AUTOMATIC ANSWER GRADER

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INSPIRATION

Digital tools, devices and advanced technologies have taken over the major manual tasks but even today manual grading all the answer sheets could be quite tedious and tiresome.

With the evolving automation, we have chosen to tackle this problem of grading answer sheets automatically in our design project.

PROBLEM STATEMENT

Having a handwritten answer sheet, with each answer, a problem solution is required to evaluate or grade the respective answer sheet by providing a score value to that answer sheet, depending upon a certain specified criterion.

OBJECTIVE

Automatic answer grader aims at presenting an automatic grading solution that could perform handwriting recognition and extraction of texts from handwritten answer sheets and furthermore could grade those sheets (evaluated by providing a score) by proving a score value, upon a certain specified criterion.

APPROACHES

1. Character by character approach
2. Line by line approach

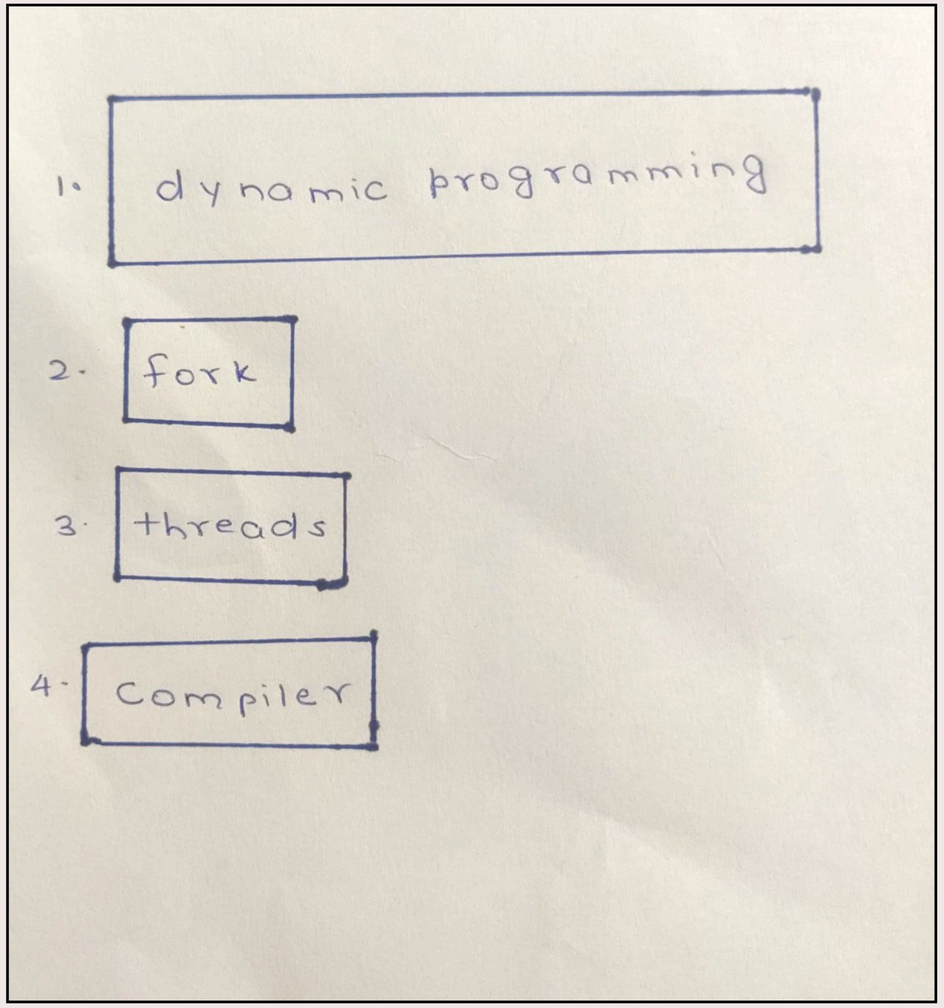
CHARACTER BY CHARACTER

1. Extracting words from answer sheets
2. Extracting characters from words
3. Handwritten Character recognition
4. Evaluation

