1. Uniform probability distribution

- Use the Matlab rand function to generate a 1xn dimensional matrix samples drawn from a uniform distribution.
- From what range does rand draw samples?
- Select a suitable number of samples.
- Display the size of the array
- Plot the data against sample number using the plot command.
- Use the histogram command and plot a histogram of the distribution.
- Ensure you put suitable labels on the plot axes and add a title, etc.
- Typical results are shown plotted below in Fig. 1.

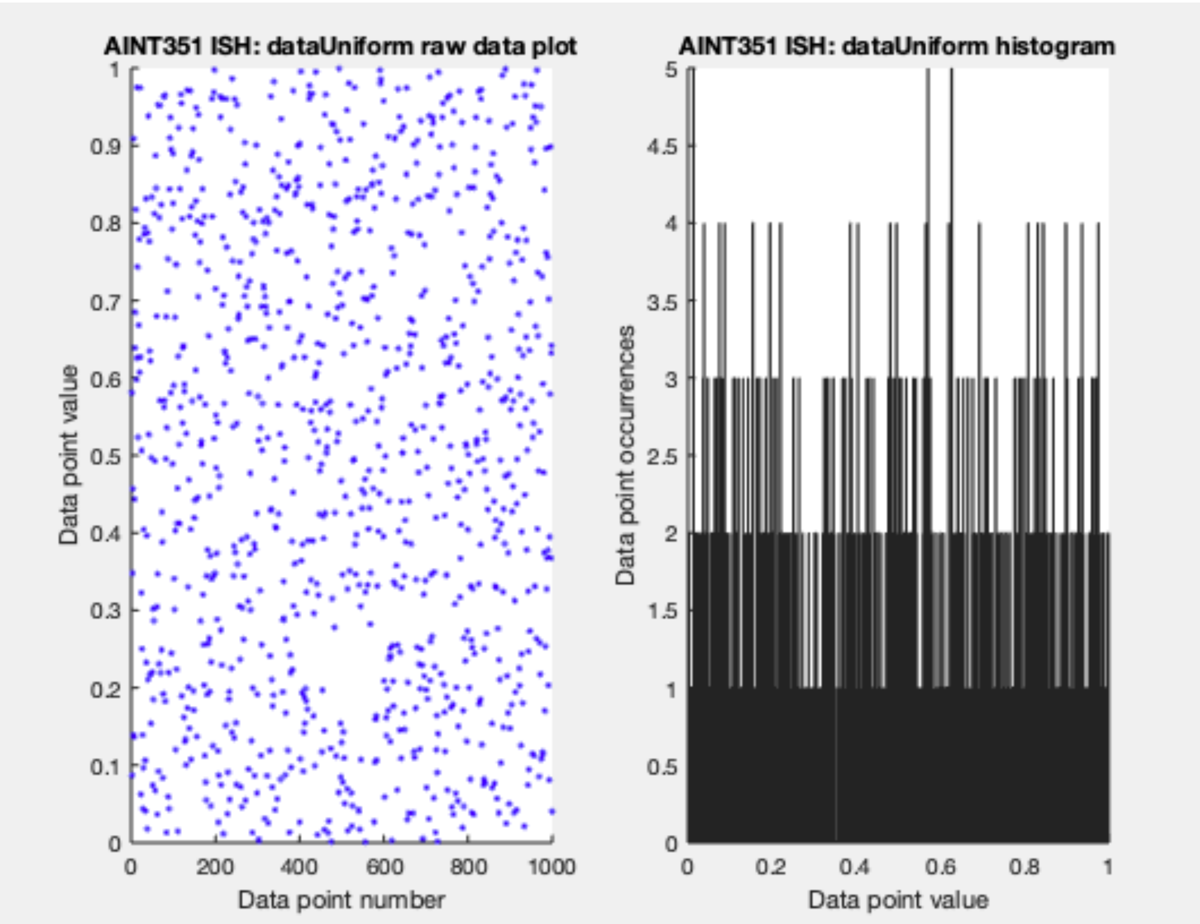

Fig. 1 Sample plot and histogram plot of data generated by the Matlab rand function

- What can you say about your plots?
- Experiment with different numbers of samples and bins.
- How many samples and bins should do you need to say something about the distribution?

