

HANDWRITTEN SIGNATURE VERIFICATION USING LOCAL BINARY PATTERN FEATURES AND KNN

Tejas Jadhav

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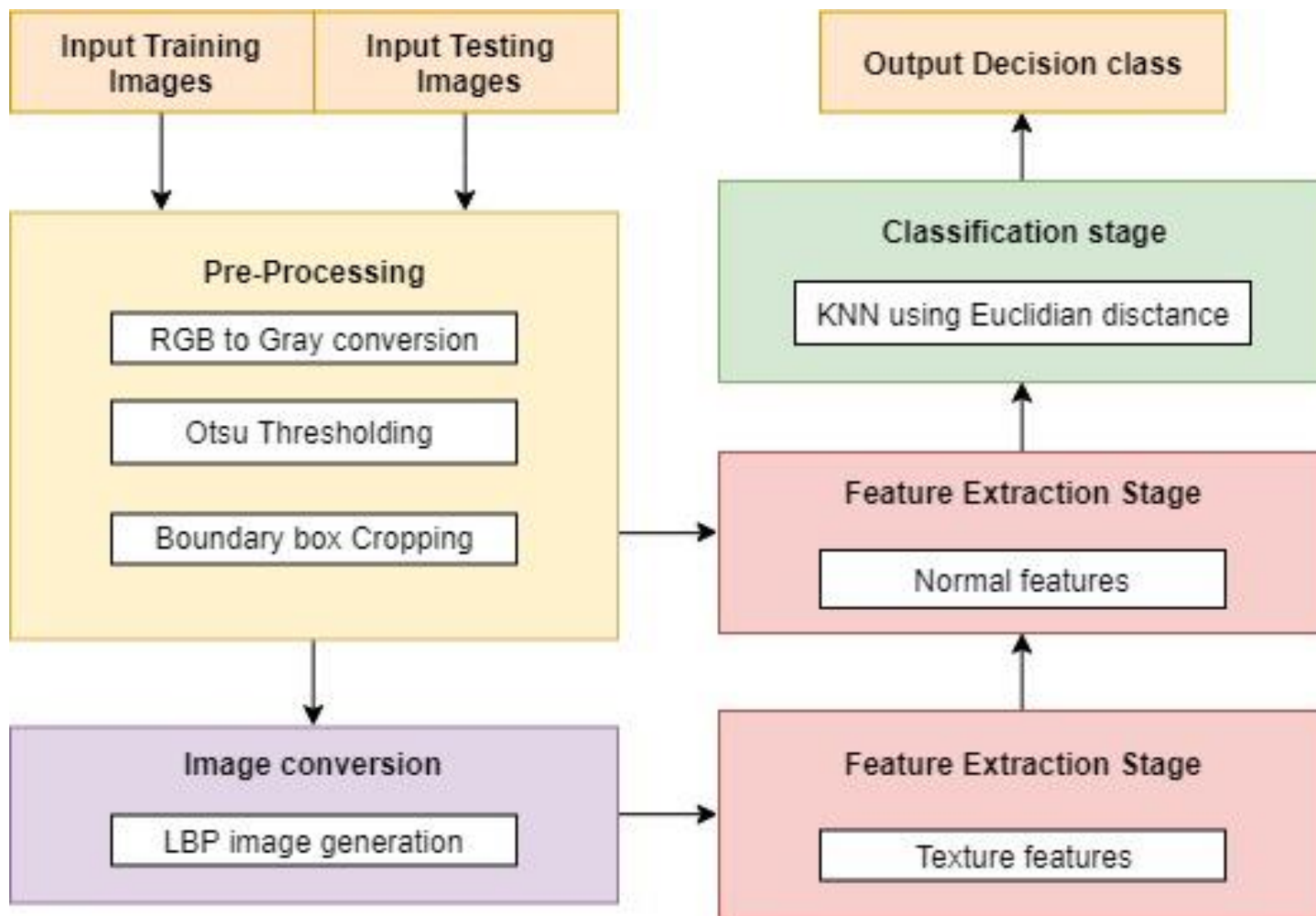
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PROBLEM DEFINITION

- Signature Verification is the procedure of determining to **whether a particular signature is genuine or forged**.
- System would take as input author ID and signature images and tell us, If the signature ,ust be 'Accepted' or 'Rejected'

Proposed Work



Proposed Work

LOCAL BINARY PATTERN

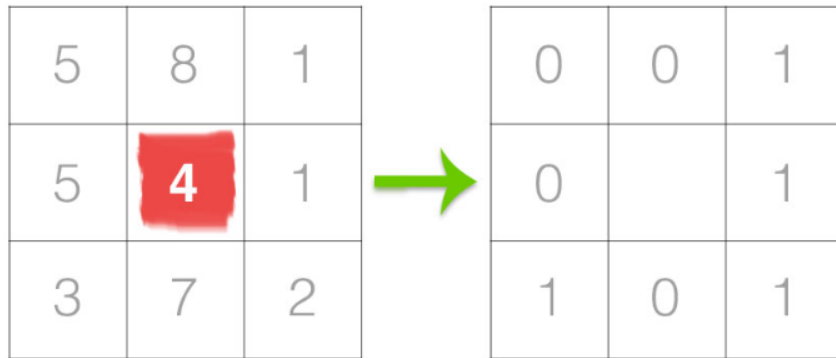


Figure 1: The first step in constructing a LBP is to take the 8 pixel neighborhood surrounding a center pixel and threshold it to construct a set of 8 binary digits.

