Seminar 7: Neural Networks Deep learning

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Neural Networks:

A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. In this sense, neural networks refer to systems of neurons, either organic or artificial in nature. Neural networks can adapt to changing input; so the network generates the best possible result without needing to redesign the output criteria [1]. The core idea of a neural network is to replicate the structure of the human brain. There are nodes that feed forward data, just like in the human brain. These systems learn by being exposed to datasets and example solutions without any task specific rule. Then these systems observe and analyse the data and try to generate their own conclusions and rules.

As you can see a neural network consists of an input layer, an output layer and some hidden layers. There may be many hidden layers and I will get to what a hidden layer is at the end of the document.

Deep Learning:

Deep learning is a branch of machine learning. Like neural networks, deep learning attempts to mimic how the human brain works. In deep learning we do not need to explicitly program everything as the aim is that the system will begin to learn and program itself [2].  There have been many advancements made in the world of deep learning and there will be many more as the processing power of computers continue to rise. Deep learning is extremely powerful as it is capable of working with extremely large amounts of data. As we know, this is extremely beneficial as the more data that a system can process the greater accuracy it will have, provided that overfitting does not occur.

Questions:

1. What is back propagation?

The algorithm responsible for calculating the gradient so as to minimise the cost of the neural      network [4].

1. What is the difference between supervised and unsupervised learning?

Supervised learning involves working with labelled data, providing an answer key to increase accuracy. On the other hand, unsupervised learning refers to learning where there are no labels and the system must detect features and patterns [5].

1. What are the different types of neural networks?

* Feedforward Neural Network – Artificial Neuron. ...
* Radial Basis Function Neural Network. ...
* Multilayer Perceptron. ...
* Convolutional Neural Network. ...
* Recurrent Neural Network(RNN) – Long Short Term Memory. ...
* Modular Neural Network [6].

1. What is a hidden layer?

In neural networks, a hidden layer is located between the input and output of the algorithm, in which the function applies weights to the inputs and directs them through an activation function as the output. In short, the hidden layers perform nonlinear transformations of the inputs entered into the network [8].

1. What is overfitting and underfitting?

Overfitting refers to a model that models the training data too well. This happens when the random fluctuations or noise is learned by the system but it cannot deal well with noise and random fluctuation from new datasets. Underfitting refers to a system that cannot model the train data nor any new datasets presented to it [7].

References:

[1] [https://www.investopedia.com/terms/n/neuralnetwork.asp#:~:text=A%20neural%20network%20is%20a,organic%20or%20artificial%20in%20nature (Links to an external site.)](https://www.investopedia.com/terms/n/neuralnetwork.asp#:~:text=A%20neural%20network%20is%20a,organic%20or%20artificial%20in%20nature).

[2] [https://www.geeksforgeeks.org/introduction-deep-learning/ (Links to an external site.)](https://www.geeksforgeeks.org/introduction-deep-learning/)

[3] [https://www.geeksforgeeks.org/neural-networks-a-beginners-guide/ (Links to an external site.)](https://www.geeksforgeeks.org/neural-networks-a-beginners-guide/)

[4][What is backpropagation really doing? | Deep learning, chapter 3 (Links to an external site.)](https://www.youtube.com/watch?v=Ilg3gGewQ5U&t=112s)[](https://www.youtube.com/watch?v=Ilg3gGewQ5U&t=112s)

[5] [https://blogs.nvidia.com/blog/2018/08/02/supervised-unsupervised-learning/#:~:text=In%20a%20supervised%20learning%20model,and%20patterns%20on%20its%20own (Links to an external site.)](https://blogs.nvidia.com/blog/2018/08/02/supervised-unsupervised-learning/#:~:text=In%20a%20supervised%20learning%20model,and%20patterns%20on%20its%20own).

[6] [https://www.digitalvidya.com/blog/types-of-neural-networks/ (Links to an external site.)](https://www.digitalvidya.com/blog/types-of-neural-networks/)

[7] [https://machinelearningmastery.com/overfitting-and-underfitting-with-machine-learning-algorithms/ (Links to an external site.)](https://machinelearningmastery.com/overfitting-and-underfitting-with-machine-learning-algorithms/)

[8] <https://deepai.org/machine-learning-glossary-and-terms/hidden-layer-machine-learning#:~:text=In%20neural%20networks%2C%20a%20hidden,inputs%20entered%20into%20the%20network>