2. The central limit theorem

- Use the rand function to generate a nxn dimensional matrix of data samples drawn from a uniform distribution.
- Select a suitable number of samples by experimentation.
- Display the size of the array.
- Average across the 2nd dimension using the Matlab mean function. Running the mean function like this generates a single nx1 vector
- Plot the averaged data vector against sample number like in part 1 and label the plots appropriately.
- Use the histogram command and then plot a histogram of the data.
- You should get results like those shown in Fig. 2.

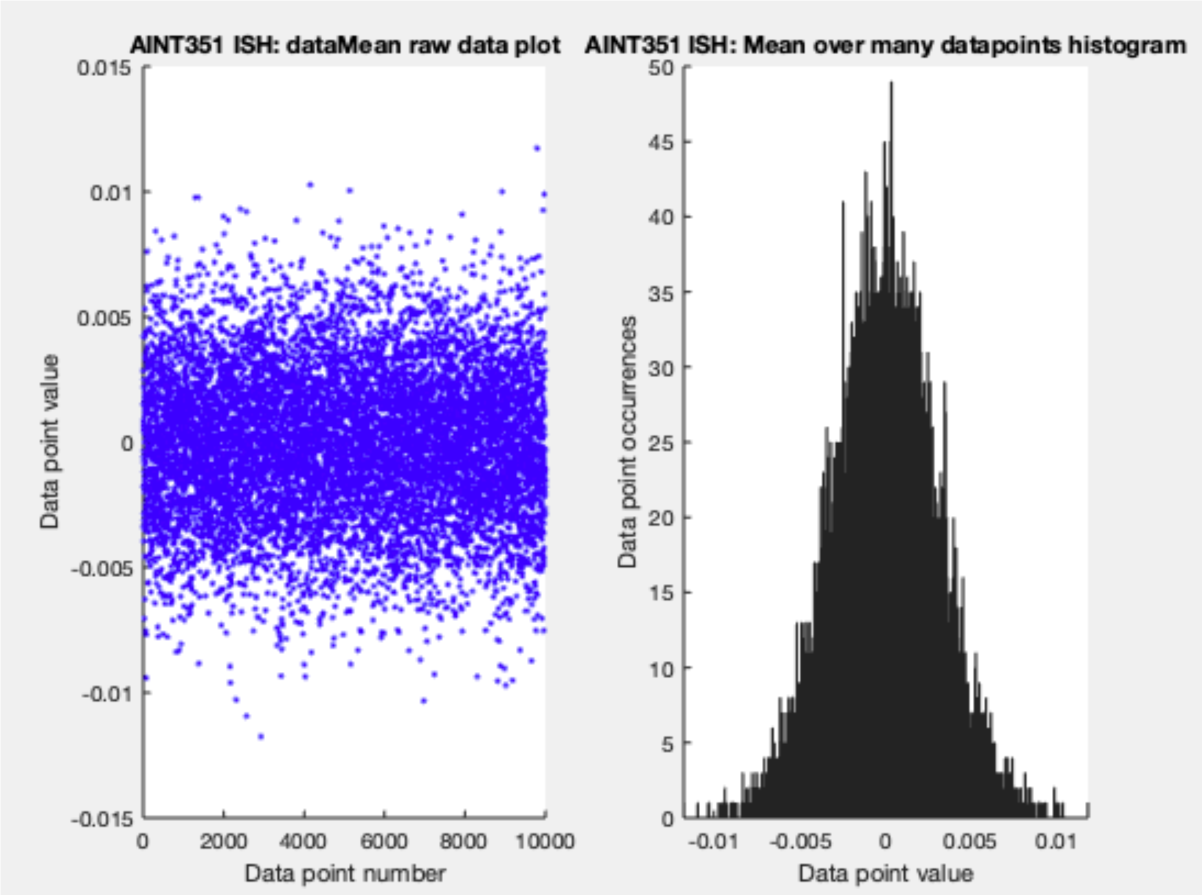

Fig. 2 Sample plot and histogram plot of data generated by averaging uniformly distributed data

- What can you say about this distribution?
- How many samples and bins do you need to get “sensible” results?

3. Normal distribution

- Use the randn function to generate a 1xn dimensional matrix of samples draw from a Gaussian distribution.
- What is the mean and standard deviation of the distribution that the randn function samples from?
- Select a suitable number of samples.
- Display the size of the array.
- Plot the data dimension against sample number.

