**Department of Computing & Informatics**

**CSC229 Machine Learning Algorithms and Programming**

Assignment – 17th March 2022

**TASK A:**

We have discussed about Artificial Neural Networks in class over the last 2 weeks. Write your own short notes on the following:

1. List at least 6 types of artificial neural networks. (for each of these write a small description and indicate the type of learning that each belongs to (i.e. supervised, unsupervised and reinforcement learning).
2. Radial Basis function neural network : It considers the distance of a point with respect to the center.
3. Feed-forward neural networks : This is where as data travels from input layers to output layers and the data may or may not contain hidden layers.It is supervised learning method.
4. Kohonen Self Organizing Neural network : It maps input vectors of arbitrary dimension to discrete map consisting of neurons.It’s unsupervised learning method.
5. Convolutional neural network : Almost as feed-forward and are mostly used in analysing visual imagery.The share their weights(parameters).It’s supervised learning technique.
6. Multilayer perception model : Has three or more layers and is used when data can’t be separated linearly . It’s a supervised learning technique.
7. Recurrent neural network : It’s based on prediction where the output of a particular layer is fed back as input. It’s a reinforcement learning method.
8. Review various sources about the backpropagation algorithm used in artificial neural networks and make your own notes.

Backpropagation is an algorithm that trains neural networks where weigihts are fine-tuned based on error rates obtained from the previous epoch. Proper weight tuning reduces the error rates making the model reliable by increasing its generalisation.

Three layers :

* Input layer
* Output layer
* Hidden layer

First inputs are added then modelled using real weights which are randomly selected. Output is calculated for every input layer to the hidden layers and finally the output layer. Error inputs are calculated through the formulae ERROR=ACTUAL OUTPUT -DESIRED OUTPUT. Then go back to the hidden layer adjusting the weights to reduce the error.Process is recurred till the desired output is obtained.

1. List 3 applications each in the sectors below:
2. Health

* Diagnosis of Diabetes.
* Medical image analysis.
* Radiology.

1. Agriculture

* Examining the impact of the variety and weather conditions on the concentration

of ferulic acid, deoxynivalenol, and nivalenol in winter wheat grain.

* Identify grain weivel in wheat kernels.
* Estimate the corn grain yield.

1. Finance

* Stock market prediction.
* Used by credit firms to evaluate loan applications.
* Credit card customers search.

1. Mobility (transport)

* Used in damage detection of vehicles.
* Used in the building of Transportation infrastructure management system.
* Used in creating of driving bots.

**Task B:**

**Instructions:** Use the Weka ML toolkit

Use the *MultilayerPerceptron* algorithm for a series of classification experiments using different network architectures and parameters. At the end of these experiments, make some conclusions. Use 10-fold cross validation for the testing. Use the diabetes and breast cancer datasets.

Find out how to change the number of layers and neurons. In addition, find out how to visualize the neural network. Use different number of layers and neurons, and observe the changes in accuracy.