



CS523 COMPUTER VISION
REPORT

Sudoku Digit Recognition and Classification

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May 9, 2020

Introduction

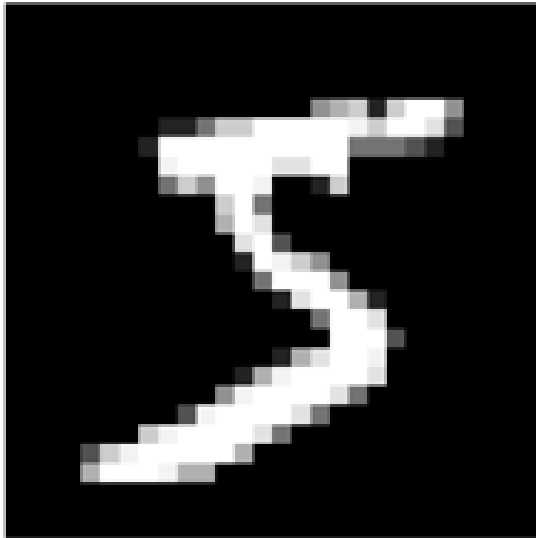
This report explains the implementation details of CS523 Computer Vision Assignment 2, which is about training a kNN classifier on the MNIST dataset, reducing the dimensions with Principal Component Analysis(PCA) and using the classifier on the Sudoku Dataset to recognize the digits. I will explain the idea behind PCA for reducing the dimensions, the kNN classifier, processing methods I have used to extract digits from the Sudoku Dataset and lastly comment on my results.

To run the code, there needs to be an images directory where the .dat files and .jpg files are located. Also python-mnist needs to be installed to load the MNIST dataset into numpy arrays.

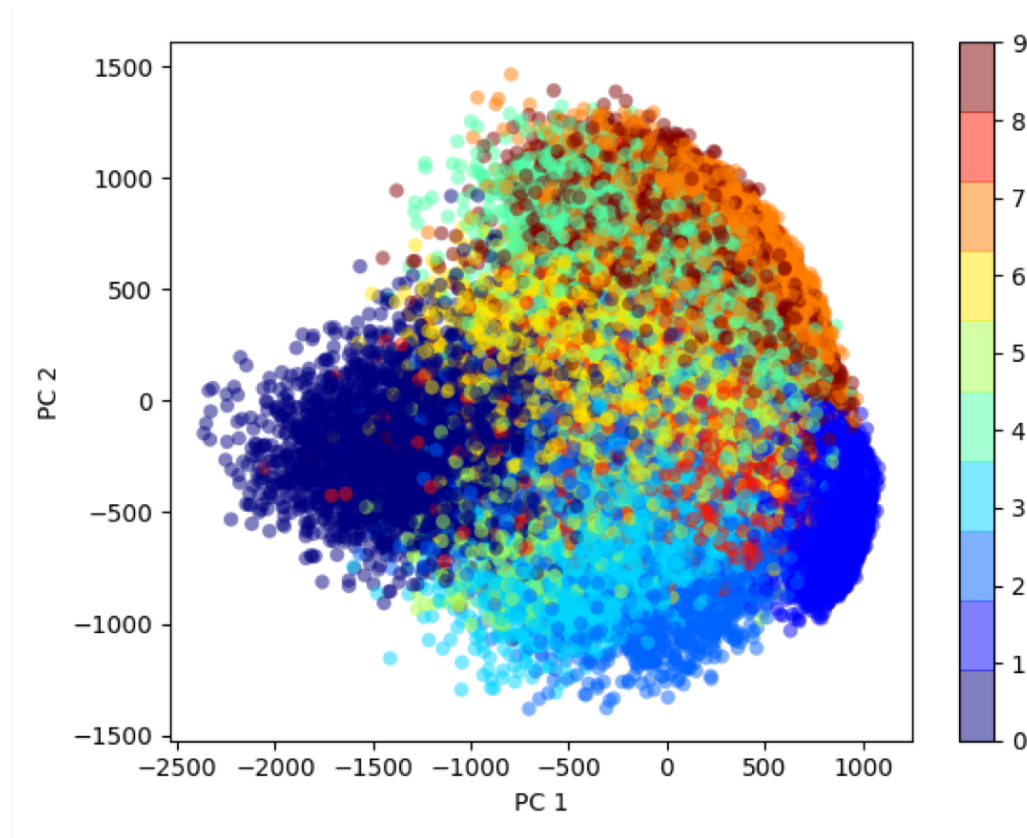
About Principal Component Analysis

Principal Component Analysis(PCA) is an algorithm used for dimensionality reduction. In the MNIST hand written digits dataset, each image comes as vectors of dimension 784. However, we do not need all the dimensions contain classifying an image. The idea is, compressing a matrix with a lot of features into a smaller matrix, with less features which preserves as much of the information in the full matrix as possible.

In my PCA algorithm, I first did stuff.



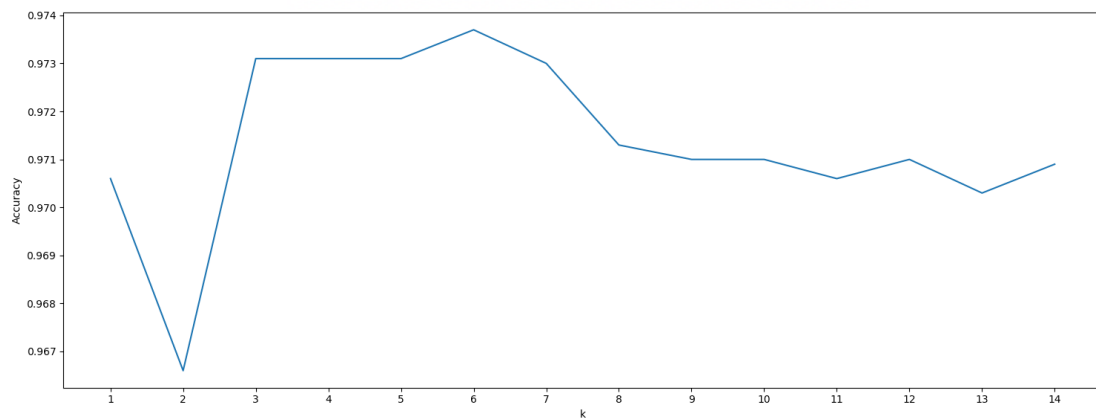
PCA results



PCA results

About k-Nearest Neighbor Algorithm

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Prediction accuracy of kNN Classifier
as a function of k (Number of Neighbours)

Predicted Actual	0	1	2	3	4	5	6	7	8	9	All
0	975	1	1	0	0	1	1	1	0	0	980
1	0	1131	1	0	0	0	3	0	0	0	1135
2	7	1	1003	0	1	0	3	11	6	0	1032
3	0	2	4	973	0	13	0	6	10	2	1010
4	0	0	0	0	960	0	4	2	0	16	982
5	3	2	1	9	1	868	5	1	1	1	892
6	4	4	0	0	3	0	947	0	0	0	958
7	1	20	10	0	2	0	0	985	0	10	1028
8	3	0	3	14	4	5	1	2	938	4	974
9	4	3	3	10	14	6	1	7	4	957	1009
All	997	1164	1026	1006	985	893	965	1015	959	990	10000

Confusion Matrix of kNN classifier with 6 neighbors
Accuracy: 97.37%

Results

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Bibliography

- [1] Reginald Watson. Grid detection with opencv on raspberry pi: Raspberry pi, Apr 2020.