**Project Overview:**

The Dry Bean Dataset consists of images of 13,611 grains of 7 different registered dry beans captured with a high-resolution camera. The goal of this project is to develop a classification model to distinguish between the seven different types of dry beans based on features such as form, shape, type, and structure. The dataset comprises 16 features extracted from the grains, including 12 dimensions and 4 shape forms. Three different algorithms were utilized for classification: **Random Forest, TensorFlow Softmax**, and **Support Vector Classifier (SVC).**

**Random Forest Classifier:**

***With Pipeline:***

**Best Parameters:** {'feature\_selection\_\_k': 16, max\_depth': 20, min\_samples\_leaf': 1, min\_samples\_split': 5, n\_estimators': 50}

**Mean CV Accuracy: 92.32%**

**Test Accuracy: 92.03%**

**Random Forest Classifier:**

***Without Pipeline:***

**Best Parameters:** {'max\_depth': 20, 'min\_samples\_leaf': 1, 'min\_samples\_split': 5, 'n\_estimators': 50}

**Mean CV Accuracy: 92.33%**

**Test Accuracy: 92.03%**

**TensorFlow Softmax:**

***With Adam Optimizer:***

model has a total of **three layers**: one input layer, **two hidden layers**, and **one output layer**. The hidden layers **contain 64 and 32 neurons**, respectively, both using the **ReLU** activation function. The output layer utilizes the **Softmax** activation function.

**Mean CV Accuracy: None**

**Test Accuracy: 93.24%**

**SVM:**

***With SVC Classifier:***

**Best Parameters:** {'C': 10, 'gamma': 'scale', 'kernel': 'rbf'}

**Mean CV Accuracy: 93.04%**

**Test Accuracy: 93.46%**

Among the three algorithms used in the project, the **Support Vector Classifier (SVC)** exhibited the **best** **results** in terms of classification accuracy. It achieved a test accuracy of **93.46%,** slightly outperforming the **TensorFlow Softmax** classifier, which attained an accuracy of **93.24%.** The **Random Forest classifier**, both with and without the pipeline, yielded slightly lower accuracies of **92.03%,** which were still respectable but slightly behind **SVC** and **TensorFlow** **Softmax**. Therefore, based on the test accuracy metric, the **SVC** algorithm emerged as the **top performer** in this classification task.