- Use the histogram command to give an indication of the shape of the distribution of the data samples.
- You should get results like those shown in Fig. 3.
- Estimate the mean and variance of the generated data and compare these values with the default values of the randn function

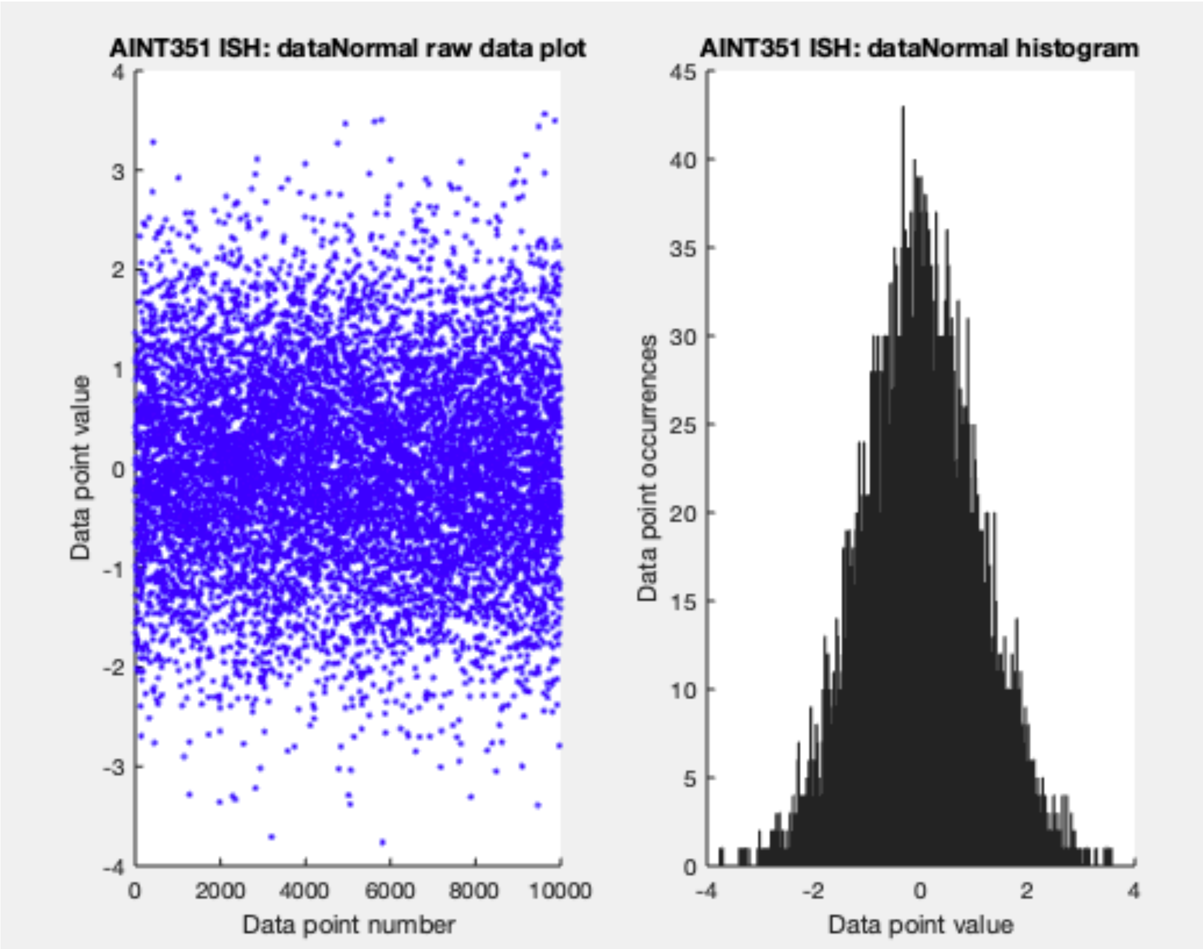

Fig. 3. Sample plot and histogram plot of data generated by the Matlab randn function

4. Generate a 2-D distribution

- Call the randn function with parameters (2, samples) to generate a 2xn dimensional matrix of samples drawn from a normal distribution.

