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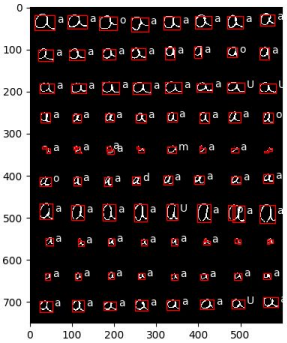
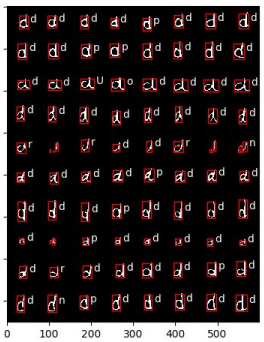
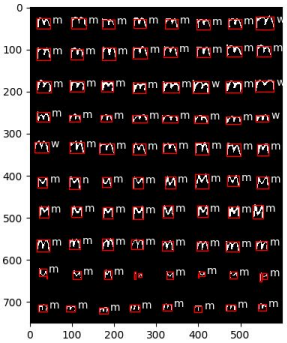
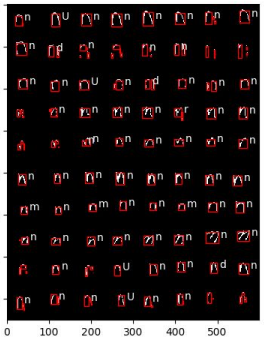
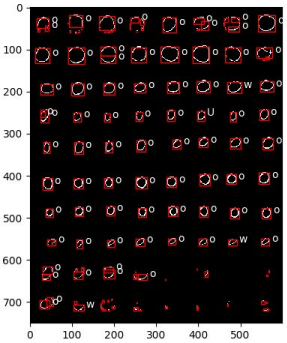
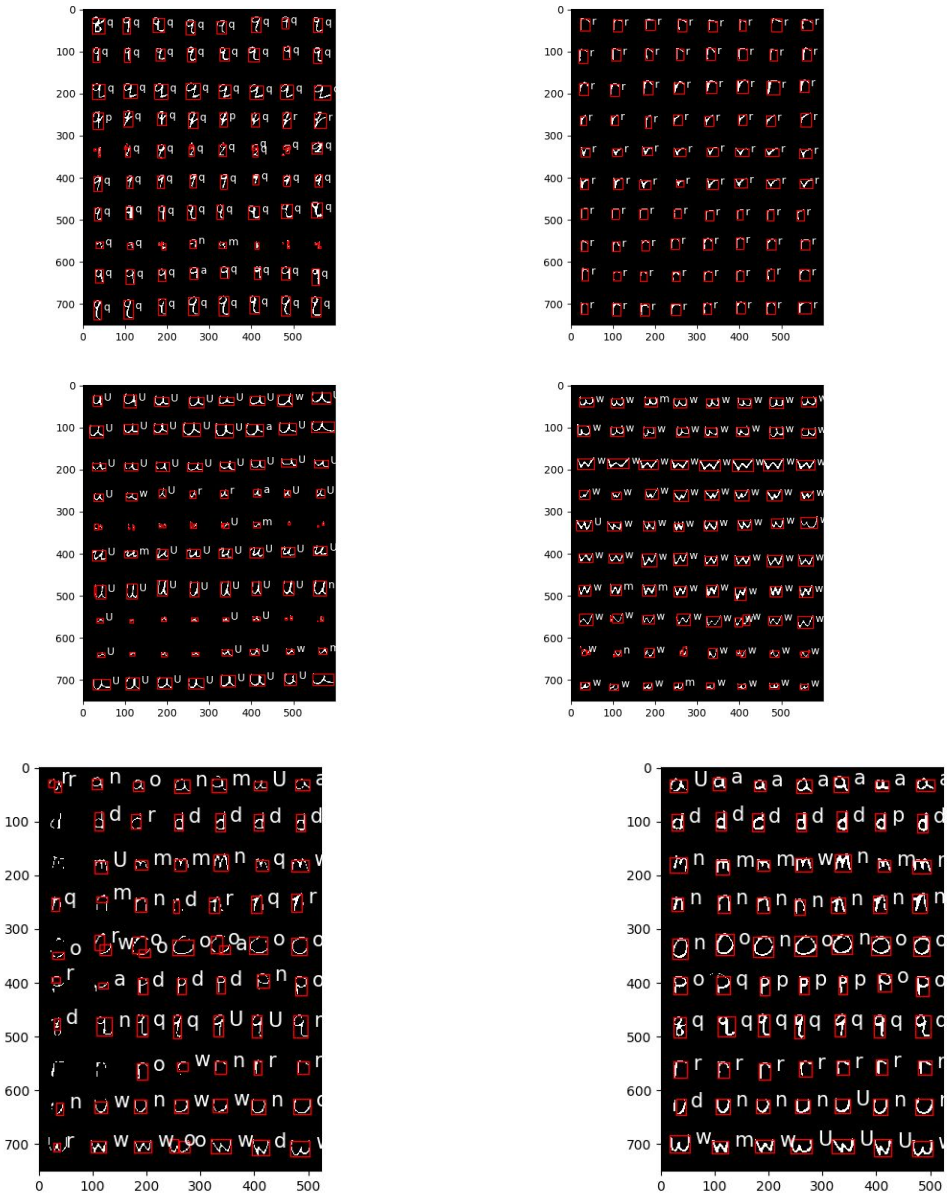
The project uses different thresholding, features and denoising as parameters

