1031    0    0   14    0    0]
 [   0    0    0    0    0    0 1117    0    0    0    0]
 [   0    0    1    5   41    0    0 1068    0    0    0]
 [  21    3    2    0    0  166    0    0  970    0    0]
 [   0  128    0    0    0    0    0    0    0  971    0]
 [   0    0    0    0    0    0    0    0    0    0 1116]]
```

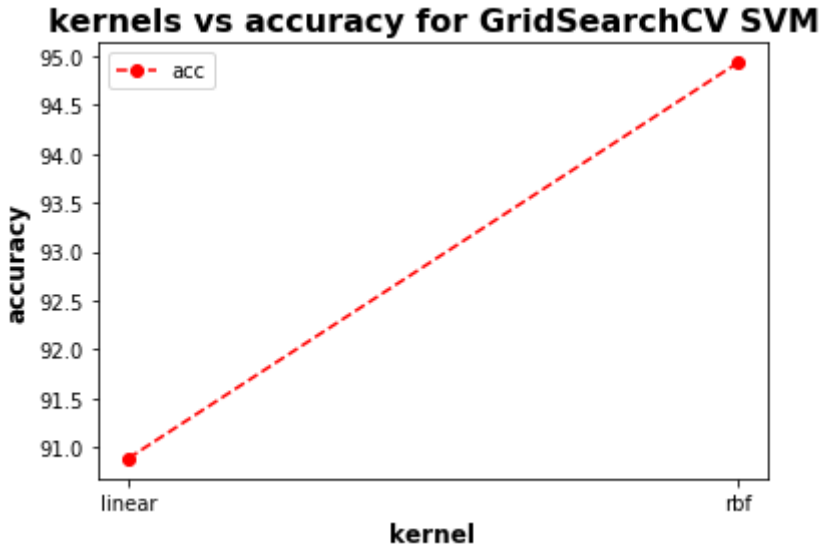


Plots for SVM, Decision tree, Knn reporting hyperparameter search:

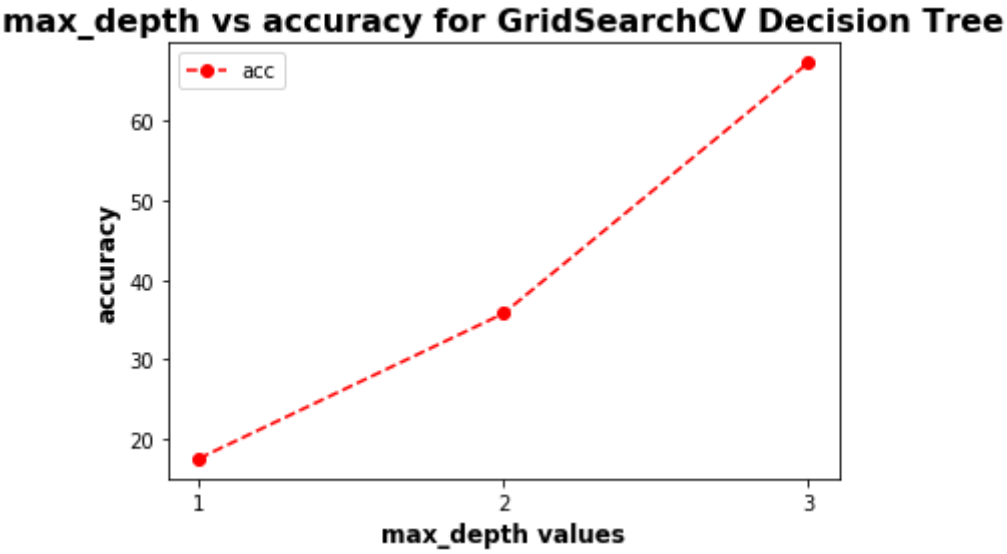
Tuning the parameter C for checking the accuracy:



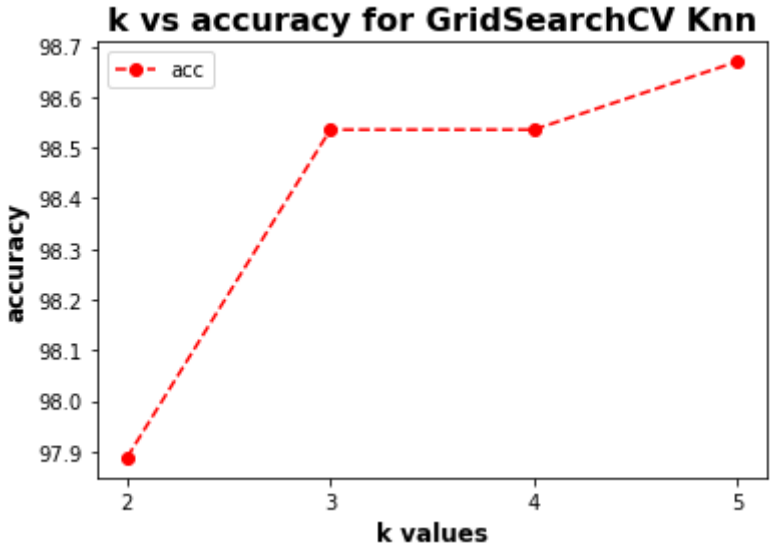
Tuning the parameter kernels for checking the accuracy:



Tuning the parameter max_depth for checking the accuracy:



Tuning the parameter k for checking the accuracy:



References used:

https://scikit-learn.org/stable/modules/generated/sklearn.model_selection.GridSearchCV.html

https://scikit-learn.org/stable/auto_examples/model_selection/plot_grid_search_digits.html

https://mubaris.com/posts/kmeans-clustering/

https://www.youtube.com/watch?v=uFbDWu0tDrE

https://www.youtube.com/watch?v=LLVVVjqVE1c

https://www.youtube.com/watch?v=D_ej0YQM0Cs

https://stackoverflow.com/questions/37665680/how-does-sklearn-compute-the-accuracy-score-step-by-step

https://towardsdatascience.com/understanding-data-science-classification-metrics-in-scikit-learn-in-python-3bc336865019

https://stackoverflow.com/questions/2148543/how-to-write-a-confusion-matrix-in-python

https://www.youtube.com/watch?v=y6DmpG_PtN0&list=PLPOTBrypY74xS3WD0G_uzqPjCQfU6IRK-