- Select a suitable number of samples.
- Display the size of the array.
- Plot the data dimension against each other to get a 2D scatter plotthat should like something like that shown below in Fig. 4.
- What is the mean vector of your dataset?
- Use the cov function to compute the covariance matrix of your dataset. What is the covariance of your dataset?
- Look at how mean and covariance estimates change as you change the number of data samples.
- What can you say about this distribution (e.g. the relationship between the two features)?

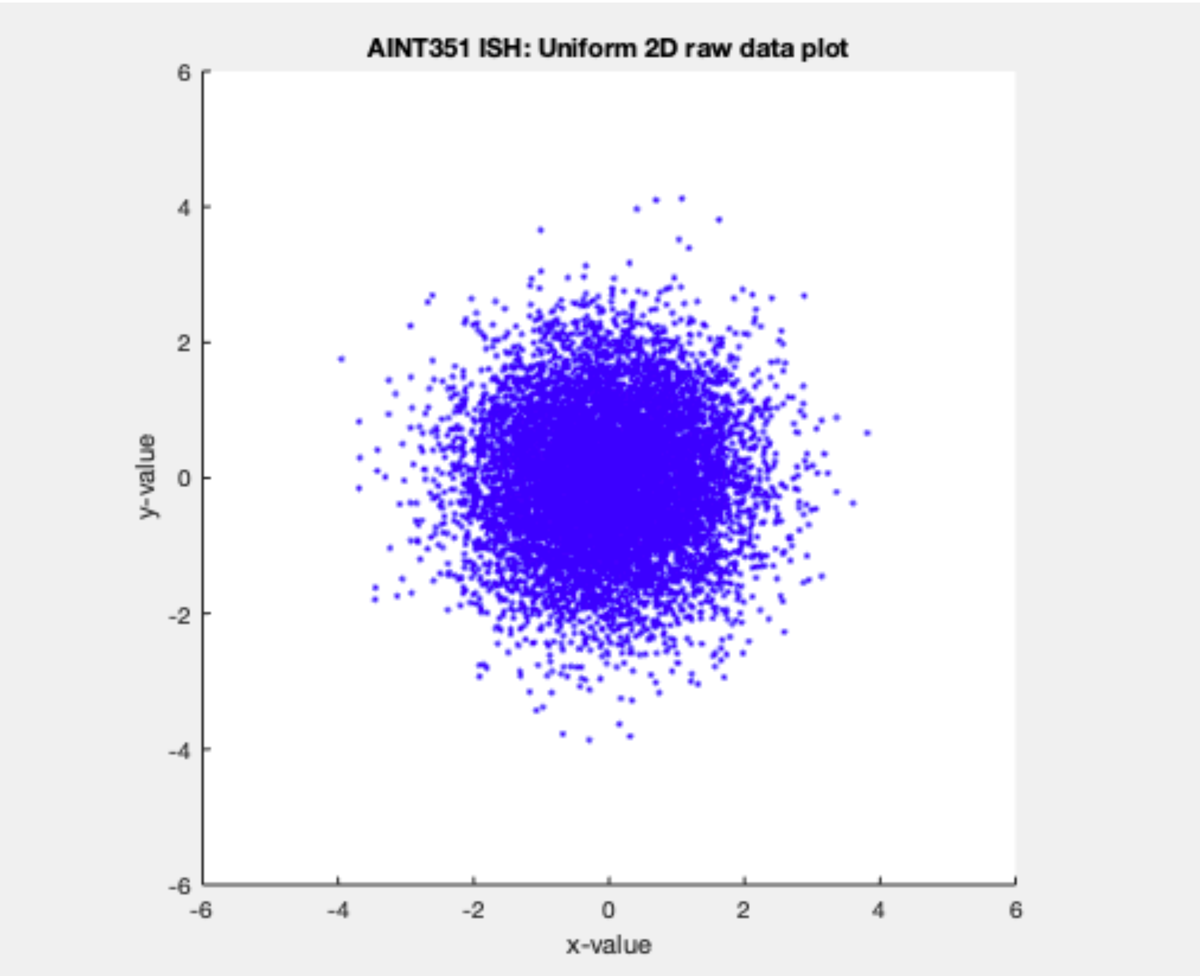

Fig. 4. Plot of the two feature values against each other for all data samples