- Threshold - can be set manually (150-200)
- Noise - removed small components with less than 10 px width and height
- Hu moments

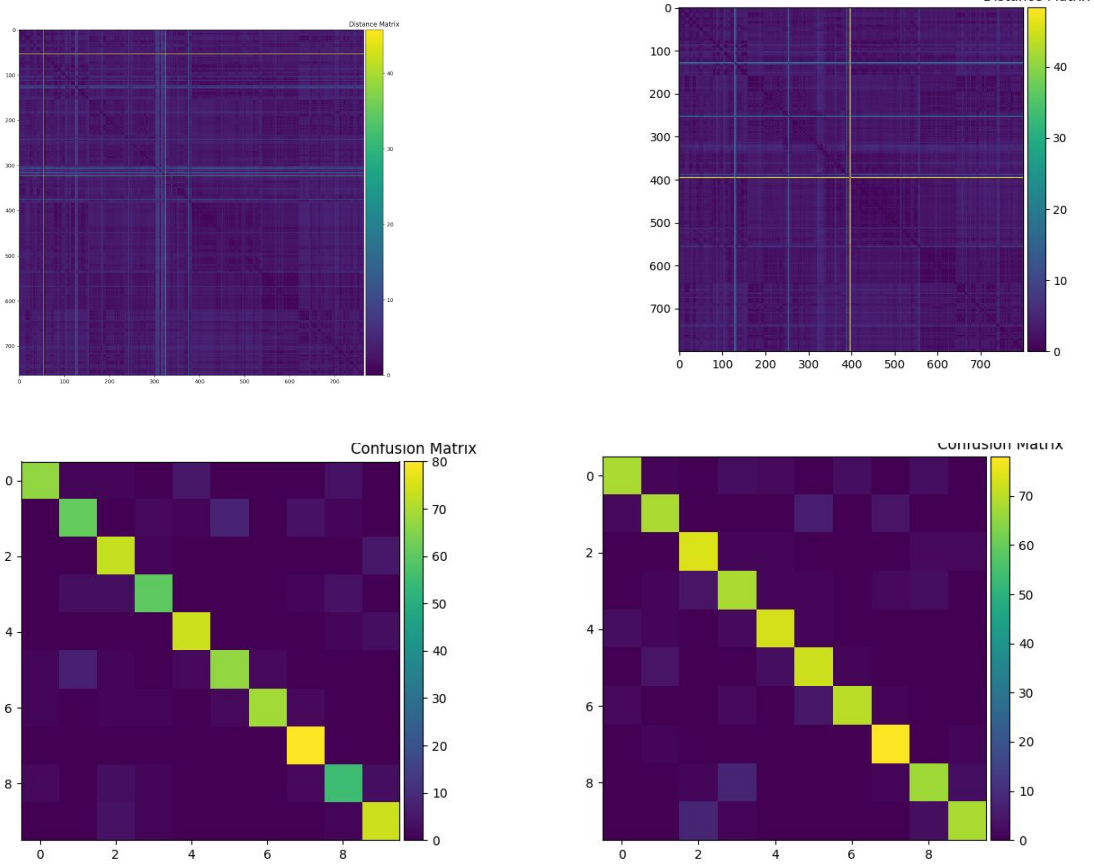
The given data gave training images with 80 characters in each file. The following are the results from testing using manual thresholding at 150 with nearest neighbors set to 5 with closing. The recognition rate came out to be 78.82%



As you can see on the left hand side is the testing results with bounding boxes using the above training set and parameters. The number of components identified in the left is 71 with a recognition rate of 31.4%

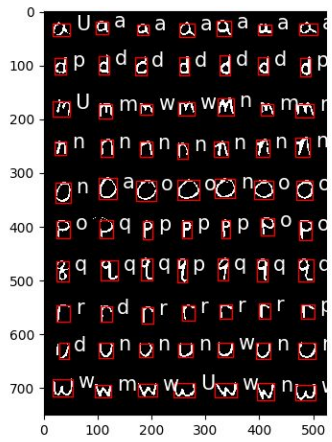
The right hand side came from the results having a threshold of 200 instead of 150. The training rate for this resulted in an 81.5%. However the resulting image came out way better compared to the other one. The components identified is 70 while the recognition rate jumped to a 68.57%

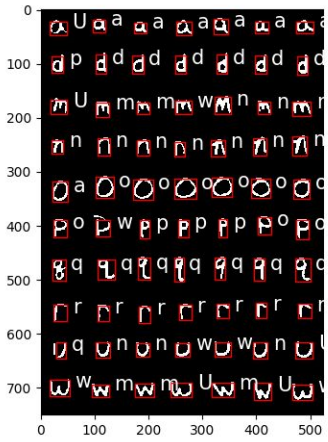



The following are the respective confusion and distance matrices using threshold 150 (left) and threshold 200 (right). The diagonal in the distance matrix is the distance of each character and itself and the confusion matrix diagonal shows when labels are correct

Manually changing the threshold results in improvements in results.