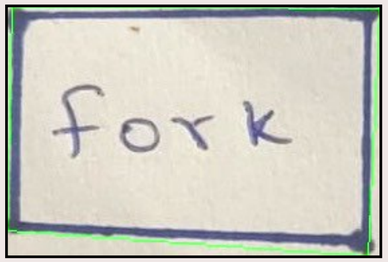
AUGMENTED DATASET

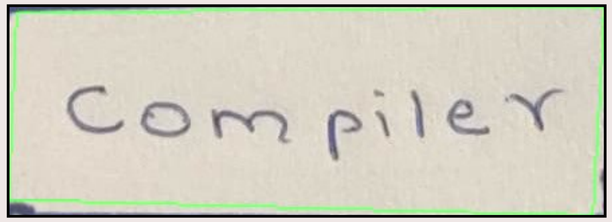
BEFORE AUGMENTATION : 520 (total)

AFTER AUGMENTATION : 1560 (total)

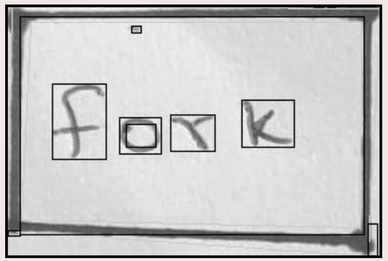


ANSWER SHEET

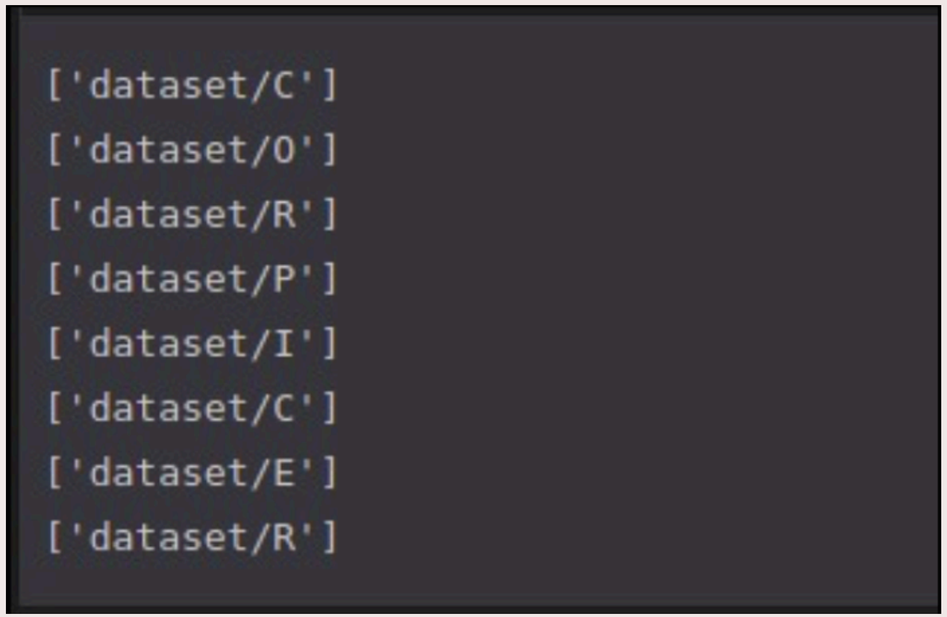




