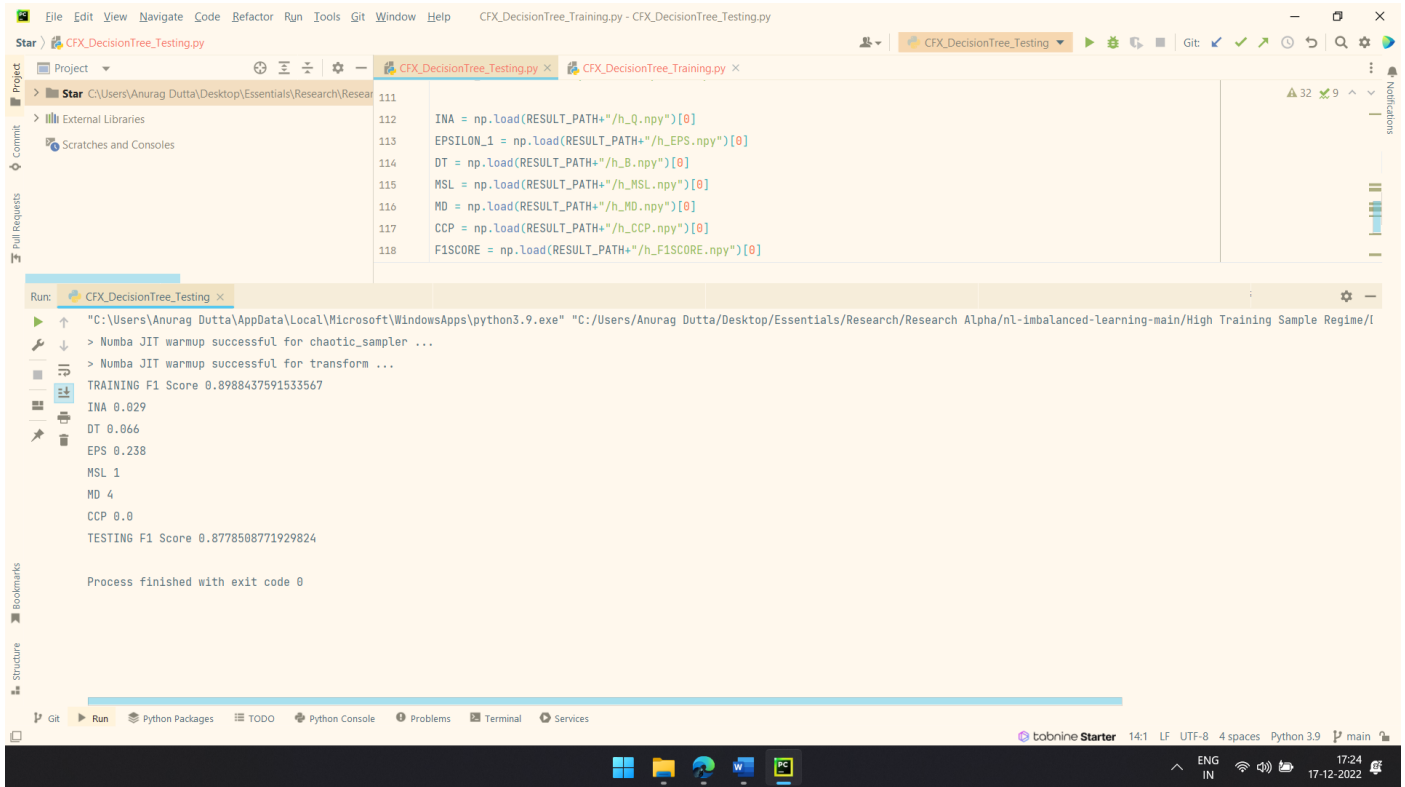


Results after Hyperparameter Tuning

ChaosNet + Decision Tree



```
111 INA = np.load(RESULT_PATH+"/h_Q.npy")[0]
112 EPSILON_1 = np.load(RESULT_PATH+"/h_EPS.npy")[0]
113 DT = np.load(RESULT_PATH+"/h_B.npy")[0]
114 MSL = np.load(RESULT_PATH+"/h_MSL.npy")[0]
115 MD = np.load(RESULT_PATH+"/h_MD.npy")[0]
116 CCP = np.load(RESULT_PATH+"/h_CCP.npy")[0]
117 F1SCORE = np.load(RESULT_PATH+"/h_F1SCORE.npy")[0]
118
```

```
Run: CFX_DecisionTree_Testing x
