

# => Machine Learning Assignment 4 <=

## 100 MARKS

If you have any problems with this practical assignment, speak up well before the deadline!

### Deadline

Submit all tasks on RuConnected by **the deadline**

### Task 0: Upvote the Kaggle notebook [10]

Upvote the Kaggle notebook called [IntroCNNsKeras](#) and I will check it against your username/email address on Kaggle.

### Task 1: Watch a Video [4 + 4 + 2 = 10]

Watch [this video by 3Blue1Brown](#) on the basics of Neural Networks. They go into an in-depth conceptual understanding of Neural Networks.

Now, answer the following questions about the video:

1. For the MNIST dataset, what are the weights in the first few layers meant to represent?
2. What are the weights in the last few layers meant to represent?
3. Why do the weights end up not representing this?

### Deliverables:

- PDF with the answers to these questions

### Task 2: Review on Machine Learning [3 + 4 + 10 + 13 = 30]

Answer the following questions on Machine Learning:

1. **Define** Machine Learning and give a simple example of it that illustrates the terms you used to define it? [3]
2. **Feature Scaling**
  - a. What is feature scaling and why do we use it? [2]
  - b. What machine learning algorithms benefit from feature scaling? Provide three examples. [3]
  - c. What machine learning algorithms typically do not require feature scaling? Provide two examples. [2]

### 3. Cross-Validation

- a. Draw a diagram that illustrates K-Fold Cross-Validation. Also, explain the diagram. [6]
  - b. What are the advantages and disadvantages of having a large vs small number of folds? [2]
4. **Gradient descent** is used to find the optimum parameters for many machine learning processes, such as linear regression.
- a. Briefly explain what gradient descent is, using a diagram, and how it helps to find the optimal parameters. What shortcomings does gradient descent have and how can we mitigate against these? [5]
  - b. Explain how plotting error data can be used to determine the degree of the polynomial to use in a logistic regression model. [4]
  - c. Explain how plotting error data can be used to determine how much to regularise a logistic regression model. [4]

#### Deliverables:

- PDF containing the answers to these questions

### Task 3: Build a Neural Network [10 + 5 + 5 + 5 = 25]

Now that we know how Neural Networks classify digits on the MNIST dataset, let's do that for the Wine Dataset!

Create a notebook on Kaggle that uses a Neural Network to classify the [wine dataset](#). You will be starting with a blank notebook, so it is up to you to decide on how to tackle this!

We are using advanced algorithms here, so you must at least:

- Split your data into a training and test set
- Use validation (but don't use K-Fold Cross-Validation)
- Report on your model performance using the test set

Once you are done, download the Python notebook, and submit it through RUConnected.

#### Deliverables:

- Python Notebook

## **Task 4: MNIST, but Fashionable! [25]**

We have done a single Neural Network. Now, let's use Convolutional Neural Networks.

The Fashion MNIST dataset is a set of grayscale images of various types of clothing. Specifically, there are 10 different types of clothes.

Use [this notebook](#) as a starting point to create a Convolutional Neural Network and classify items on the Fashion MNIST dataset.

### **Deliverables:**

- Link to modified Kaggle notebook