EXTRACTED WORDS



EXTRACTED CHARACTERS



CHARACTER RECOGNITION

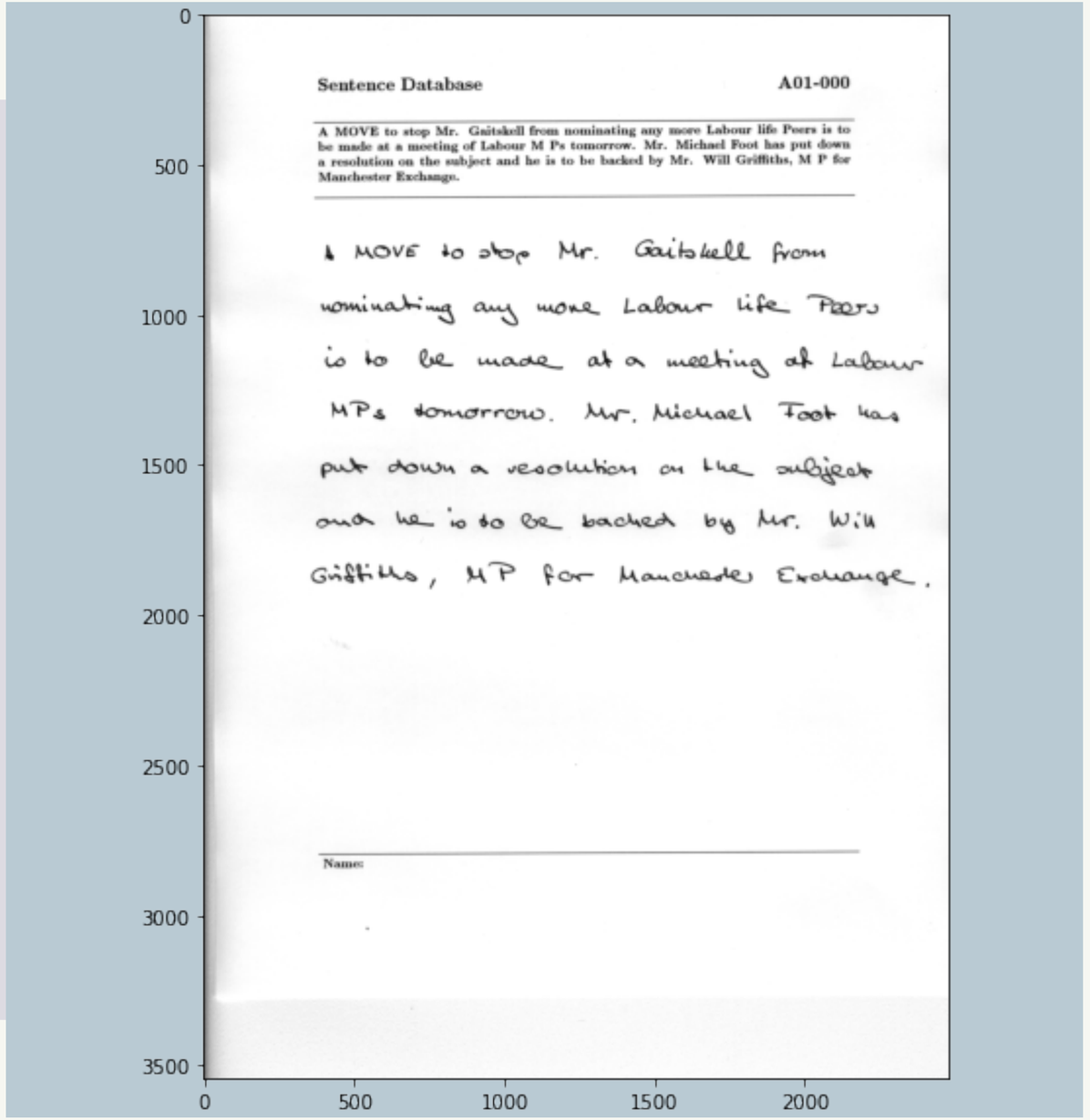
USING MOBILE NET

LINE BY LINE

1. Image Processing
2. Words Recognition
3. Grading/Evaluation

DATASET SAMPLE

(IAM DATASET)