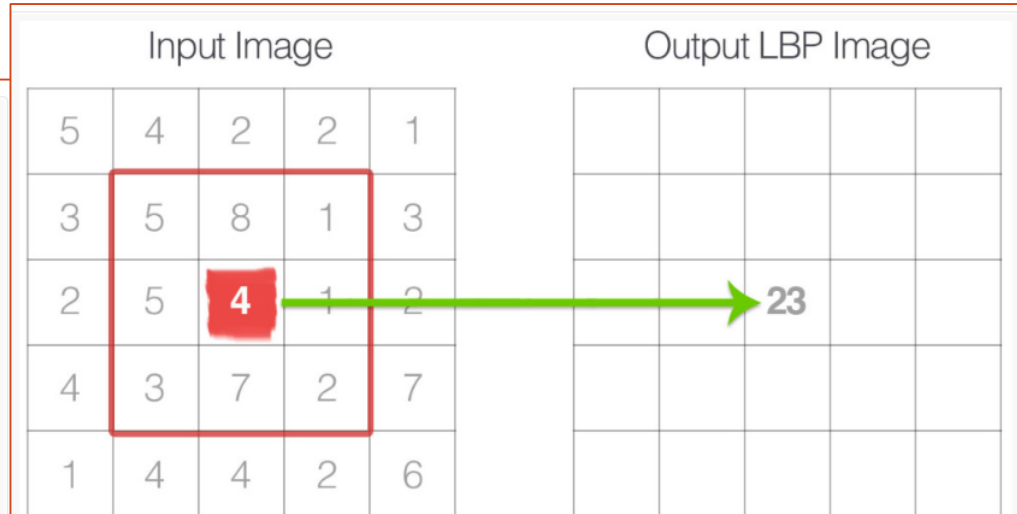


Figure 3: The calculated LBP value is then stored in an output array with the same width and height as the original image.

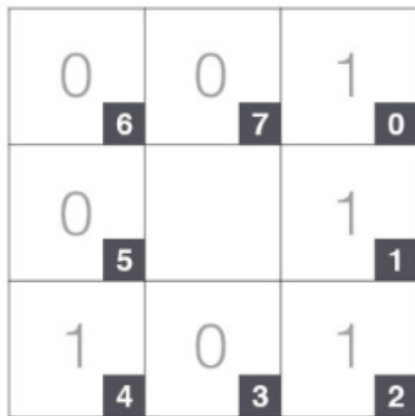


Figure 2: Taking the 8-bit binary neighborhood of the center pixel and converting it into a decimal representation. (Thanks to Bikramjot of [Hanzra Tech](#) for the inspiration on this visualization!)

IMPLEMENTATION TOOL & SETUP

- **Python using PyCharm**

- Python is a popular programming language used in web & software development, mathematics, system scripting
- PyCharm is a python editor and compiler allows intelligent code completion, on-the-fly error checking and quick-fixes, easy project navigation, and much more.



- **SQL using MySQL**

- SQL is a standard language for storing, manipulating and retrieving data in databases.
- MySQL is an open source relational database management system, very easy to establish, use and manage



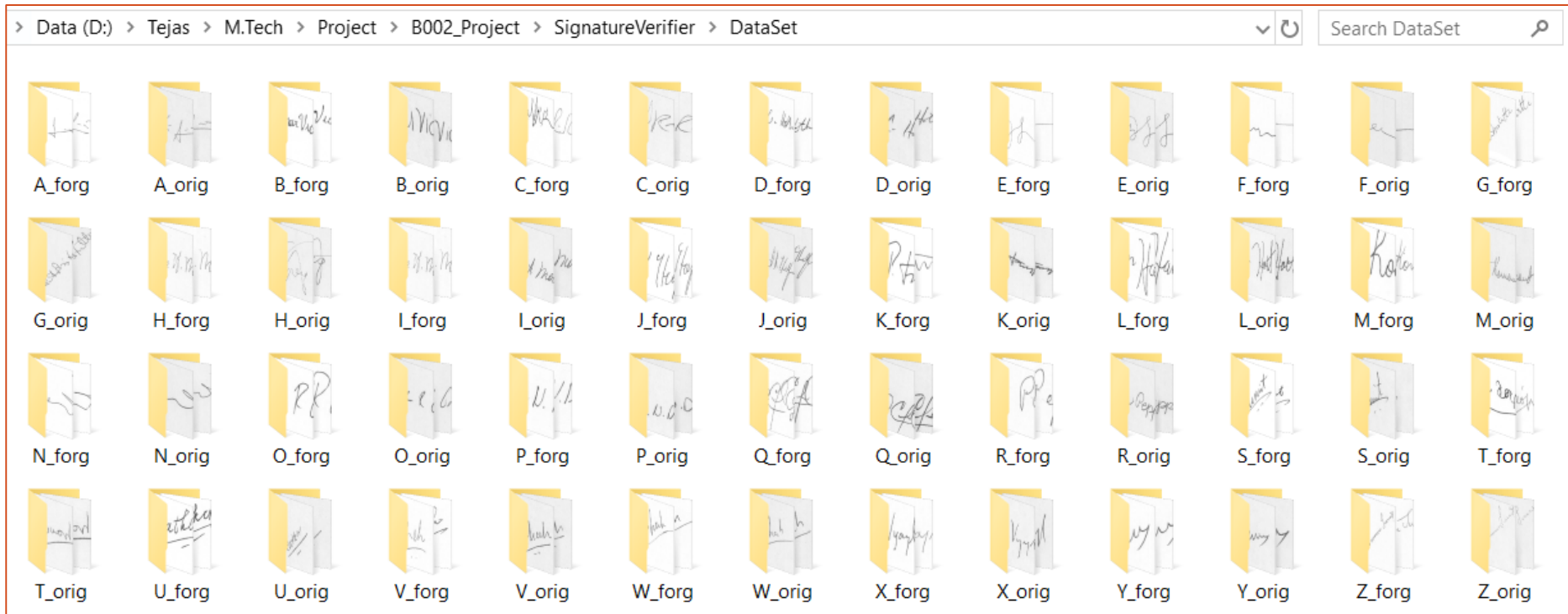
IMPLEMENTATION TOOL & SETUP

■ Python libraries

Using number of libraries, which are easy to install & import..

