

CECS 551
Assignment 5
Total: 40 Points

General Instruction

- Submit uncompressed file(s) in the Dropbox folder via BeachBoard (Not email).
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1. Design neural networks to classify hand written numbers using **keras** library, however, **do not** include convolutional layers.
 - (a) Design neural networks and implement them.
 - Find `Assignment_5_mnist.ipynb` and `mnist.zip`.
 - `train_X` and `test_X` are list of intensities in 8-bit gray scale of 28×28 images.
 - `train_y` and `test_y` are list of integers which are the classes of the corresponding images.
 - The objective of the networks is classifying images into 0 to 9.
 - (b) Split the training dataset into `sub_training` and validation sets randomly. Use $\frac{1}{6}$ of training dataset as validation set. Use the ‘accuracy’ as metric. Please repeat 10 times of random split for each hyper-parameters and architecture, and aggregate (average) the accuracy.
 - (c) (20 points) Optimizer evaluation
 - Implement a neural network which has single hidden layer with 32 units. Using the network, find best hyper-parameters of the following optimizers; SGD, RMSprop, Adam, Adagrad.
 - Train the network with the training dataset (not `sub_training`) with the best hyper-parameters of each optimizer.
 - For each optimizer, report **test accuracy** using the test dataset.
 - (d) (20 points) Architecture evaluation
 - Pick the best optimizer and it’s hyper-parameters from the previous part.
 - Using `sub_training` and validation datasets, find the best architecture in terms of the number of layers, the number of units, and activation functions.
 - Report 3 best architectures in terms of **test accuracy**. Please include architecture diagram as shown in Figure 1.
 - (e) Submit `ipynb` files which include your source codes and `pdf` file which includes your report.

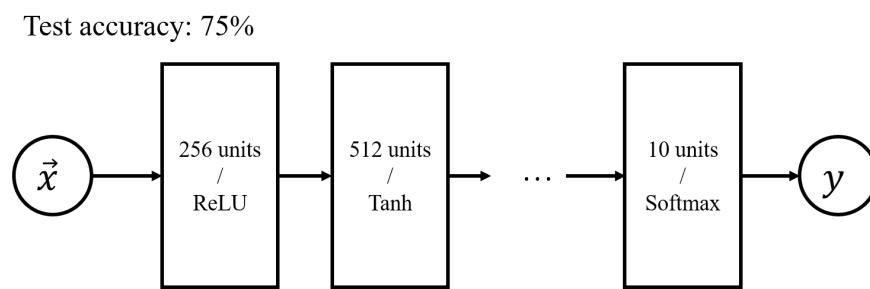


Figure 1: A network architecture example