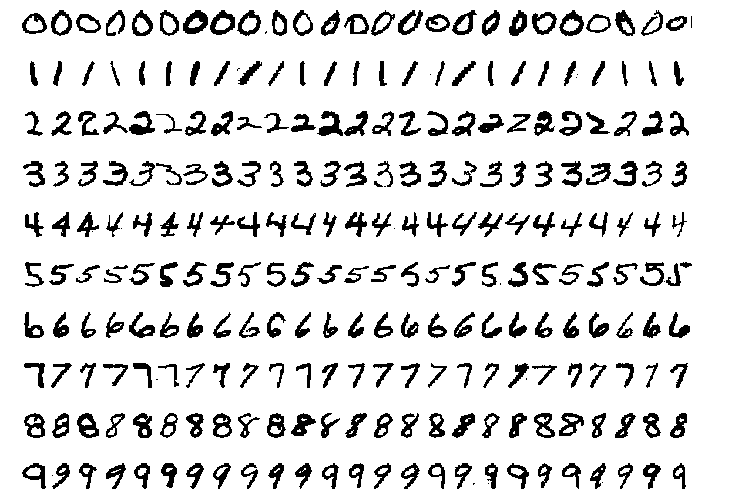
Construction of a Digit Recognition system

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Index

1 - Introduction

In this report we will provide the results of our digit recognition system that our pattern recognition consulting company developed. Our system will be used by the client to classify indivitual digits in bank account numbers and he monetary amount in cheques. We focused on two scenarios to prove the accuracy of our digit recognition system:

1 - We train the pattern recognition system once with 200 objects per class.

2- We train is trained for each batch of cheques with 10 objects per class.

To develop our digit recognition system we used the **prnist** dataset developed by the US National Institute of Standards and Technology (NIST).

The prnist dataset is a collection of scanned hand written digits from 0 to 9

Each class is a digit and there is a maximum of 1000 objects per class (i.e: 1000 different ways to hand write each digit).

Our first task was to uniformize the dataset. We developed a preprocessing script that resizes every image from the NIST dataset to 68x68 pixels (see **preprocess.m** in the pipeline folder for more details). We tested the classifiers on 3 different ways of representing data: pixels, extracted features and clusters.

For each representation we tested several classifiers:

* Parametric: nmc, ldc, qdc, fisherc, loglc
* Non parametric: knnc, parzenc
* Advanced: neural networks, support vector classifier, one-class classifiers, combining classifiers.

We also tested a series of other techniques like filtering the images (see **getSmoothedDataset.m** in the pipeline folder for more details), kernalizing the dataset (see **raw\_kernelization.m** in the pipeline folder for more details).

In this report we provide graphs and tables that showcase our results. Our objective for scenario 1 is to create a classification error bellow 5% and for scenario 2 bellow 25%.

2 - Feature Extraction & Selection

To extract features from the prnist images we used a series of PRtools functions (e.g: im\_profile im\_moments, im\_mean, im\_profile, im\_stat, im\_skel\_meas, im\_harris). In total we extrated 389 features from the grayscale images and combiend them into one dataset.

This is a relatively high dimension and out of those 389 features, not every single one holds valuable discriminatory information. So we evaluated the ideal dimension of features using the funcion **clevalf**

on the extracted dataset using the classifiers presented in the introduction as the criterion. We called the function for each classifier and combined the resulting grahpsh

in 2 figures: dimension evaluation of parametric classifiers and non parametric. Bellow we show the figures.

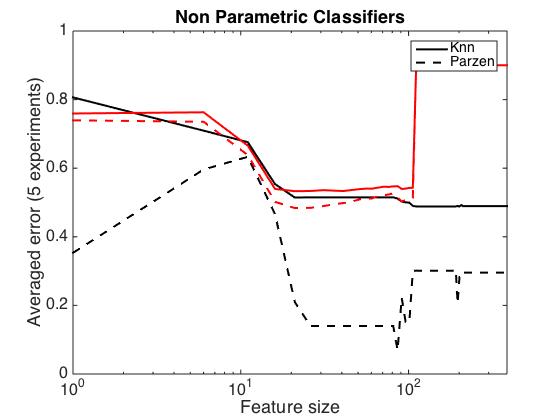


Fig. 2.2 - Non Parametric classifier

As we can see, the best performing classifier is ldc with 101 features.

We then proceeded to select the 101 best performing features. For this we used the forward feature selection algorithmprovided by PRtools: **featself.** This function outputs a mapping that was used to select the best performing features from the original 389 feature dataset.

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