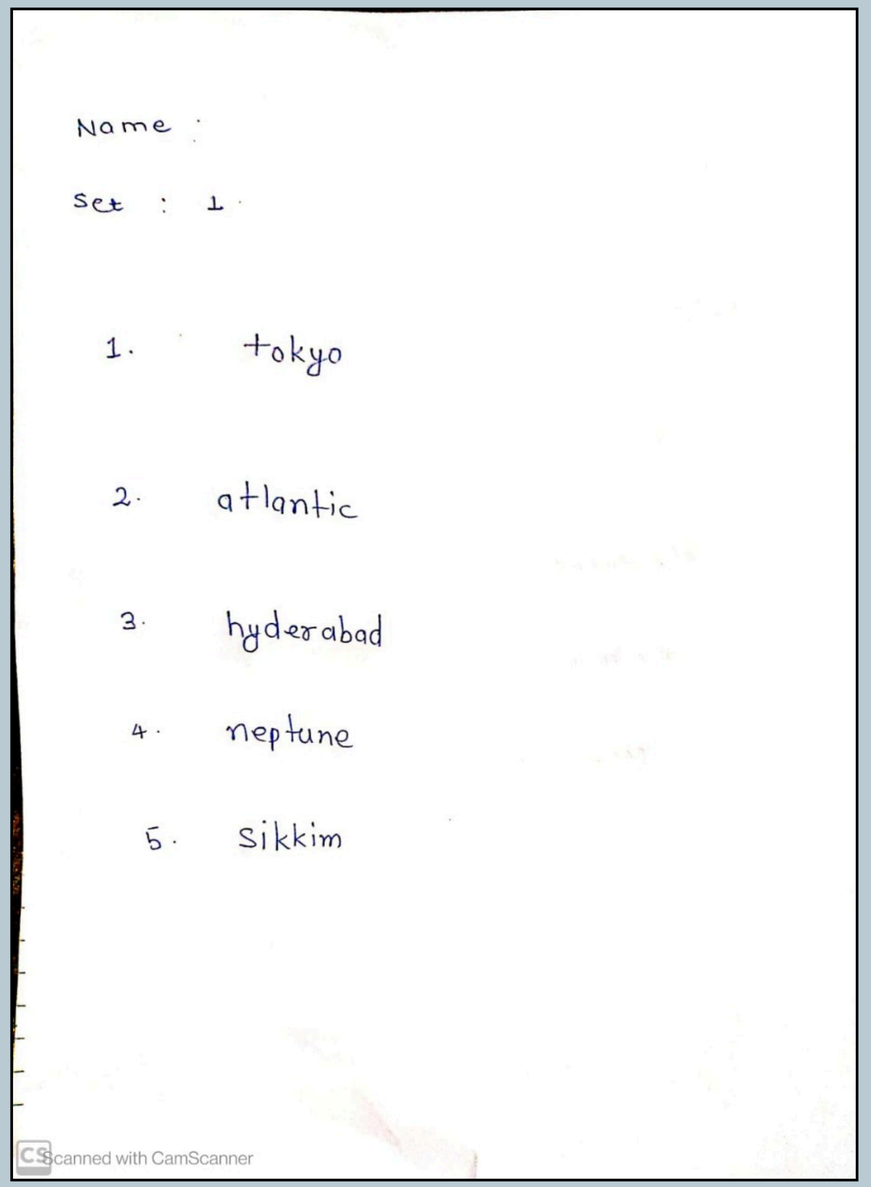


DATA COUNT

TOTAL IMAGES : 1539 Pages

TOTAL WORDS : 115320 Words

ANSWER SHEET



Name :