Package	Description
OpenCV	Computer vision and machine learning software library.
NumPy	Scientific computing & array-processing
Imutils	Functions to make basic image processing functions easier
Math	Provides access to the mathematical functions
Matplotlib	Python 2D plotting library
Pymysql	A simple database interface for Python
OS	allows easy file handling
Scipy	Provides many user-friendly and efficient numerical routines
PySimpleGUI	User interface renderer

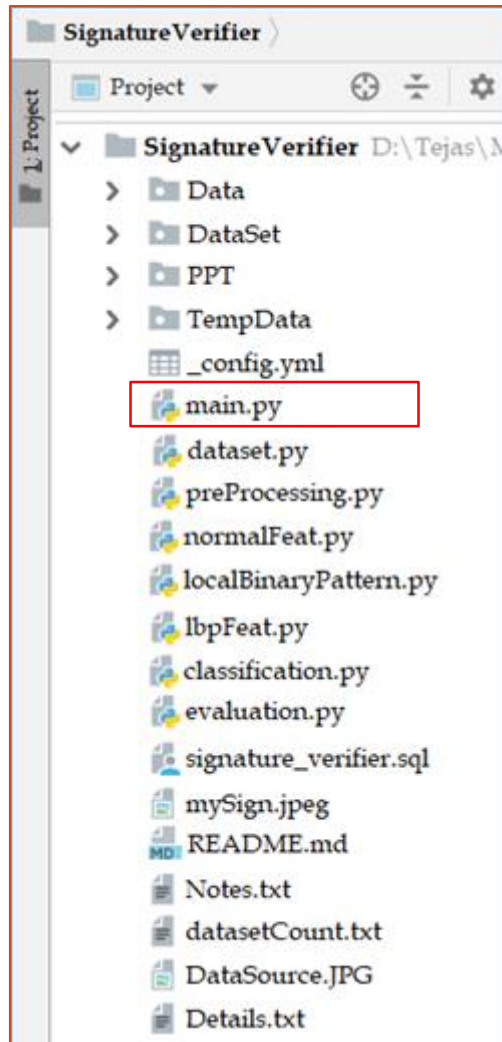
Dataset



26 Authors, 1272 Images
1007 Training images (79.17%)
265 Testing images (20.83%)

IMPLEMENTATION WORK DONE

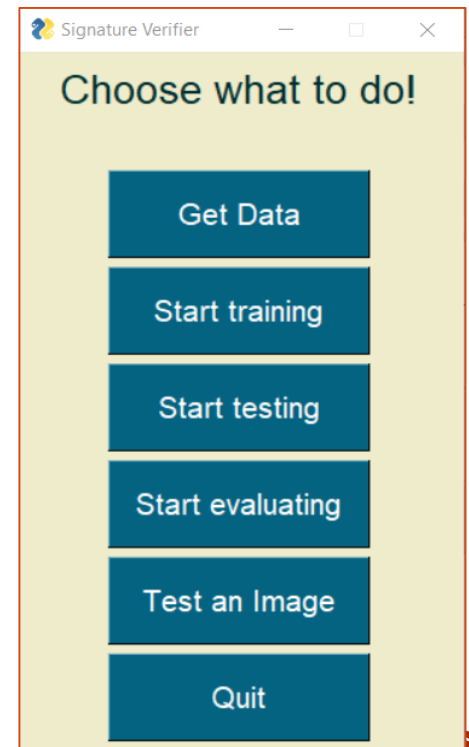
IMPLEMENTATION



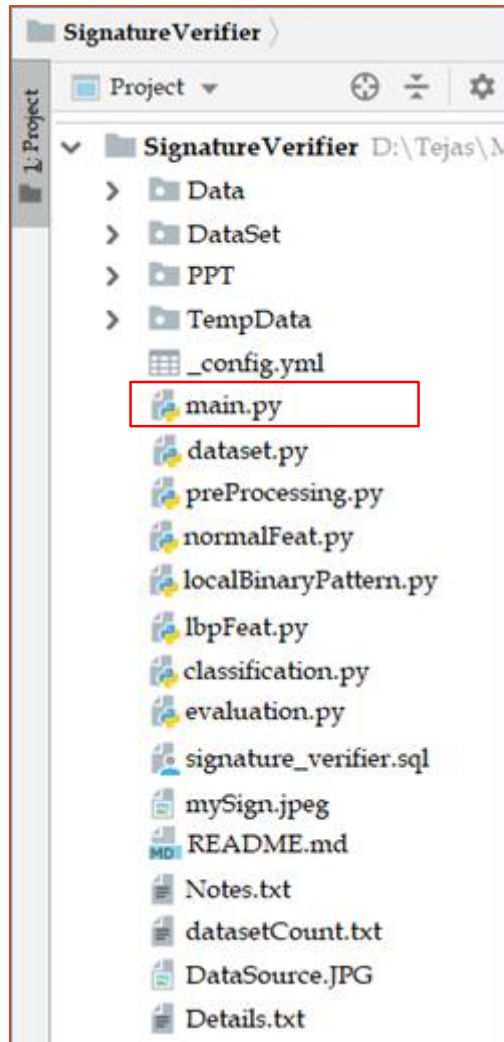
■ Main.py

- This is the main python file where the system working starts, calls the other functions, gives the appropriate results and ends.

```
405 while(str(button) != "Quit"):
406     window = sg.Window('Signature Verifier', de
407     button, values = window.Read()
408
409     if(str(button) == "Get Data"):
410         window.Close()
411         ds.getData()
412     elif(str(button) == "Start training"):
413         window.Close()
414         train()
415     elif(str(button) == "Start testing"):
416         window.Close()
417         test()
418     elif(str(button) == "Start evaluating"):
419         window.Close()
420         ev.evaluate()
421     elif(str(button) == "Test an Image"):
422         window.Close()
423         testOne()
424     else:
425         window.Close()
426
```

