**IN3063 – Maths AI Report**

TASK 1

**Sigmoid & ReLU:**

* By Aymen
* Pros & Cons (<https://www.educative.io/answers/sigmoid-vs-relu>)
  + A screenshot of a computer code

    Description automatically generatedSigmoid Pros:
    - Has the ability to map numbers to probabilities which is useful for binary classification
    - Output is bounded and prevents large/unstable outputs during training
  + Sigmoid Cons:
    - Has a gradient vanishing problem (occurs when gradient of loss function becomes very small during backpropagation)
    - Computationally expensive when dealing with a large dataset
  + ReLU Pros:
    - Avoids the gradient vanishing problem as it always has a constant gradient of 1 for all positive inputs – makes backpropagation easier
    - Power efficient – all values under 0 are discarded
  + ReLU Cons:
    - Weights can lead to negative inputs for a neuron which returns 0 – leading the neuron to be dead

**Softmax:**

* **A screen shot of a computer program

  Description automatically generated**By Aymen
* **A screen shot of a computer code

  Description automatically generated**As you can see in the ‘before’ code, I’ve implemented a basic softmax using the softmax formula. However, it causes numerical issues when using large numbers as you can see from the screenshot to the right. It tells me that ‘overflow encountered’ in exponential and ‘invalid value encountered in divide’. To overcome this issue, I’ve replaced the code by subtracting the maximum value in the array from every value by using the max function. Now the code works as you can see on the second screenshot (after code) to the right. Both code works when using small numbers, but we’ll stick with the after code as it can handle very large numbers without errors. (<https://www.sharpsightlabs.com/blog/numpy-softmax/>)