Set : 1

1. tokyo

2. atlantic

3. hyderabad

4. neptune

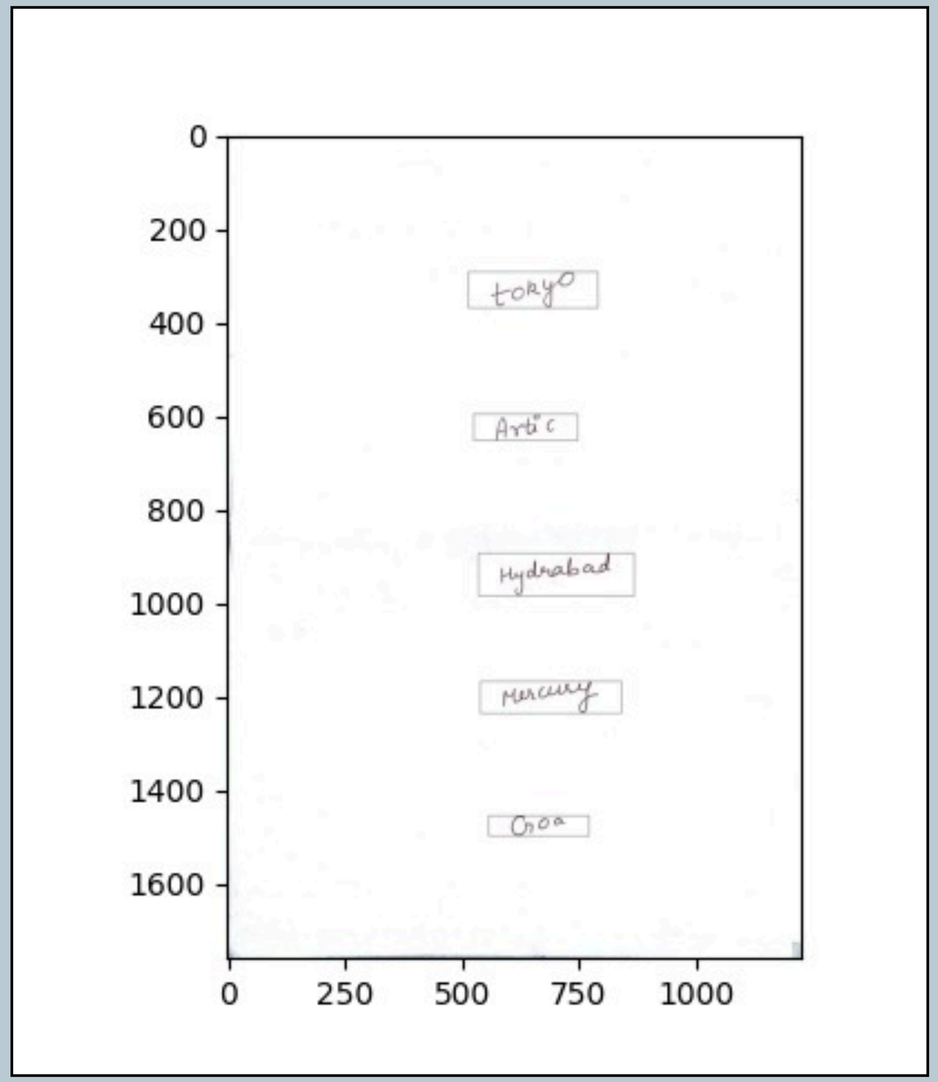
5. Sikkim

Scanned with CamScanner

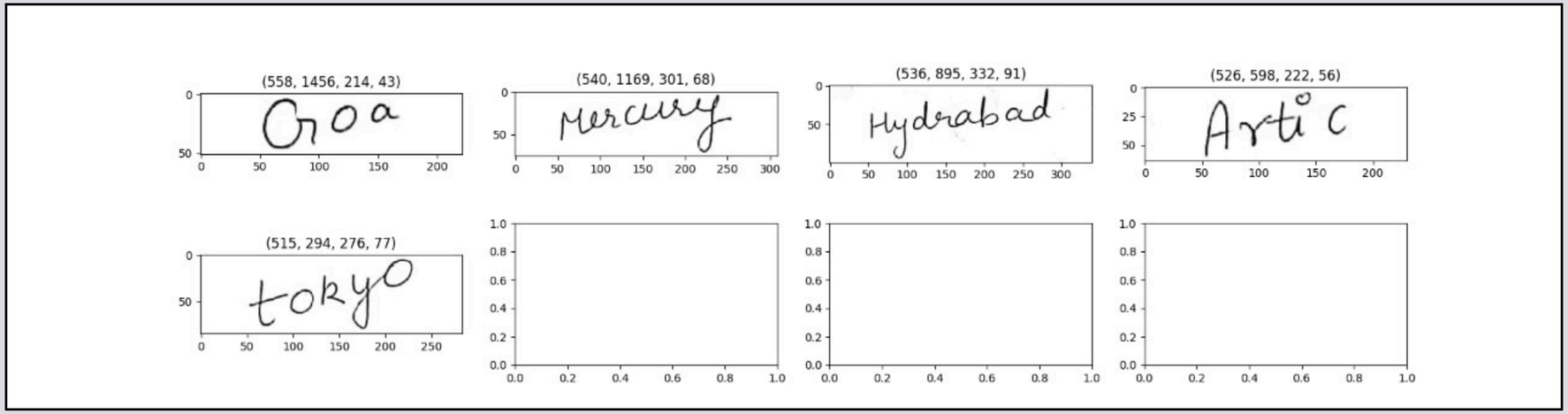
IMAGE PROCESSING

1. Grayscale image
2. Gaussian blur for noise reduction
3. Rectangular shaped kernel
4. Image Dilation
5. Find Contours
6. Filter required contours
7. Draw rectangles around words

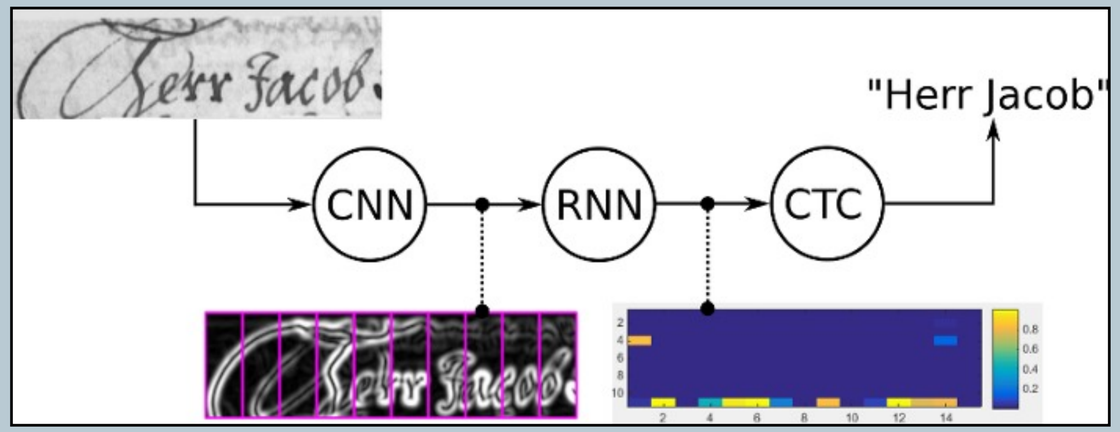
PROCESSED IMAGE



EXTRACTED WORDS



WORD RECOGNITION



SOURCE : *Towardsdatascience*

CNN

