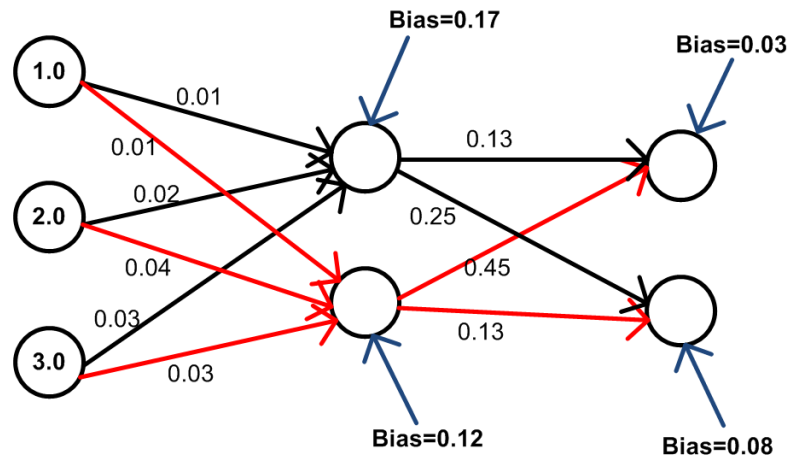


Assignment 3

Question 1)



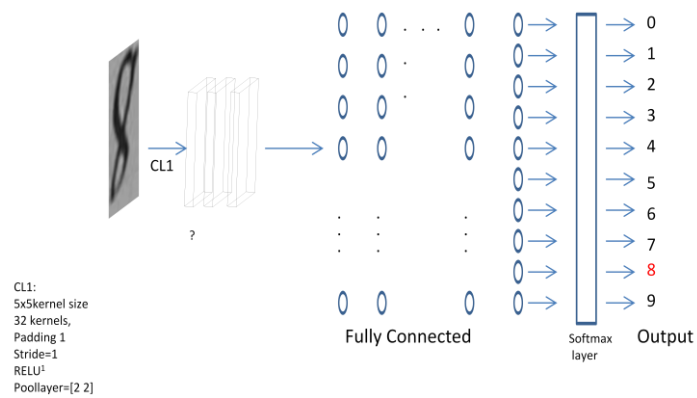
Find the Recurrent Neural Network model above.

- How many weights and biases does the RNN model have?
- How many input-to-hidden weights does the RNN have?
- How many hidden node biases does the RNN have?
- How many hidden-to-output weights does the RNN have?
- How many output nodes does the RNN have?
- What are the input values in the RNN?
- Apply 1 time iteration to the network model to find the values of hidden nodes and output nodes. (**USE tanh as activation function and Softmax Function**).
- Apply Elman approach to store the hidden values into the state nodes. Show the figure and explain.

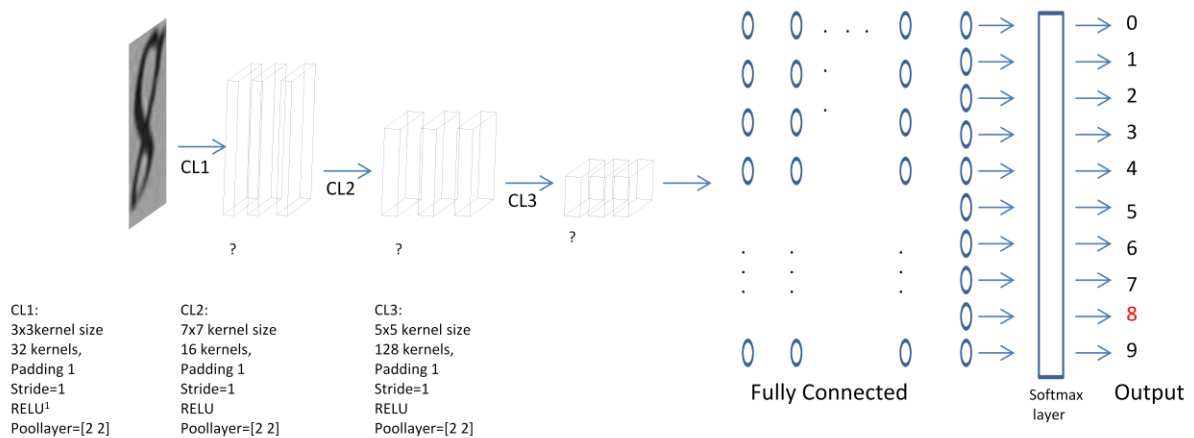
Question 2)

Convolutional Neural Networks (CNNs) are popular and powerful for different object classification and recognition on the given input images. Please find the number of inputs for Fully Connected Neural Network for the following questions:

- Let's assume that the input image size is 416x416x1 and the following information for CNN is given



b) Let's assume that the input image size is 128x128x1 and the following information for CNN is given



OPTIONAL Question 3) Use CNN algorithm to recognize different objects (aircraft, face and cell phone) on images. The training (50 image for each object) and testing data sets (totally 30 images) were provided in the folder. Based on the dataset, you construct your CNN algorithm with ONE CONVOLUTIONAL LAYER AND ONE FULLY CONNECTED LAYER (hidden layer has 1000 neurons and you can change the number of neurons and hidden layers). After that,

- First normalize the images.
- Train the CNN with the normalized grayscale images as input images for the CNN. Estimate the accuracy of the algorithm.
- Construct CNN with THREE CONVOLUTIONAL LAYERS AND TWO FULLY CONNECTED LAYERS (each hidden layer has 1000 neurons and you can change the number of neurons and hidden layers).

d) Construct CNN with FIVE CONVOLUTIONAL LAYERS AND FIVE FULLY CONNECTED LAYERS (each hidden layer has 1000 neurons and you can change the number of neurons and hidden layers).

e) Compare a and b and conclude your results.

IMPORTANT NOTE: You are free to use any parameter and parameter value (e.g. learning rate, kernel size, number of kernels, batch size, iteration etc.) for this question.

IMPORTANT

* The submission deadline of your results is **15th of April until 23:00**. You can solve questions manually or use any software programming language in PC.

*Please submit your document including **your answers (show how to solve the questions), explanation and your name** and **personal number** on the course webpage in Canvas.

* The outcome of your results will be **pass** or **fail**.

* Contact me (hku@bth.se) if you have any questions.