****

**First Step** is to get some information about our data, reading, printing and doing our checks.

**First, Checking for missing values** using this line of code : “data.isna().sum()”, There was no missing value and data is balanced.

**Second, Checking for duplicates**, also There was no duplicated value.

**Showing some Statistics** of our data using this line of code: “data.describe()”

**Some visualizations of our data**

Chart, histogram, box and whisker chart

Description automatically generated

After splitting our data into “Training set and Test set”, here is a plot for our output column which is “class” using “seaborn”.

Chart, histogram

Description automatically generated

There is another type of visualization (Confusion Matrix) for our data also using “seaborn”.

Chart, bar chart

Description automatically generated

1. **Hard Margins SVM and Soft margins SVM implementations**

We import Support Vector Machine from “sklearn” library, using svc classifier to split our (Training set and Test set).

**Hard Margin**

* Build model using SVC classifier

model\_clf1 = svc(kernel='linear',C=1)

* Fitting our data into the model using this line of code:

model\_clf1.fit (train\_features, train\_labels)

* Calculating Accuracy in two ways:

**First:** using “cross\_val\_score” function from “sklearn.model\_selection”

**Second:** using “accuracy\_score” from “sklearn.metrics”

Calculate error using “mean\_squared\_error” from “sklearn.metrics”

for each epoch (we run experiment on 50 epochs)

1. **Accuracy\_HardMargin = 53.086419753086425**

**MSE\_HardMargin= 0.44538706256627786**

**Error plot for Hard Margin**

**Chart

Description automatically generated**

**Accuracy plot for Hard Margin**

**Chart

Description automatically generated**

1. **ROC curve of Hard Margin**

**Chart, line chart

Description automatically generated**

**Soft Margin**

1. Using same steps of hard margin for the second model except this line of code:

* **model\_clf2 = svc(kernel='linear',C=0.002)**

1. **Accuracy\_SoftMargin = 100.0**

**MSE\_SoftMargin= 0.009544008483563097**

**Error plot of Soft Margin**

**Chart

Description automatically generated**

**Accuracy of Soft Margin**

**Chart

Description automatically generated**

1. **ROC curve of Soft Margin**

**Chart

Description automatically generated**