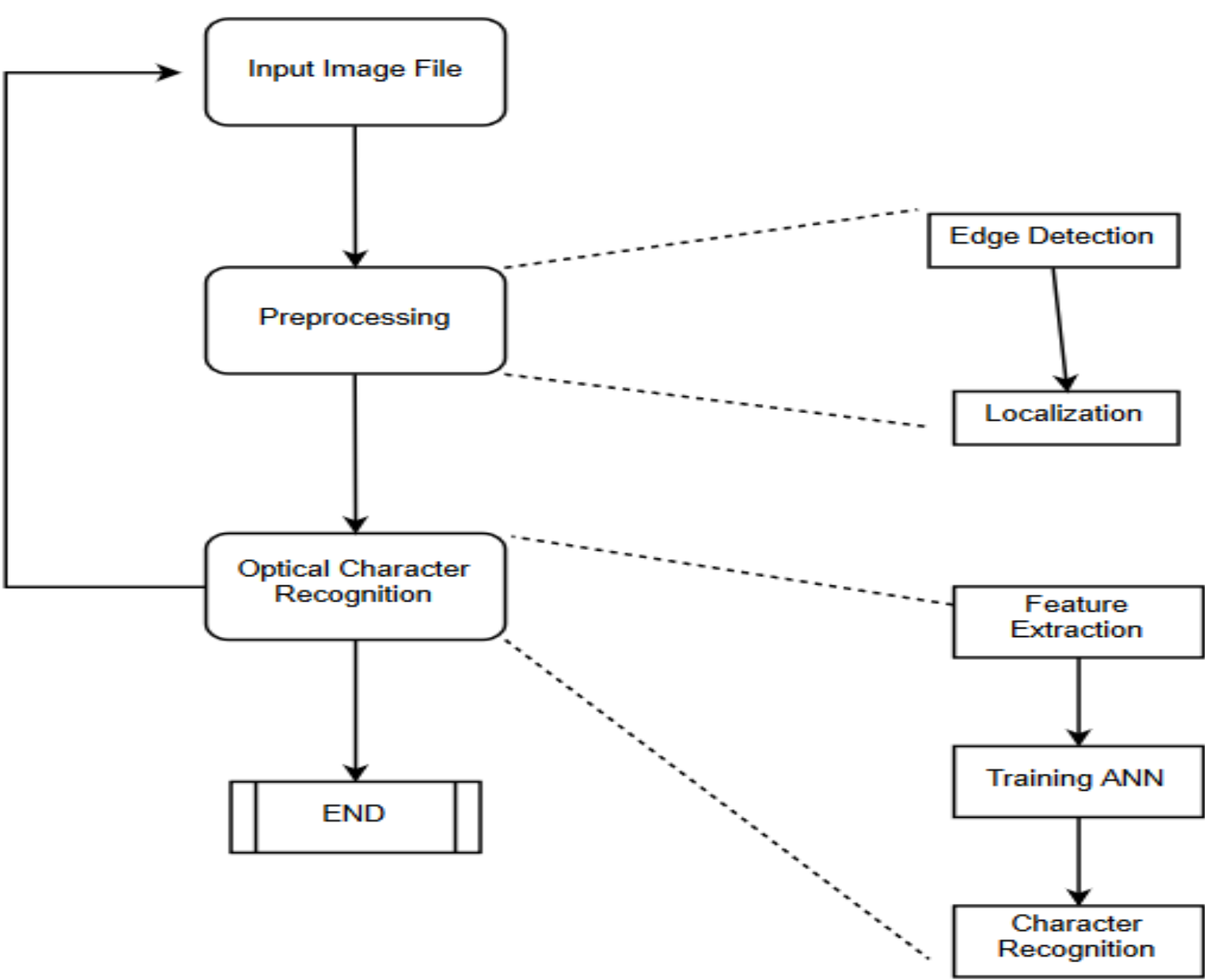# Automatic Number Plate Recognition

Abhash Jain, Abhishek Srivastava, Ajay V, Darshan Bhandari, Deepak Gupta, Kamal Sharma
North Carolina State University