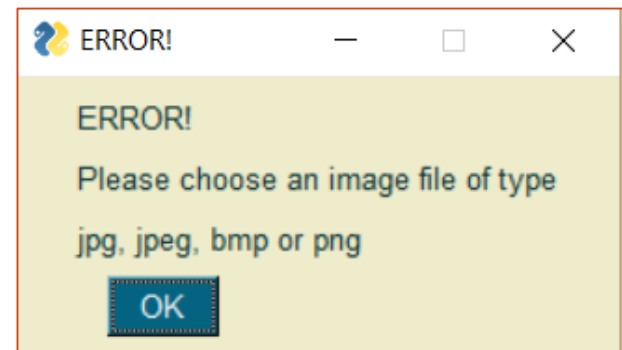
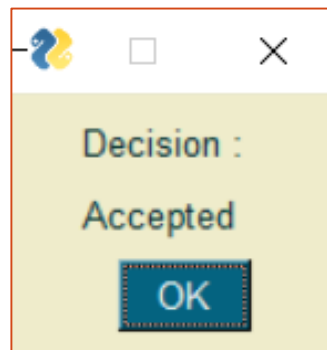
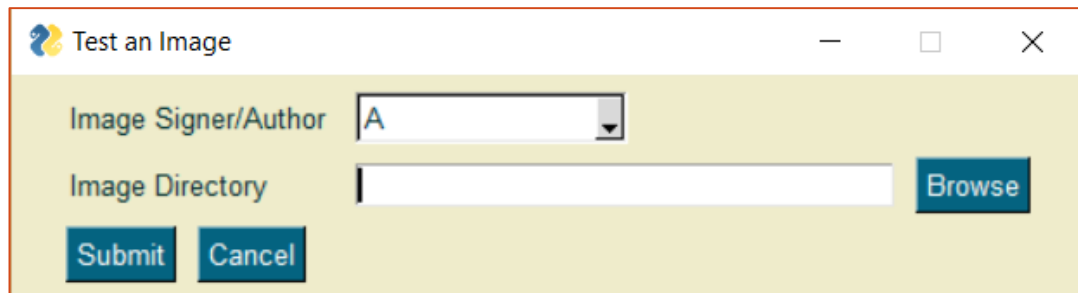


IMPLEMENTATION

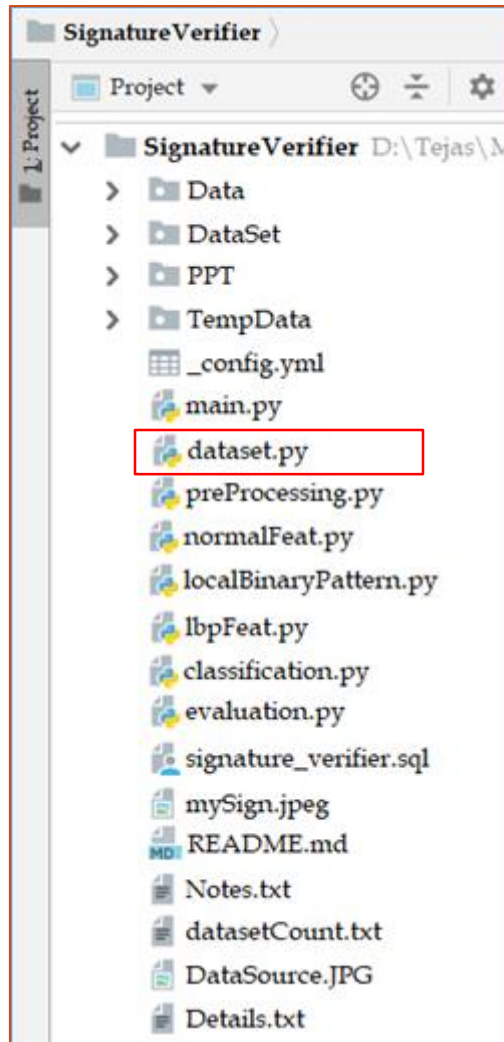


- **Main.py**

- Test an Image: Clicking on this button will display a popup form and allow user to browse through his computer and perform testing over a single image.



IMPLEMENTATION

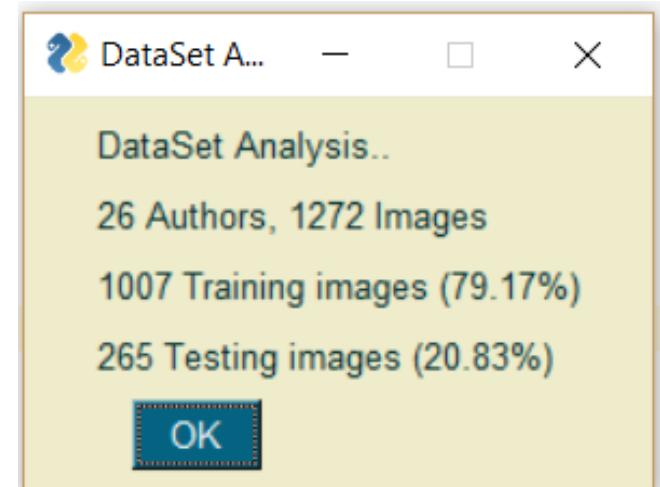


■ Dataset.py

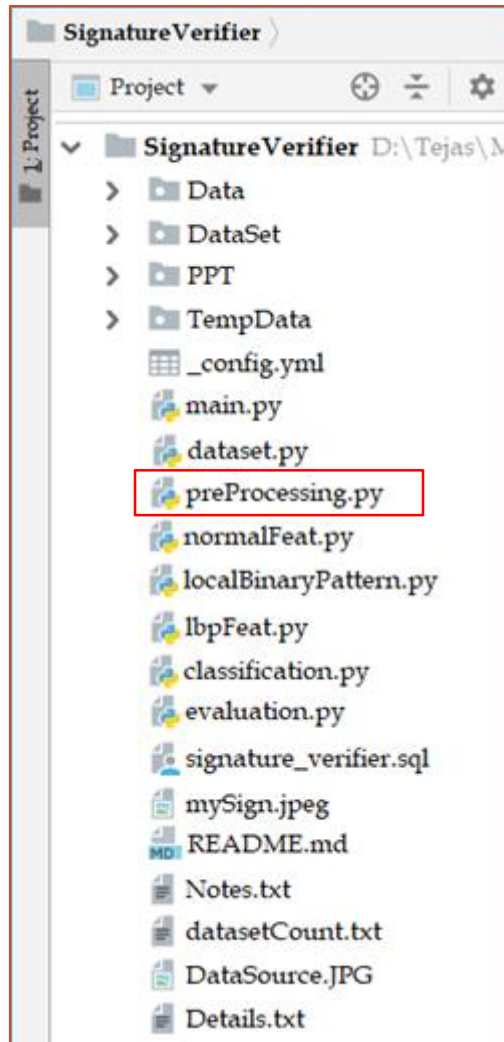
- Our dataset is read, renamed, copied and organized in the correct naming convention to a different folder, from where our system will use
- xyz.png → A_orig_17.png
- Also gives an analysis of the count of dataset

```
Images = 1
exists = os.path
if not exists:
    os.rename("D

dataFolder = tra
dataexists = os.
if not dataexist
shutil.copy(
```