"C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:/Users/Anurag Dutta/Desktop/Essentials/Research/Research Alpha/nl-imbalanced-learning-main/High Training Sample Regime/I
> Numba JIT warmup successful for chaotic_sampler ...
> Numba JIT warmup successful for transform ...
TRAINING F1 Score 0.8988437591533567
INA 0.029
DT 0.066
EPS 0.238
MSL 1
MD 4
CCP 0.0
TESTING F1 Score 0.8778508771929824

Process finished with exit code 0
```

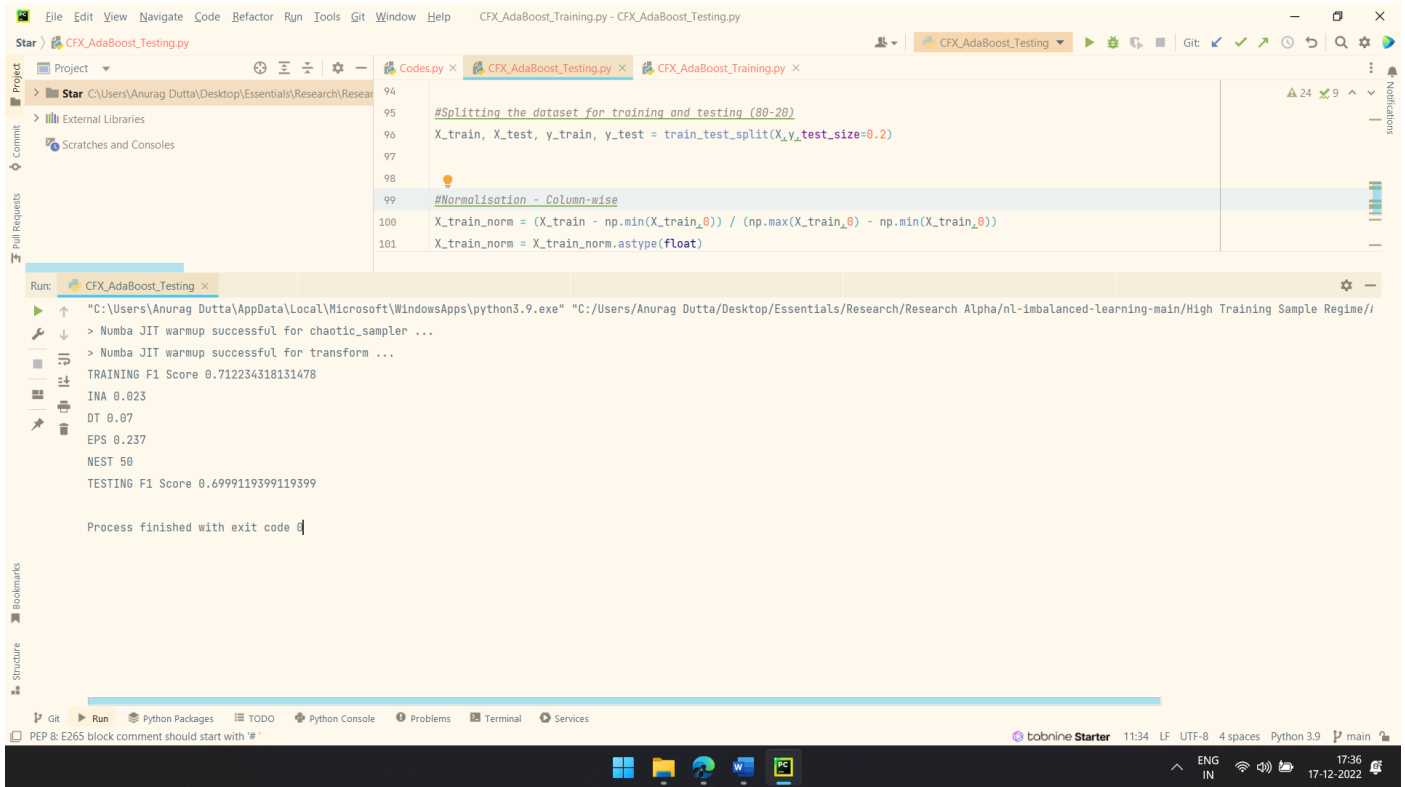
INITIAL_NEURAL_ACTIVITY = [0.029]