1. Input Image is fed to CNN
2. Relevant features extraction
3. 5 layers are used
    1. Convolution operation
    2. Last layer to input
4. RELU function is applied
5. Feature Map

RNN

1. LSTM is used as it is able to propagate information through longer distance
2. Output matrix is passed to the CTC

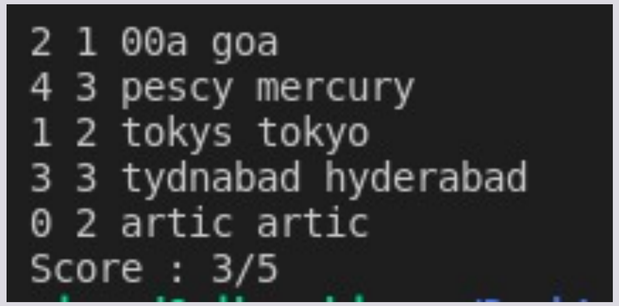
CTC

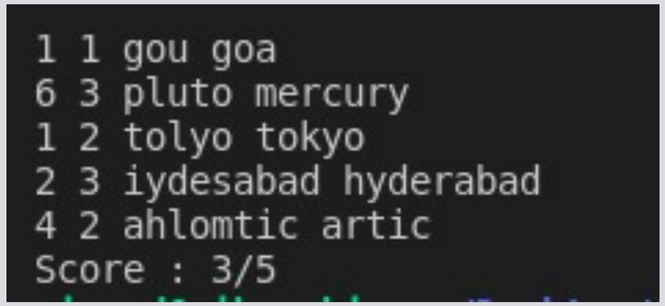
1. Loss value is calculated using RNN output matrix and ground truth
2. While inferring, CTC decodes matrix into final text

