Pattern Recognition
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HW4

Note: Though some of these exercises specifically require MATLAB, you may use MATLAB to help with plotting, computation, and/or verification of your results. This is in fact encouraged.

1. Clustering

Use the k-means function provided by Matlab (with k=2) to find the cluster centres of the samples generated by:

```
N=200;
X = [randn(N,2)+ones(N,2); randn(N,2)-ones(N,2)];
```

Plot the cluster centres found and the samples belonging to one cluster or another with two different colours. How many samples were misclassified? Repeat the experiment (with the same X) and check the mean error.

• Using the fuzzy c-means toolbox provided find the two clusters and plot the cluster centres. Also, plot the degree of belonging of the sample to each one of the two clusters.

• Now you will be experimenting with the simple retina vessel segmentation shown during the first Homework

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First, you will be normalising the image. Load retina.jpg and convert it to double precision. For each colour channel estimate the background using a 2D median filter.
Example: backgroundRed = double(medfilt2(retImage(:,:,1), [30 30]));

Obtain the preprocessed image by subtracting the background from the original image (remember to use double precision and to perform this process for each colour channel)
Create a sample for each pixel of the image. The feature vectors will have 3 dimensions, one for each colour channel.
Use k-means to find 4 clusters and plot them.

You should obtain: one cluster with artefacts at the edges of the image;
one cluster with the optic nerve (the bright disc) and other reflections;
one cluster with noise across the whole image and finally one cluster with the vessels.

Use fuzzy c-means to find other 4 clusters. Plot the 4 resulting images containing the degree of belonging of the pixels to each class.