DISCRIMINATION_THRESHOLD = [0.066]

EPSILON = [0.238]

TRAINING F1 Score 0.8988437591533567
TESTING F1 Score 0.8778508771929824

ChaosNet + AdaBoost



```
File Edit View Navigate Code Refactor Run Tools Git Window Help CFX_AdaBoost_Training.py - CFX_AdaBoost_Testing.py
Star > CFX_AdaBoost_Testing.py
Project > Star C:\Users\Anurag Dutta\Desktop\Essentials\Research\Research
> External Libraries
Scratches and Consoles
Codes.py x CFX_AdaBoost_Testing.py x CFX_AdaBoost_Training.py x
94
95 #Splitting the dataset for training and testing (80-20)
96 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
97
98
99 #Normalisation - Column-wise
100 X_train_norm = (X_train - np.min(X_train, 0)) / (np.max(X_train, 0) - np.min(X_train, 0))
101 X_train_norm = X_train_norm.astype(float)
Run: CFX_AdaBoost_Testing x
> "C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:\Users\Anurag Dutta\Desktop\Essentials\Research\Research Alpha\ml-imbalanced-Learning-main\High Training Sample Regime/"
> Numba JIT warmup successful for chaotic_sampler ...
> Numba JIT warmup successful for transform ...
TRAINING F1 Score 0.712234318131478
INA 0.023
DT 0.07
EPS 0.237
NEST 50
TESTING F1 Score 0.6999119399119399
Process finished with exit code 0
tobnine Starter 11:34 LF UTF-8 4 spaces Python 3.9 main
PEP 8: E265 block comment should start with '#'
```

INITIAL_NEURAL_ACTIVITY = [0.023]

DISCRIMINATION_THRESHOLD = [0.070]

EPSILON = [0.237]

```
TRAINING F1 Score 0.712234318131478
TESTING F1 Score 0.6999119399119399
```

ChaosNet Standalone

```
120 f1 = f1_score(y_test, Y_PRED, average='macro')
121 print('TESTING F1 SCORE', f1)
122
123 np.save(RESULT_PATH+"F1SCORE_TEST.npy", np.array([f1]))
124
```

Run: Chaosnet_Testing

```
"C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:/Users/Anurag Dutta/Desktop/Essentials/Research/Research Alpha/nl-imbalanced-learning-main/High Training Sample Regime/
> Numba JIT warmup successful for chaotic_sampler ...
> Numba JIT warmup successful for transform ...
TESTING F1 SCORE 0.7369457297088875
Process finished with exit code 0
```