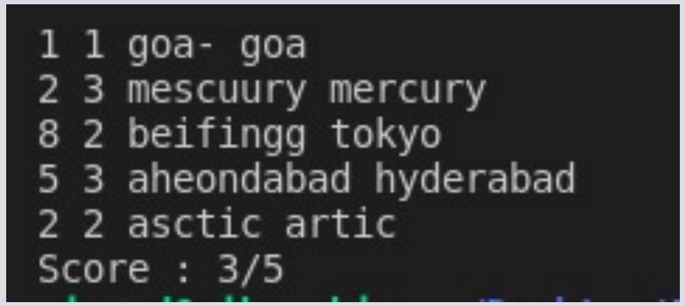
EVALUATION

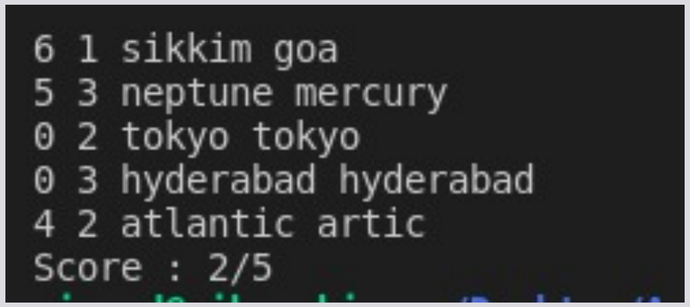
1. Setting a threshold value
2. Finding Edit Distance
3. If threshold * correctAnswerLength is greater than equal to EditDistance
    1. Grade Correct
4. Else Grade Incorrect

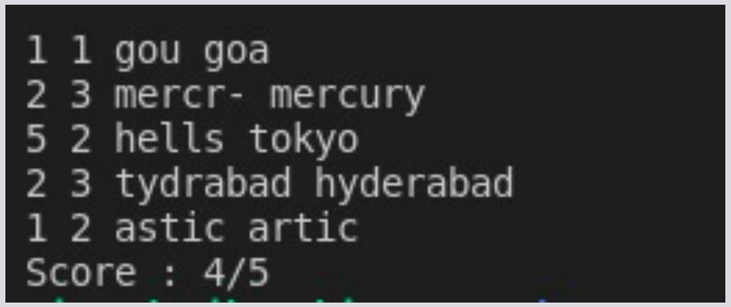
RESULTS


2 1 00a goa
4 3 pescy mercury
1 2 tokys tokyo
3 3 tydnabad hyderabad
0 2 artic artic
Score : 3/5


1 1 gou goa
6 3 pluto mercury
1 2 tolyo tokyo
2 3 iydesabad hyderabad
4 2 ahlomtic artic
Score : 3/5


1 1 goa- goa
2 3 mescuury mercury
8 2 beifingg tokyo
5 3 aheondabad hyderabad
2 2 asctic artic
Score : 3/5


6 1 sikkim goa
5 3 neptune mercury
0 2 tokyo tokyo
0 3 hyderabad hyderabad
4 2 atlantic artic
Score : 2/5


1 1 gou goa
2 3 mercr- mercury
5 2 hells tokyo
2 3 tydrabad hyderabad
1 2 astic artic
Score : 4/5

