**NPTEL – DEEP LEARNING**

**WEEK – 1**

1. Video 1 – Biological neurons – This video covers the discovery of brain and the cells in the brain. The name of the theory is “Reticular theory” and “Neuron Doctrine”. Term “Neuron” originated in 1891. Reticular theory (1871 - 1873) and Neuron Doctrine (1888 - 1891). Both got Nobel Prize in 1906.
2. Video 2 - From Spring to Winter of AI –
   1. MuCulloch(Neuro-Scientist) and Pitts (logician) proposed a model of neuron in 1943
   2. Frank Rosenblatt invented a new model called “Perceptron” in 1958.
   3. First generation Multilayer perceptron invented in 1965 - 1968
   4. In 1969, Minsky and Papert found the limitations of Perceptron.
   5. After 1969, people started losing interest in AI.
   6. 1986, Backpropagation algorithm was invented.
   7. Gradient Descent was discovered in 1847 by Cauchy.
   8. Universal Approximation theorem in 1989. Basically, it stated that neural networks can be used to solve all kinds of problems.
3. Video -3 – Deep Revival –
   1. 2006 – Unsupervised Pre-training. Discovery done by Hinton and Salakhutdinov.
   2. 2007 – 2009 - More strategies of training a deep neural networks.
   3. 2009 – Success in Handwriting recognition competition
   4. 2010 – Success in speech recognition
   5. 2010 – Success on MNIST Data
   6. 2010 – Started using GPUs to train a deep neural network.
   7. 2011 - Success in visual pattern recognition
   8. 2012 – 2016 - Success on ImageNet.
   9. AlexNet a CNN with 8 layers
   10. ZFNet with 8 layers
   11. VGGNet with 19 layers
   12. GoogleNet with 22 layers
   13. MS RES net with 152 layers – works better than humans in image recognition.
4. Video – 4 - From Cats to CNN
5. Video – 5 – Faster , higher and stronger-
   1. Finding better optimization algorithms and finding better accuracies.
   2. Faster convergence
   3. Adagrad, RMSProp, Adam – Optimization Algorithms
6. Video – 6 – The curious case of sequences –
   1. Time series, speech, music
   2. RNN and LSTM
   3. Vanishing gradient problem – difficult to train and RNN for a long sequence.
   4. LSTM is used to resolve the above problem of vanishing gradient problem.
7. Video – 7 – Beating humans at their own games.
   1. Playing Atari games using deep reinforcement learning algorithms
   2. Deepstack algorithm for poker
8. Video - 8 - Madness in 2013
   1. Language modeling could be done successfully using deep NN.
   2. Speech recognition
   3. Machine translations
   4. Conversation modeling
   5. Question answering system
   6. Computer vision/ Object detection or recognition
   7. Image Captioning
   8. Video Captioning
   9. Video and Text Summarization
   10. All the above use cases can be resolved using Deep Neural Networks.
9. Video – 9 – Need for sanity (Disadvantages of Neural Networks)
   1. Might be susceptible to over fitting.
   2. vanishing/exploding gradients
   3. Not very robust
10. Video -10 - Motivation from Biological Neurons
11. The most fundamental unit of deep learning is called an artificial neuron.
12. Video -10 - McCulloch Pits neuron , Thresholding logic

a. Implement AND , OR , NOT , XOR functions with help of McCulloch Pitts Neurons (MP Neuron)

1. MP Neurons can be used to represent Boolean functions which are linearly separable.
2. Video -12 - Perceptrons
3. Numerical weights were introduced for the inputs and a mechanism for learning these weights.