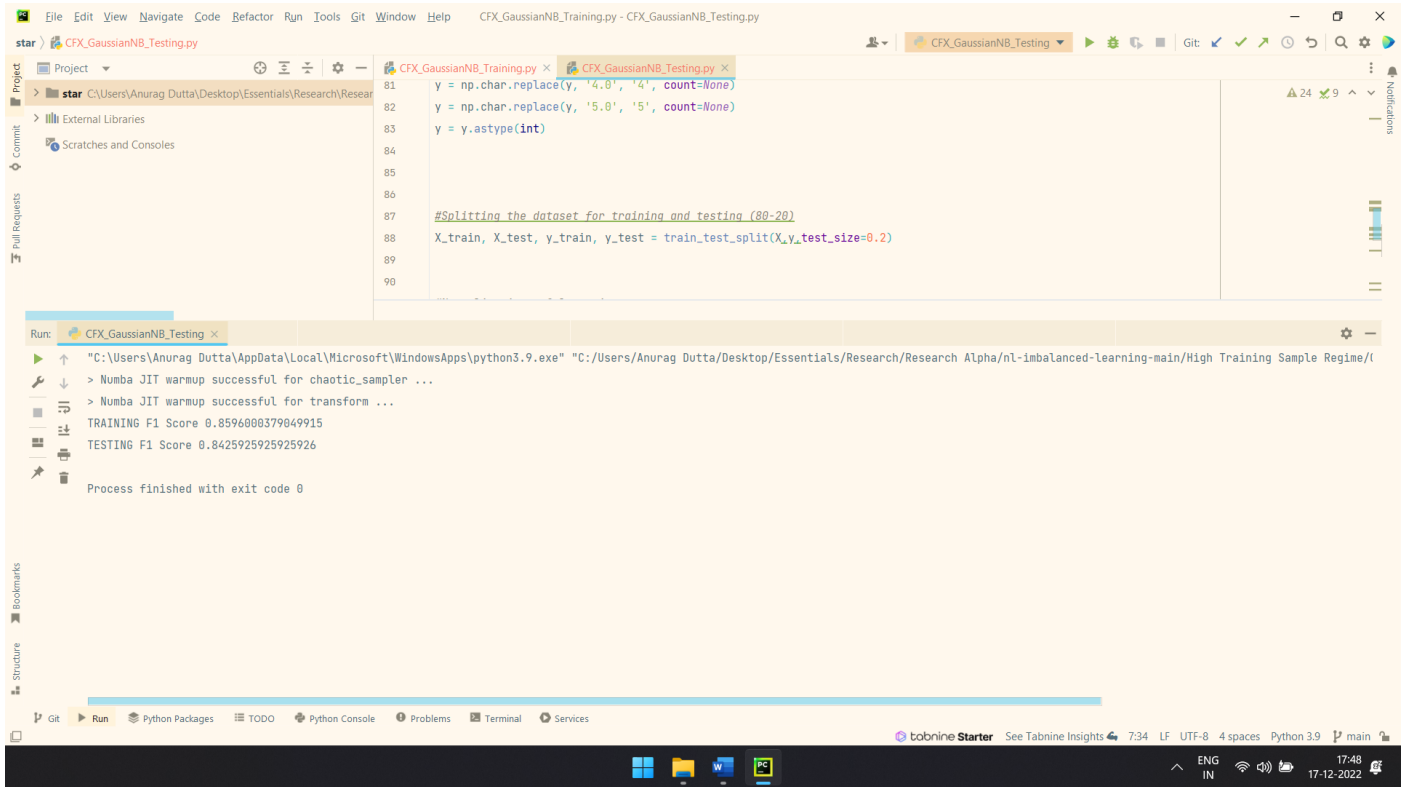
INITIAL_NEURAL_ACTIVITY = [0.03]

DISCRIMINATION_THRESHOLD = [0.07]

EPSILON = [0.226]

```
TRAINING F1 Score 0.7778545471767979
TESTING F1 SCORE 0.7369457297088875
```

ChaosNet + Gaussian Naïve Bayes



```
File Edit View Navigate Code Refactor Run Tools Git Window Help CFX_GaussianNB_Training.py - CFX_GaussianNB_Testing.py
star > CFX_GaussianNB_Testing.py
Project
  star C:\Users\Anurag Dutta\Desktop\Essentials\Research\Research
  External Libraries
  Scratches and Consoles
CFX_GaussianNB_Training.py x CFX_GaussianNB_Testing.py x
81 y = np.char.replace(y, '4.0', '4', count=None)
82 y = np.char.replace(y, '5.0', '5', count=None)
83 y = y.astype(int)
84
85
86
87 #Splitting the dataset for training and testing (80-20)
88 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
89
90
Run: CFX_GaussianNB_Testing x
  "C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:/Users/Anurag Dutta/Desktop/Essentials/Research/Research Alpha/nl-imbalanced-Learning-main/High Training Sample Regime/(
  > Numba JIT warmup successful for chaotic_sampler ...
  > Numba JIT warmup successful for transform ...
  TRAINING F1 Score 0.8596000379049915
  TESTING F1 Score 0.8425925925925926
  Process finished with exit code 0
Git Python Packages TODO Python Console Problems Terminal Services
tobnine Starter See Tabnine Insights 7:34 LF UTF-8 4 spaces Python 3.9 main
ENG IN 17:48 17-12-2022
```

