Lab 1: Intro to MATLAB for Artificial Intelligence (CS303B)

This lab introduces you to MATLAB . Some of the exercises use image files that are available on the VLE.

Exercise 1: Introduction to MATLAB

If you are new to MATLAB then you should work through the *Getting Started with* MATLAB tutorials available here: https://www.mathworks.com/help/matlab/getting-started-with-matlab.html
or alternatively Chapter 1 of the *Getting Started with* MATLAB guide PDF available here:
https://ww2.mathworks.cn/help/pdf_doc/matlab/getstart_zh_CN.pdf

or a wonderful course for a beginner:
https://matlabacademy.mathworks.com/R2020a/cn/portal.html?course=gettingstarted#chapter=5&lesson=1&section=2

All available PDF:
https://ww2.mathworks.cn/help/pdf_doc/matlab/index.html

Even if you have used MATLAB before it is recommended that you review these tutorials to refresh your memory.

In this course, you also need to install the following Toolbox:

- ✓ Image Processing Toolbox
- ✓ Computer Vision Toolbox
- ✓ Deep Learning Toolbox
- ✓ Statistics and Machine Learning Toolbox

Exercise 2: Warming up - Exponential functions and some basic numeric calculus

1. Evaluate the exponential growth function $y = e^x$ over the values `(0:0.05:10)`. Plot this function using `plot` (passing it both x and y vectors). Now plot e^{a*x} for different values of a.
2. Take the log of the exponential growth function evaluations. Plot the result and check that it is as you expected.
3. Use `diff` to numerically estimate the derivative of the exponential growth function (i.e., use `diff(y)/0.05`). Plot this against the original exponential function and check that it is as you expected.
4. Make a new MATLAB 'M-file' by selecting 'File—New—M-File' from the main menu. Inside this file create a function called myfunc that for now just evaluates the exponential function. Save this file as 'myfunc.m'. Now use the MATLAB numeric integration routine `quad` over the interval [0,1] to estimate the integral (i.e. area under the curve between 0 and 1). Help and an example for this exercise can be found by typing `help quad`. Creating function files is very useful and will be important later.

Exercise 3: 2D Plotting & images in MATLAB

1. Create the function $f(x, y) = \frac{sin\sqrt{x^2+y^2}}{\sqrt{x^2+y^2}}$ (or try $f(x, y) = \frac{\sin(x^2+y^2)}{x^2+y^2}$)for $x = -20...20$, $y = -20...20$ and plot it as a 3D plot(`plot3, meshgrid`)
2. f can be visualised as a 2D image (`imagesc`). Change the colour of the plot (colormap, scaling, limits).
3. MATLAB provides basic functions for image import/export, visualization, etc. Use the documentation to explore them (`doc image`).
   (a) Import and display "lena_colour.jpg" as a colour image. (Note the difference between `image` and

`imagesc`!)

(b) Convert it to a greyscale image and visualise it.

(c) Export the greyscale image as “lena_colour.png”.

(d) Visualise it as surface plot (`surf`). (Specify the property “`LineStyle`” of the surface plot as “`none`” for better visualisation)

(e) Visualise the image as both a normal image and a surface plot in the same figure.

Exercise 4: Toolboxes

1. MATLAB provides functions for many specialised areas of science and engineering and mathematics; these come packaged as 'toolboxes'. In this course we'll be making use of toolboxes such as the Computer Vision System Toolbox and the Image Processing Toolbox. You can read more about these toolboxes here:

   `http://www.mathworks.co.uk/help/vision/index.html`
   `http://www.mathworks.co.uk/help/images/index.html`

2. As a simple first example of a function in the Computer Vision System Toolbox, try the following code that uses the `insertText` to insert text on an image.

```
I = imread('lena_colour.jpg');
J = insertText(I,[100, 100],'<Insert your caption here>')
imshow(J);
```

Reference

1. Use the MATLAB help (`doc`)

2. Many MATLAB tutorials can be found on the web.
3. https://ww2.mathworks.cn/help/pdf_doc/matlab/getstart_zh_CN.pdf

4. Ask the tutor.