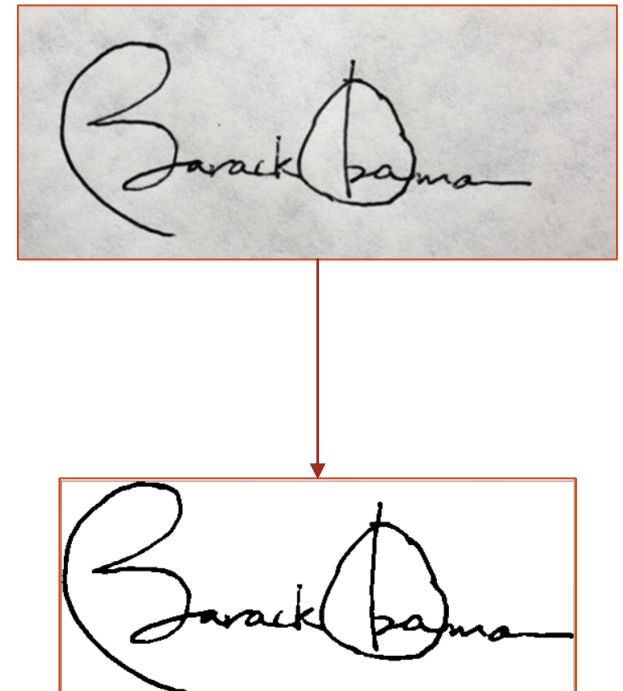
IMPLEMENTATION



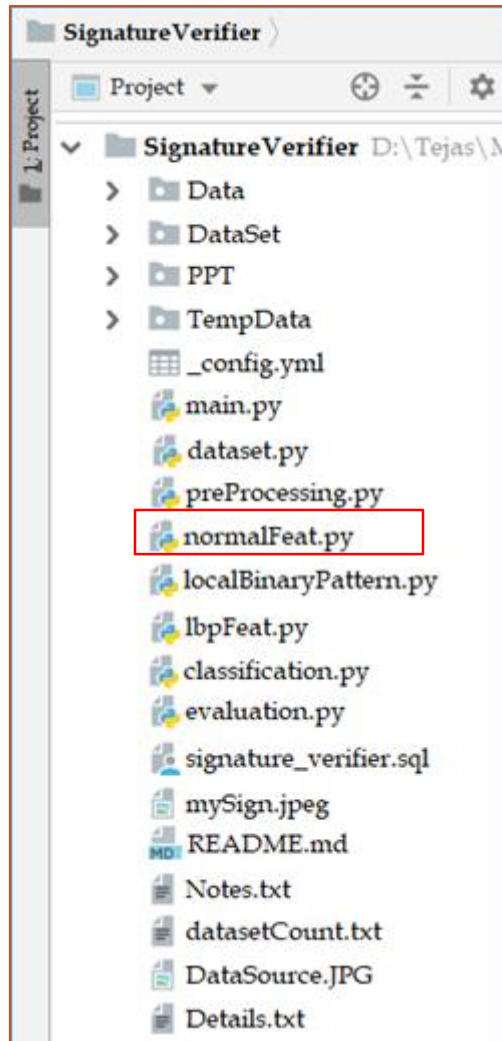
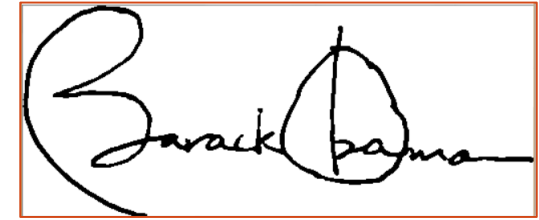
■ Preprocessing.py

- This function takes the image in the raw format and converts into a pre-processed format.

1. Resize ,
2. RGB to Grey ,
3. Otsu thresholding,
4. Boundary Box cropping



IMPLEMENTATION



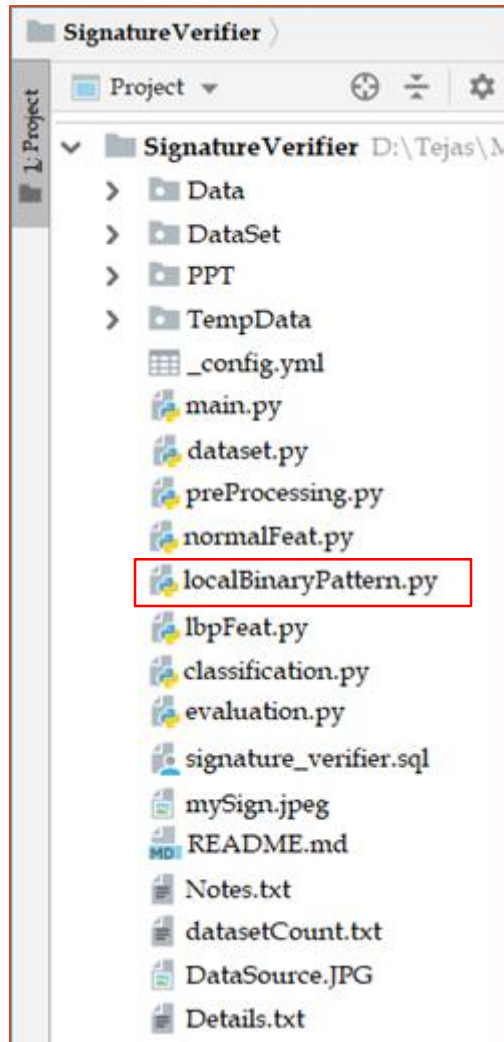
■ NormalFeat.py

- This function extracts features of the signature from the pre-processed images.