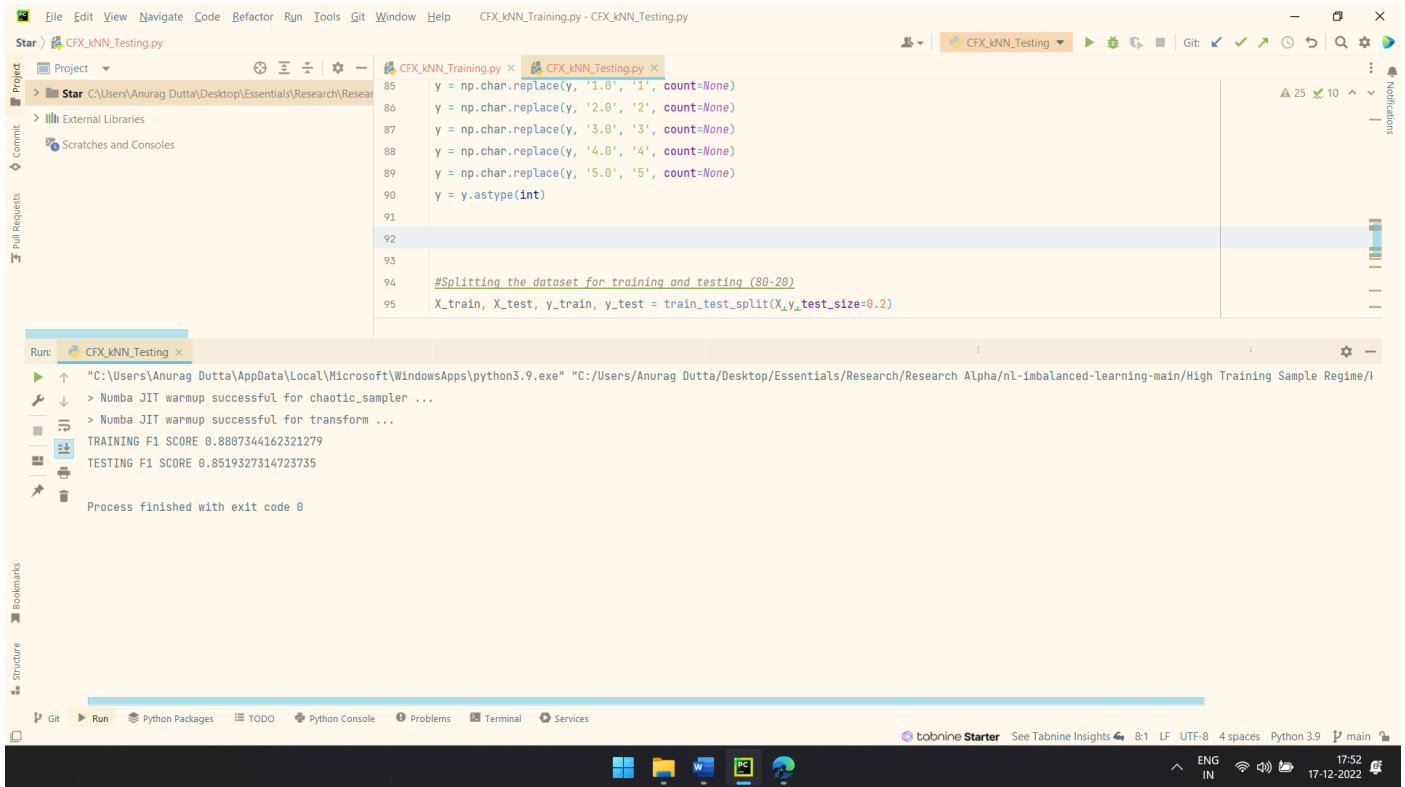
INITIAL_NEURAL_ACTIVITY = [0.03]

DISCRIMINATION_THRESHOLD = [0.07]

EPSILON = [0.228]

```
TRAINING F1 Score 0.8596000379049915
TESTING F1 Score 0.8425925925925926
```