The threshold is further modified using otsu and adaptive thresholding.
Using otsu the training recognition rate resulted in 82.6%, identified 70 components and the rest resulted in 61.4% recognition.
Otsu is further tested by adding blur
The training rate is 82.7%, 70 components and 68.57% recognition

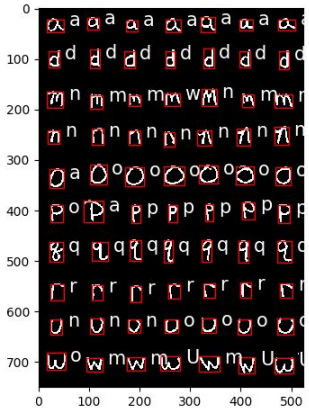




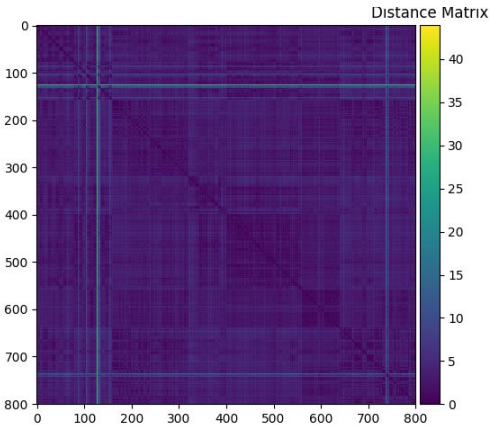
Gaussian blur being used to average neighbors and using morphological closing.(no blur left, blur right)

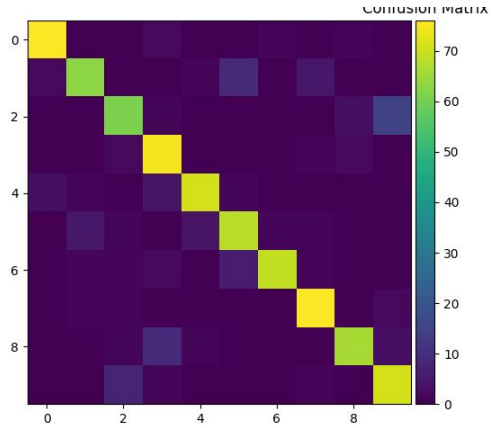
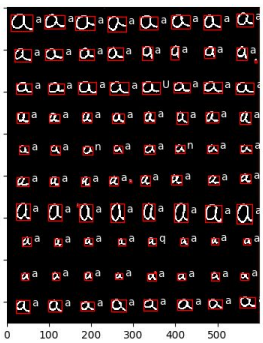
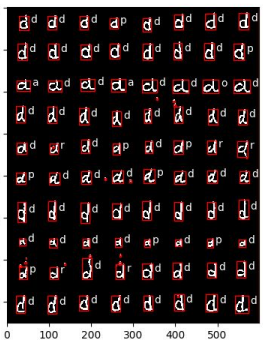
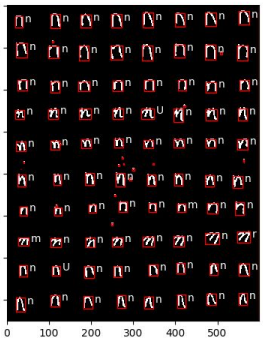
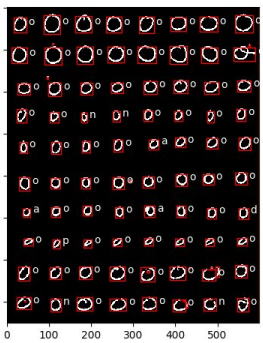
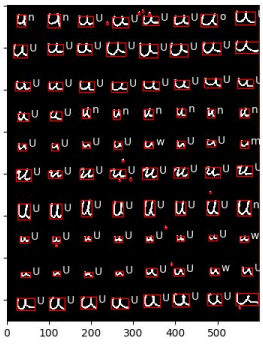
Adaptive thresholding:
Training rate: 86.89%
Components found: 70
Test Rate: 71.42%

Adaptive thresholding resulted in the highest accuracy using KNN value 3.



Results and data taken from adaptive thresholding


Distance Matrix


Confusion Matrix