1. Introduction

Automatic Number Plate Recognition using Image Processing and OCR. ANN was used and exploration of CNNs.
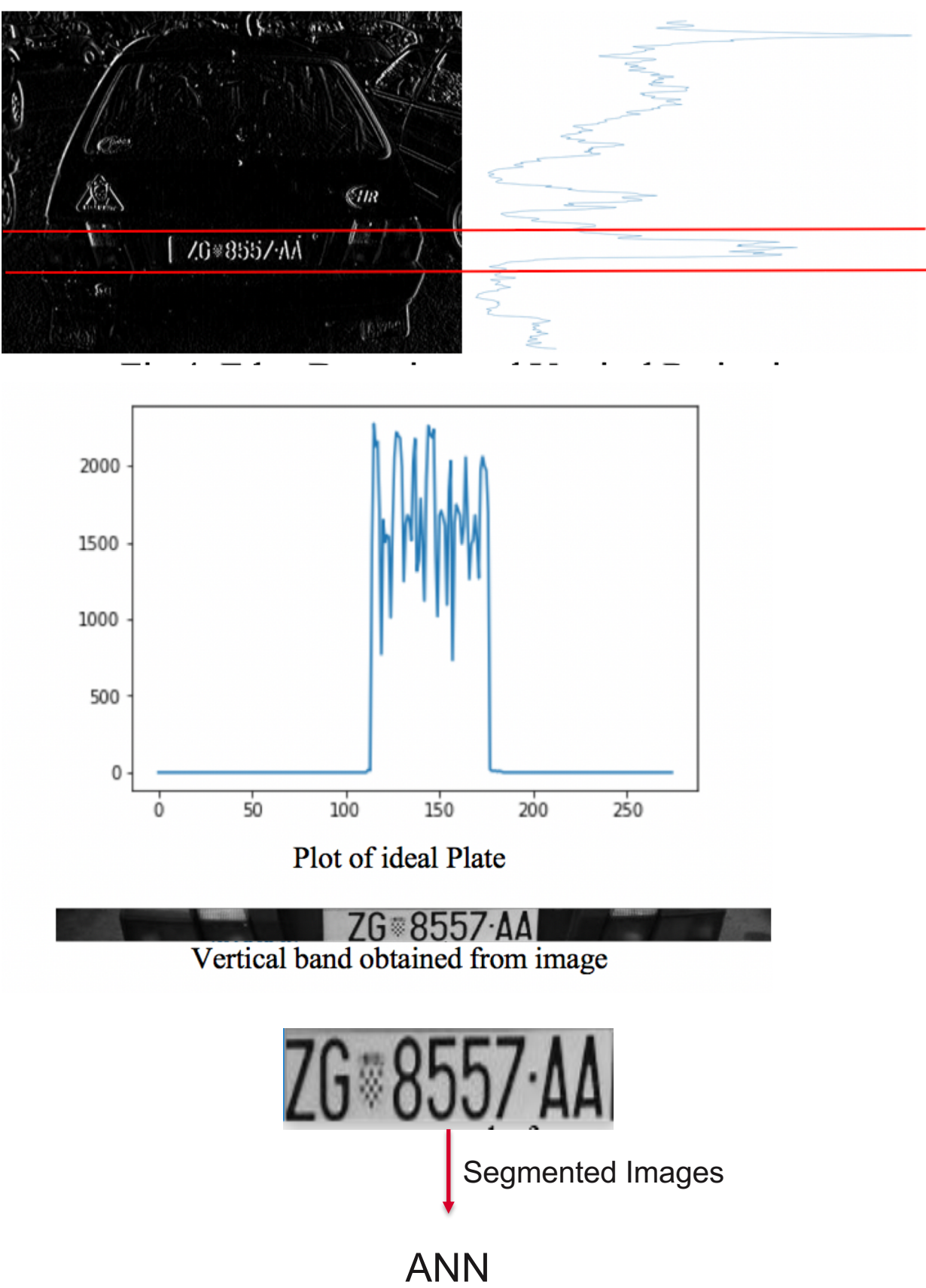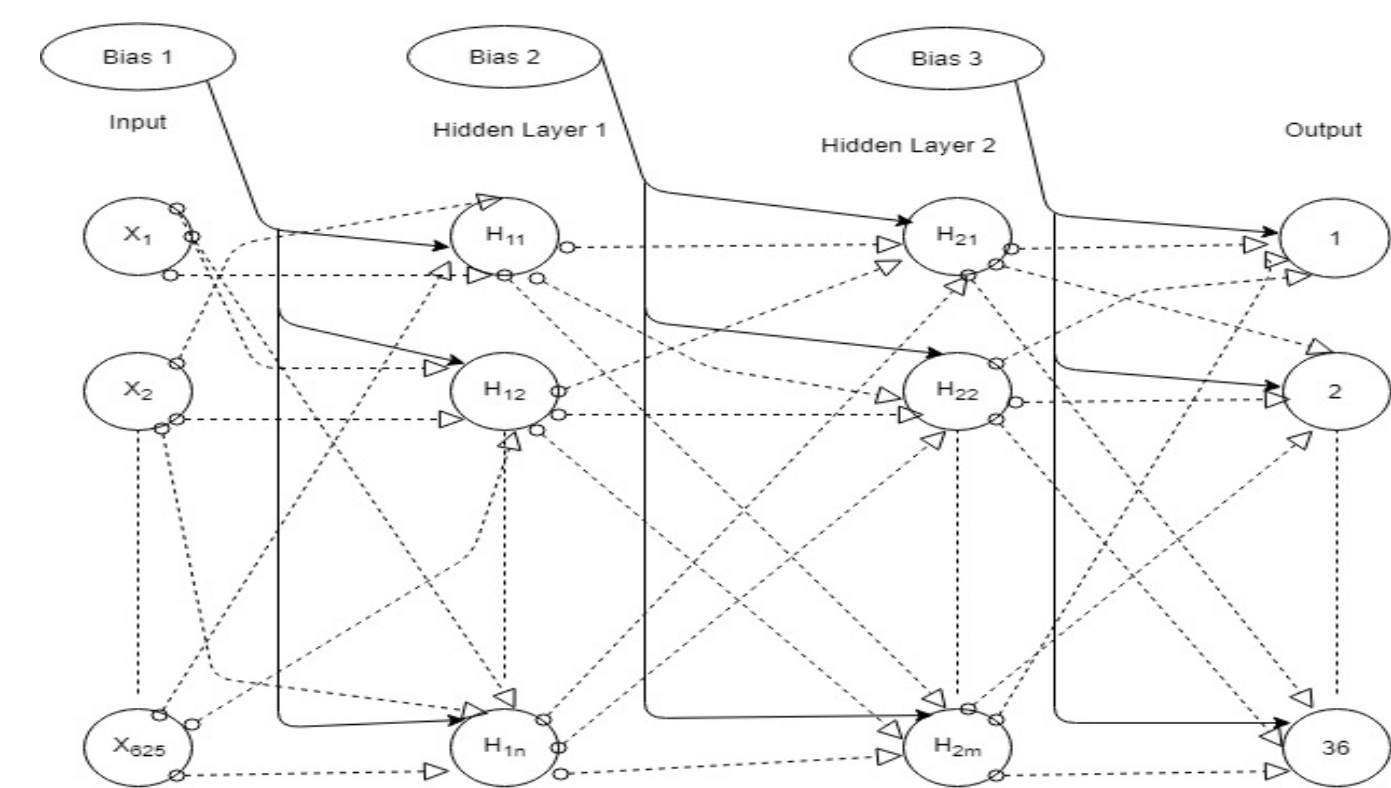