ChaosNet + k – Nearest Neighbors



```
File Edit View Navigate Code Refactor Run Tools Git Window Help CFX_kNN_Training.py - CFX_kNN_Testing.py
Star > CFX_kNN_Testing.py
Project
> Star C:\Users\Anurag Dutta\Desktop\Essentials\Research\Research
> External Libraries
Scratches and Consoles
Commit
Pull Requests
CFX_kNN_Training.py x CFX_kNN_Testing.py x
85 y = np.char.replace(y, '1.0', '1', count=None)
86 y = np.char.replace(y, '2.0', '2', count=None)
87 y = np.char.replace(y, '3.0', '3', count=None)
88 y = np.char.replace(y, '4.0', '4', count=None)
89 y = np.char.replace(y, '5.0', '5', count=None)
90 y = y.astype(int)
91
92
93
94 #Splitting the dataset for training and testing (80-20)
95 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)

Run: CFX_kNN_Testing x
"C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:\Users\Anurag Dutta\Desktop\Essentials\Research\Research Alpha\ml-imbalanced-Learning-main\High Training Sample Regime/I
> Numba JIT warmup successful for chaotic_sampler ...
> Numba JIT warmup successful for transform ...
TRAINING F1 SCORE 0.8807344162321279
TESTING F1 SCORE 0.8519327314723735
Process finished with exit code 0

Git Run Python Packages TODO Python Console Problems Terminal Services
tobnine Starter See Tabnine Insights 8:1 LF UTF-8 4 spaces Python 3.9 main
ENG IN 17:52 17-12-2022
```

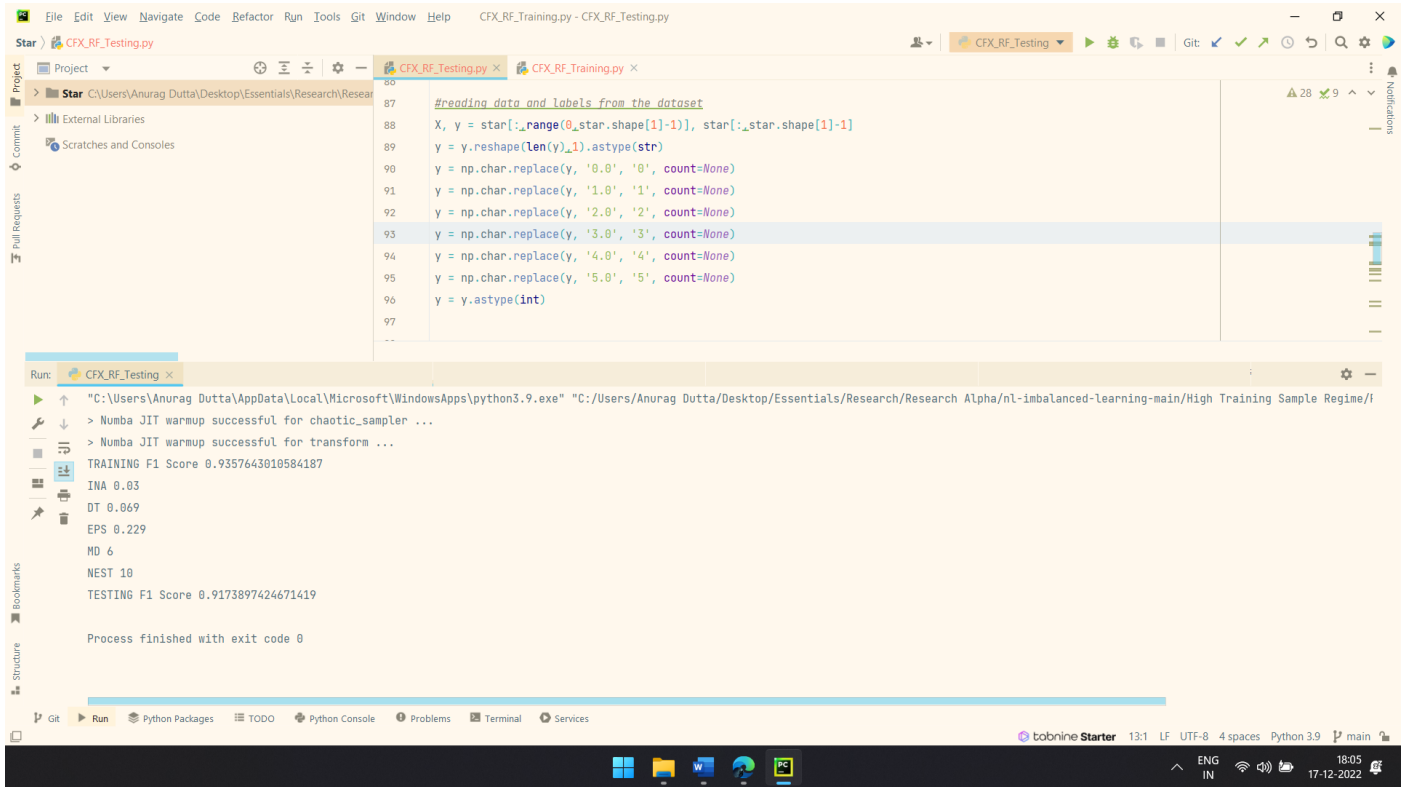
INITIAL_NEURAL_ACTIVITY = [0.029]