1. Aspect Ratio
2. Center of Gravity - X
3. Center of Gravity - Y
4. Baseline Shift
5. Energy: local difference in brightness, or square of brightness
6. Dissimilarity: the weights with which intensities move linearly away from the diagonal
7. Haralick: quantify an image based on texture
8. Kurtosis: Kurtosis is a measure of the combined weight of a distribution's tails relative to the center of the distribution

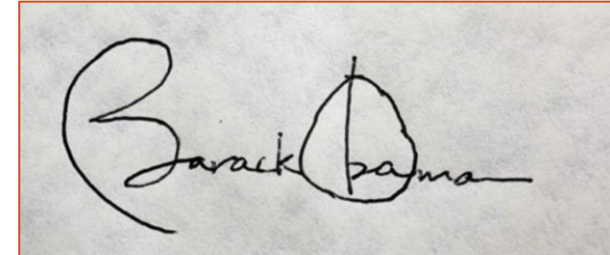
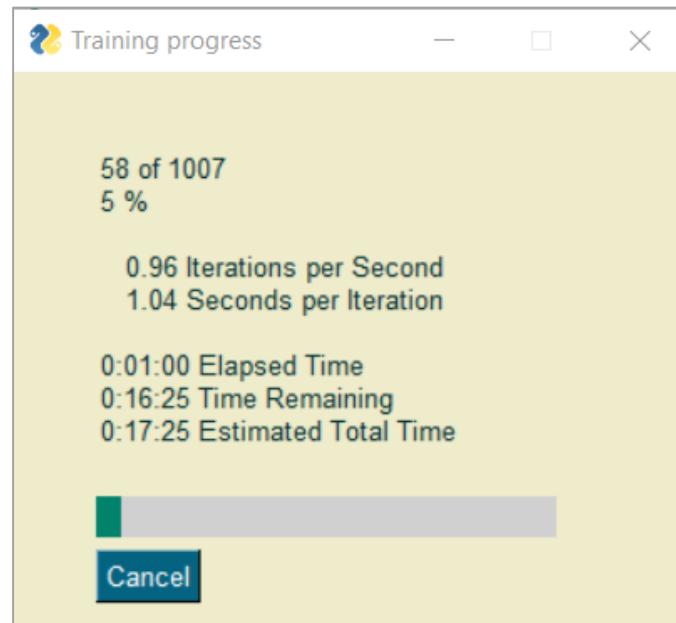
```
~~~ Normal features ~~~  
Aspect Ratio : 2.402135231316726  
X_COG: 338.5539421701799  
Y_COG: 140.53258886252678  
Baseline shift: 0.7266805826126017  
Energy: 0.958966395847317  
Dissimilarity: 1.9347761808716222  
Haralick: 950.8804485905165  
Kurtosis: 28.81512693799091
```


IMPLEMENTATION

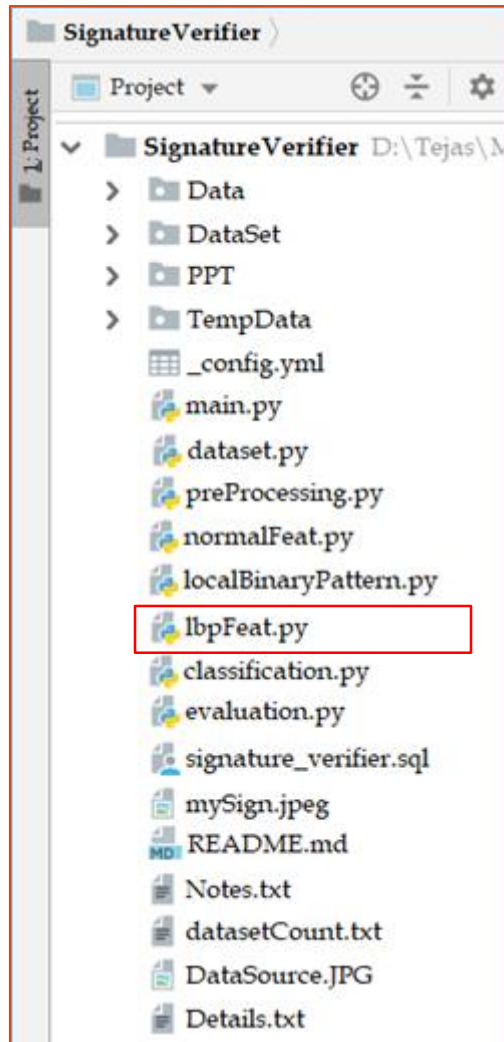


❑ LocalBinaryPattern.py

- This python file contains function that converts the image into LBP image
- LBP image is darker and shows off the textures of the image to help us extract them



IMPLEMENTATION



■ **LbpFeat.py**

- This function extracts texture based features of the signature from the LBP images.

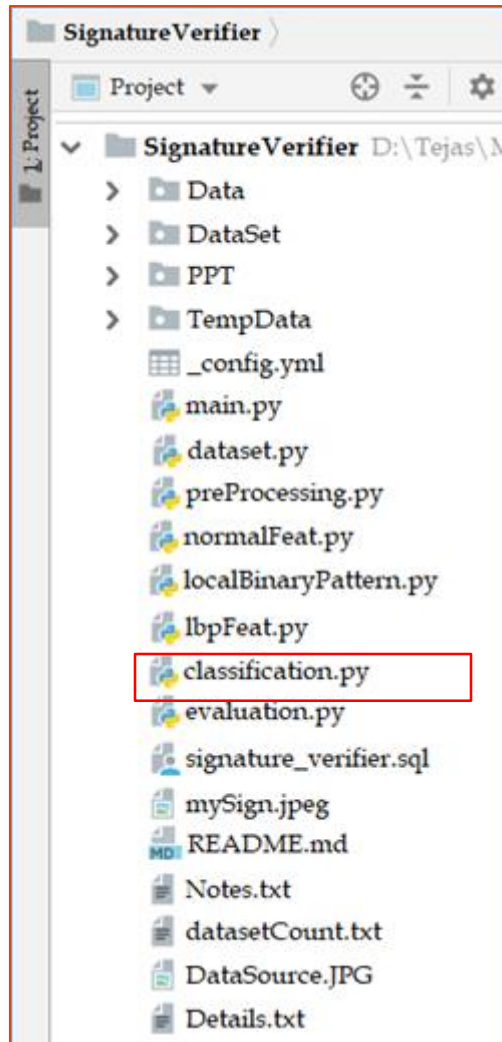


1. Contrast:
2. Normalized Area
3. Energy
4. Dissimilarity
5. Haralick
6. Kurtosis