2. Data description

The training dataset for ANN consists of 50K images of individual alphanumeric characters.
The test images consist of diverse images of cars (night images, images at different viewing angle, low quality images), with the number plate clearly visible and has minimum reflection.

3. Technical Details

The implementation is done in Python 2.7. Project has 2 modules:
1. Preprocessing of the image.
   - Noise removal.
   - Vertical and Horizontal edge detection
   - Segmentation
2. Optical Character Recognition using ANN.

Plot of ideal Plate

ZG 8557 AA
Vertical band obtained from image

ZG 8557 AA
Segmented Images

ANN

4. Results

The accuracy of localization and segmentation highly depends on image quality, visibility of number plate, viewing angle, appropriate lighting etc. Further, the performance of ANN is directly proportional to the quality of the segmented images.

The results generated from rigorous testing are as follows:

	Accuracy
Plate Localization	81%
Character Segmentation	60%
OCR from the segmented characters	55.66%

5. Parameter choices for ANN

- Batch size = 16,
- Learning rate = 0.01,
- Network architecture = 2 Hidden layers (400, 300) nodes
- Activation function = Sigmoid/ Relu/ Tanh
- Optimization algorithm: Adam/ Gradient Descent
- Regularization: L2

These choices were made after rigorous testing with a number of values and these parameter values proved to be the optimal choice.

6. Conclusions

Advantage is that the system has less complexity with less features to calculate and highly adaptable. Neural Networks perform better for image classifications compared to other simple classification algorithms. Adam optimization converges faster than gradient descent.
On the other hand, accuracy highly depends upon environmental conditions and image quality.

7. References

Bhavin V. Kakani, Divyang Gandhi, Sagar Jani, "Improved OCR based Automatic Vehicle Number Plate Recognition using features trained Neural Network." IEEE- 2017
Sarbjit Kaur, Sukhvir Kaur , "An Efficient Approach for Number Plate Extraction from Vehicles Image under Image Processing." IJARCS, 2014