DISCRIMINATION_THRESHOLD = [0.070]

EPSILON = [0.213]

```
TRAINING F1 SCORE 0.8807344162321279
TESTING F1 SCORE 0.8519327314723735
```

ChaosNet + Random Forest



```
80
81
82
83
84
85
86
87 #reading data and labels from the dataset
88 X, y = star[:,_range(0_star.shape[1]-1)], star[:,_star.shape[1]-1]
89 y = y.reshape(len(y),1).astype(str)
90 y = np.char.replace(y, '0.0', '0', count=None)
91 y = np.char.replace(y, '1.0', '1', count=None)
92 y = np.char.replace(y, '2.0', '2', count=None)
93 y = np.char.replace(y, '3.0', '3', count=None)
94 y = np.char.replace(y, '4.0', '4', count=None)
95 y = np.char.replace(y, '5.0', '5', count=None)
96 y = y.astype(int)
97
```

Run: CFX_RF_Testing x

```
"C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:/Users/Anurag Dutta/Desktop/Essentials/Research/Research Alpha/nl-imbalanced-learning-main/High Training Sample Regime/i
> Numba JIT warmup successful for chaotic_sampler ...
> Numba JIT warmup successful for transform ...
TRAINING F1 Score 0.9357643010584187
INA 0.03
DT 0.069
EPS 0.229
MD 6
NEST 10
TESTING F1 Score 0.9173897424671419

Process finished with exit code 0
```