```
~~~ LBP features ~~~  
Contrast: 17.679818216493544  
Normalized area: 4.2712653288740245  
Homogeneity: 0.8302425919185281  
Energy: 0.6608064821892133  
Dissimilarity: 1.0182713821221416  
Haralick: 157.50156224641563  
Skewness: -5.43953922460237  
Kurtosis: 33.18020199220615
```

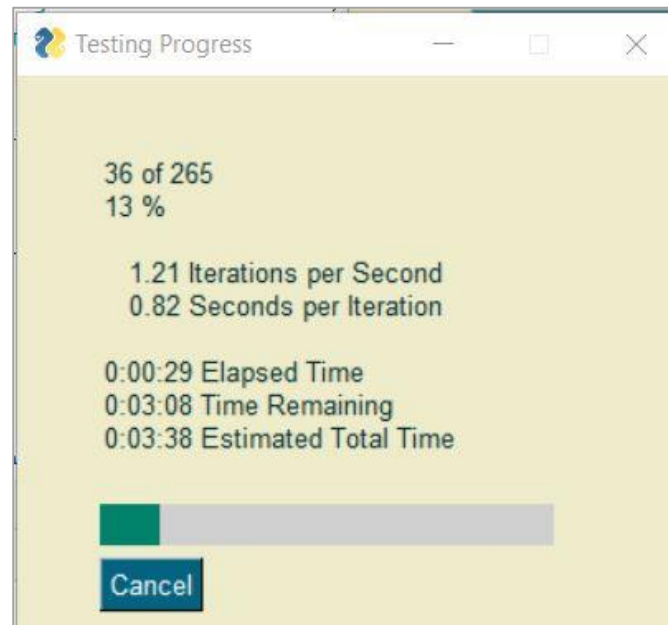
7. Skewness: asymmetry in a statistical distribution, in which the curve appears distorted or skewed either to the left or to the right
8. Homogeneity: value that calculates the tightness of distribution of the elements in the GLCM to the GLCM diagonal

IMPLEMENTATION



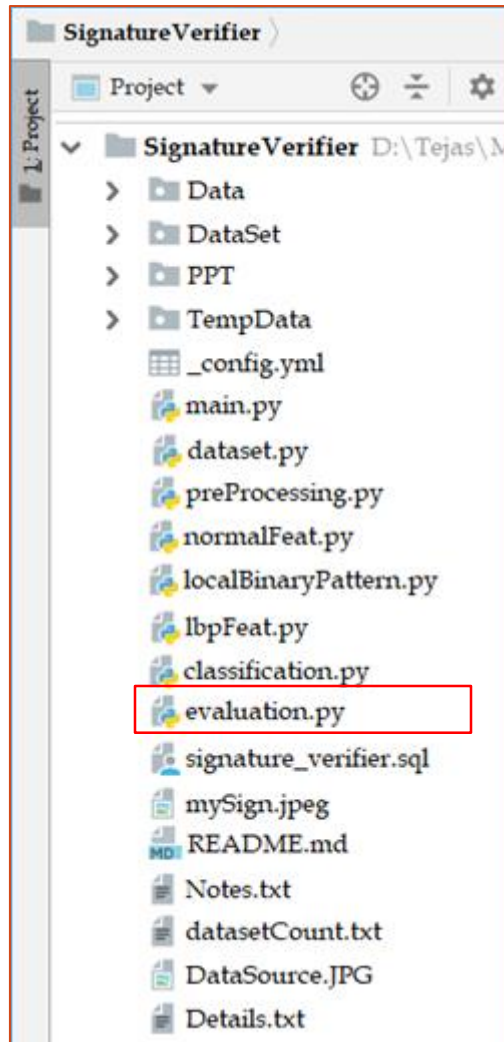
■ Classification.py

- This python file contains KNN classification function which classifies the given test data to a class.
- KNN algorithm works on the Euclidian distance based approach where the classes of the K nearest neighbours is given to the test data vector.



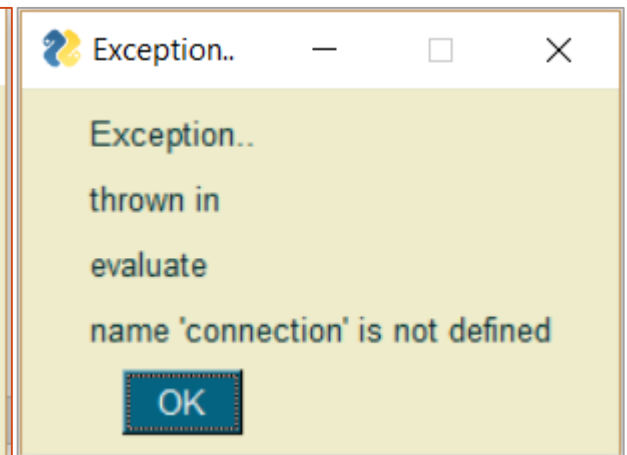
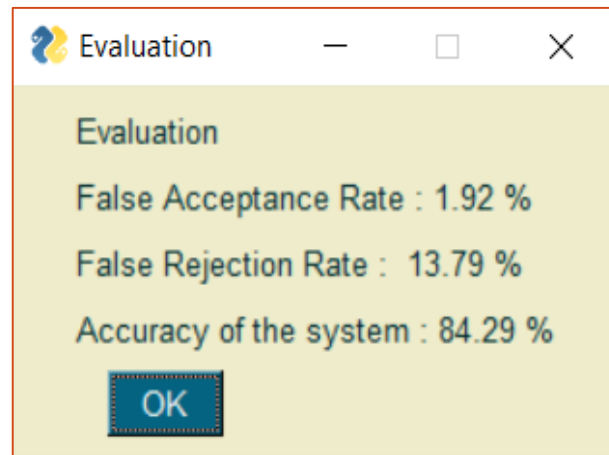
```
~~~~~  
Image file :  A_forged_21.png  
      ■  
      ■  
      ■  
  