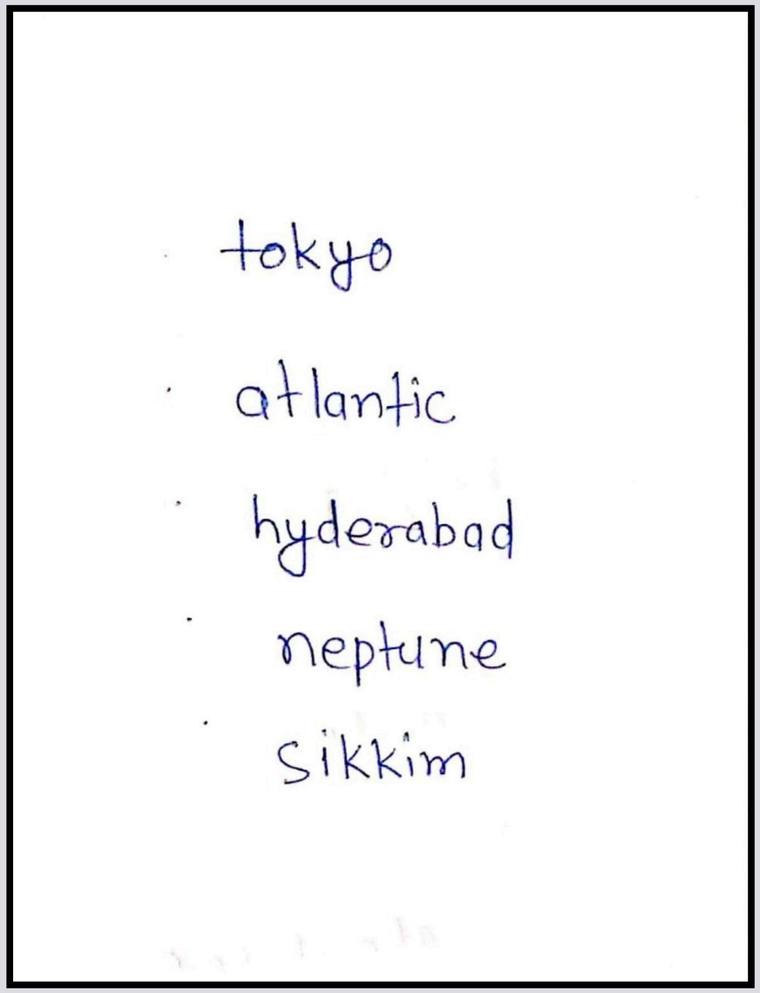
```
2 1 groau goa
2 3 mercay mercury
3 2 tofoys tokyo
8 3 seln hyderabad
5 2 indian artic
Score : 1/5
```

```
5 1 earth goa
6 3 mumbal mercury
7 2 antarric tokyo
8 3 belying hyderabad
terminate called after throwing an instance of 'std::logic_error'
  what():  basic_string::_M_construct null not valid
Aborted (core dumped)
```

```
1 1 goa. goa
4 3 mexeny mercury
6 2 byingg tokyo
7 3 rdsaboel hyderabad
4 2 atrble artic
Score : 1/5
```

```
1 1 go. goa
1 3 meccury mercury
3 2 tor0 tokyo
2 3 tyderabsad hyderabad
1 2 atic artic
Score : 4/5
```

```
6 1 manpr- goa
7 3 bueto mercury
2 2 toty0 tokyo
5 3 ahendabad hyderabad
3 2 arcr artic
Score : 1/5
```



BEST PREDICTION

```
6 1 sikkim goa
5 3 neptune mercury
0 2 tokyo tokyo
0 3 hyderabad hyderabad
4 2 atlantic artic
Score : 2/5
```

GRADING ACCURACY

1. 60 % of the answer sheets have been graded correctly
2. 30 % are having minute errors
3. 10 % missed an answer

SCOPE FOR IMPROVEMENT

1. Working on cursive handwriting
    1. Deslanting Algorithm
2. Multiple word answer evaluation
    1. Increasing input size of neural network
3. Improved strategy for grading
4. Improved accuracy for model
    1. Add more CNN layers

GITHUB REPOSITORY

https://github.com/neha-soni-16/Automatic-Answer-Grader.git

CONCLUSION

An Automatic answer grading model has been proposed and implemented for perform handwriting recognition and extraction of texts from handwritten answer sheets and furthermore grading of those sheets (evaluated by providing a score) by proving a score value, upon a certain specified criterion for evaluation.

REFERENCES

1. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=667887
2. https://arxiv.org/pdf/1910.00663.pdf
3. https://github.com/GitYCC/crnn-pytorch
4. https://www.cs.toronto.edu/~graves/icml_2006.pdf
5. https://github.com/githubharald/DeslantImg

Thank you