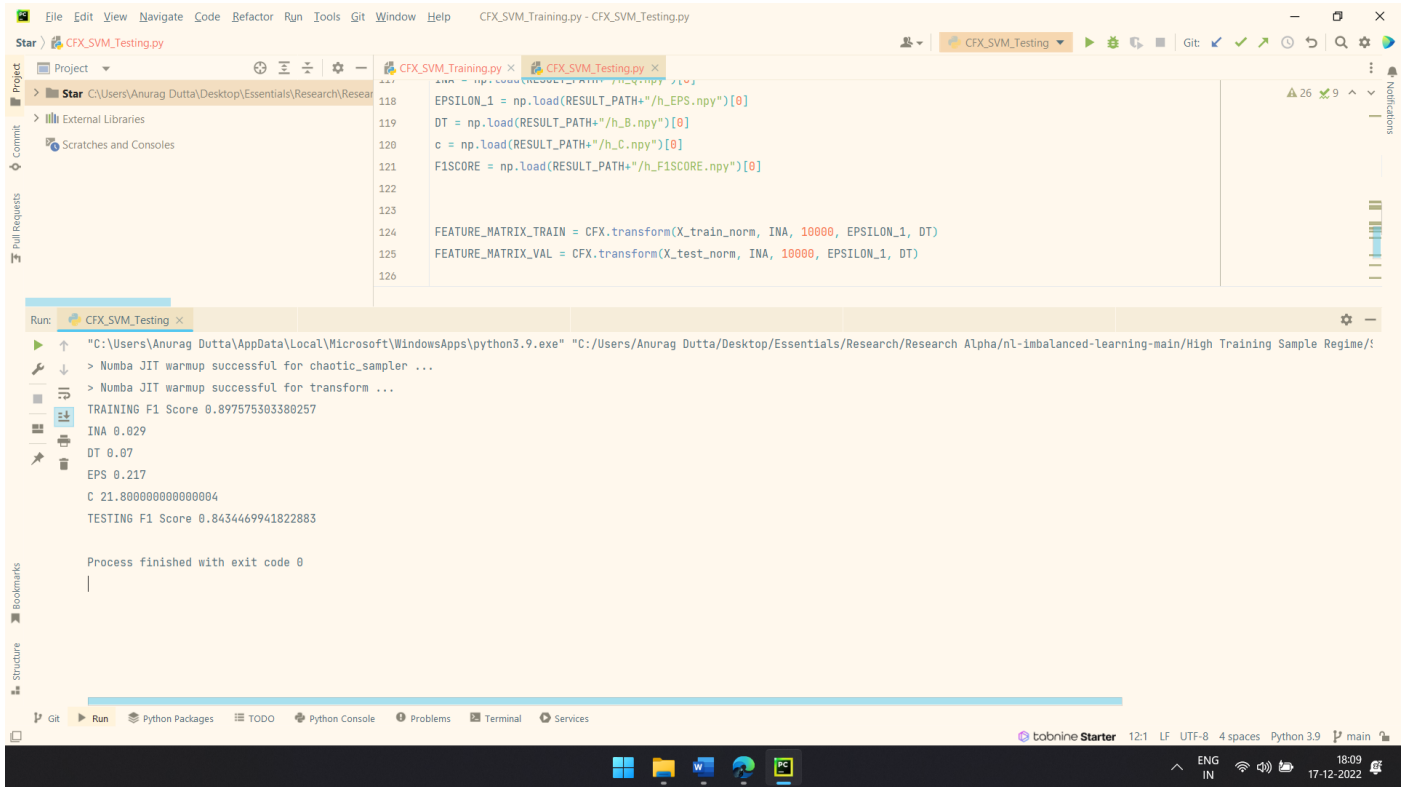
INITIAL_NEURAL_ACTIVITY = [0.030]

DISCRIMINATION_THRESHOLD = [0.069]

EPSILON = [0.229]

TRAINING F1 Score 0.9357643010584187
TESTING F1 Score 0.9173897424671419

ChaosNet + Support Vector Machine



The screenshot shows a VS Code editor with a Python script open. The script defines parameters for a Support Vector Machine (SVM) model and uses the ChaosNet library for feature transformation. The execution output in the Run console shows the training and testing F1 scores, as well as the initial neural activity, discrimination threshold, and epsilon values.

```
118 EPSILON_1 = np.load(RESULT_PATH+"/h_EPS.npy")[0]
119 DT = np.load(RESULT_PATH+"/h_DT.npy")[0]
120 c = np.load(RESULT_PATH+"/h_C.npy")[0]
121 F1SCORE = np.load(RESULT_PATH+"/h_F1SCORE.npy")[0]
122
123
124 FEATURE_MATRIX_TRAIN = CFX.transform(X_train_norm, INA, 10000, EPSILON_1, DT)
125 FEATURE_MATRIX_VAL = CFX.transform(X_test_norm, INA, 10000, EPSILON_1, DT)
126
```

Run: CFX_SVM_Testing x

```
"C:\Users\Anurag Dutta\AppData\Local\Microsoft\WindowsApps\python3.9.exe" "C:\Users\Anurag Dutta\Desktop\Essentials\Research\Research Alpha\ml-imbalanced-Learning-main\High Training Sample Regime/"
> Numba JIT warmup successful for chaotic_sampler ...
> Numba JIT warmup successful for transform ...
TRAINING F1 Score 0.897575303380257
INA 0.029
DT 0.07
EPS 0.217
C 21.800000000000004
TESTING F1 Score 0.8434469941822883

Process finished with exit code 0
```

INITIAL_NEURAL_ACTIVITY = [0.029]

DISCRIMINATION_THRESHOLD = [0.066]

EPSILON = [0.217]

```
TRAINING F1 Score 0.897575303380257
TESTING F1 Score 0.8434469941822883
```