Actual Class:  A_forged  
Decision:  Rejected  
~~~~~
```

IMPLEMENTATION

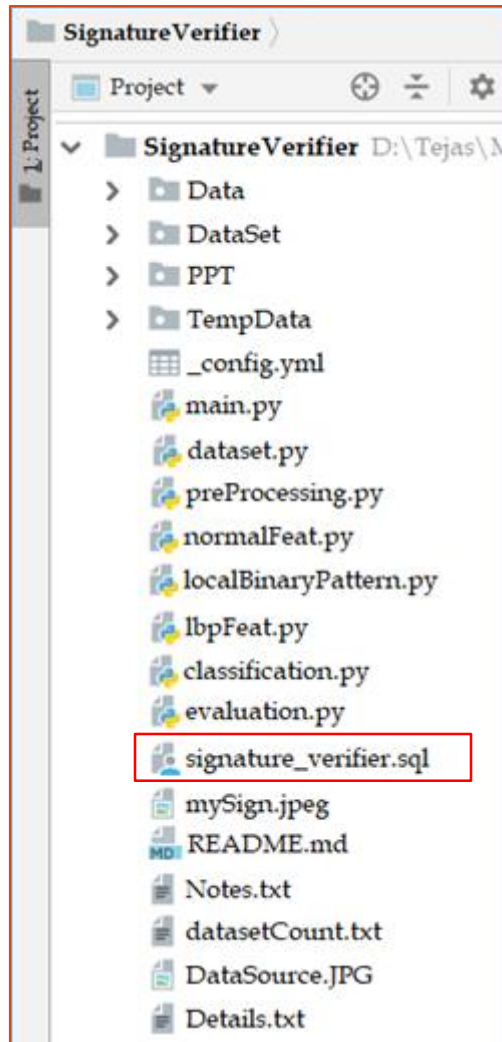


■ Evaluation.py

- The evaluation parameter used for measuring accuracy of the system is recognition rate. We find the FAR and FRR which stand for False Acceptance Rate and False Rejection Rate. The number of falsely accepted images over the total images is FAR and the number of falsely rejected images over the total images is FRR
- In our experimentation, we find our accuracy to be highest with 84.29% at $K = 22$ in our KNN classifier. The table below shows the different recognition rates for different values for K.

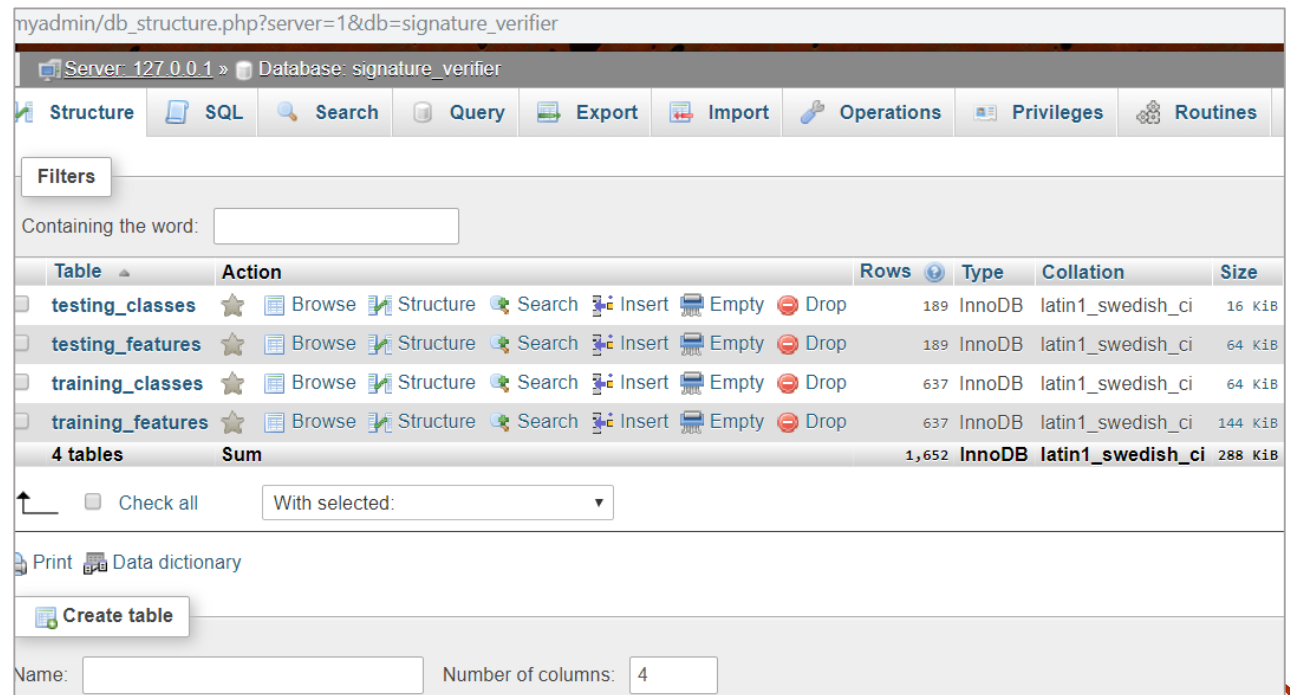


IMPLEMENTATION



- **Signature_verifier.sql**

- This has SQL queries for creating database, creating tables, inserting entries into the tables.
- Main.py also inserts and reads data into the database one row at a time



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- [42] Dataset source :- http://www.iapr-tc11.org/mediawiki/index.php?title=Datasets_List#Handwritten%20Documents

THANK YOU 😊

Any Questions?

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