CIS – 490: Machine Learning

Learning Activity 4

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1. Describe the major concept difference between traditional neural network and deep learning.

Ans. Both neural networks and deep learning are machine learning models and deep learning is a machine learning model based on neural networks itself. The major difference between the two is the number of layers that are used to make up the network.

A traditional neural network may contain 3-4 layers while a deep learning network may contain hundreds of layers.

1. What are typical applications of deep learning?

Ans. Deep Learning models learn to perform classification directly from images, sounds or text. It has applications in:

Face recognition

Image analysis

Driver assistance systems

Video analysis

1. What make Deep learning state of the Art?

Ans. The high degree of accuracy achieved by deep learning models make it state of the art. Deep Learning achieves accuracy at a rate higher than ever before, making it useful various important industries. It performs even better than humans in some cases.

1. What are the three technology enablers make this degree of accuracy possible for deep learning?

Ans. There are three technology enablers that have made this degree of accuracy possible for deep learning methods:

1. Availability and easy access to massive, labelled datasets
2. Increased computing power through GPU’s along with cloud computing.
3. A variety of pretrained models created by experts such as AlexNet.

Previously, these enablers were not present. This is one reason why despite being theorized in the 1980’s, it is only recently that deep learning models have become more ubiquitous.

1. Describe Deep neural network structure.

Ans. The structure of a deep neural network has been inspired by and modelled after the biological nervous system. It is made up of multiple nonlinear processing layers.

It consists of an input layer, multiple hidden layers and an output layer. Each layer is interconnected via nodes and each hidden layer uses the output of a previous layer as its input.

The models learn from vast sets of labelled datasets, and they learn features directly from the dataset without the need for manual feature extraction.

1. Describe coevolutionary neural network (CNN) structure, the three types of operations of its Feature Detection Layers, and classification layers.

Ans. A convolutional neural network (CNN) convolves learned features with input data, and uses 2D convolutional layers, making it well suited to processing 2D data.

The three operations that its Feature Detection Layers perform are:

1. Convolution: It passes the images through a set of convolutional filters, activating certain features from the images.
2. Pooling: It simplifies the output by reducing the number of parameters the network needs to learn about by performing nonlinear downsampling.
3. Rectified Linear Unit (RLU): It maps negative values to 0 while keeping the positive values., hence allowing for more effective training.

Each operation is performed over hundreds of layers with each layer increasing the complexity of the learned image features.

After the hidden layers learn about the features of the data, the network works to classify the data.

The second to last layer is a fully connected layer which outputs a vector of K dimensions, where K is the number of classes the network can predict. This vector contains the probabilities for each class for a given data item.

The last layer uses a softmax function to output the classification output.

1. What is AlexNet?

Ans. AlexNet is deep learning network model that was first published in 2012 and has since become a well-known model in the research community. It is model for classifying images. It can classify images into over 100 categories including cats, dogs, pencils etc.

1. How many layers does CheXNet have? How many images are used for training, validation and test, respectively? What are main contributions of CheXNet?

Ans. CheXNet contains 121 convolutional layers in a CNN. 98637 images were used for the training dataset, 6351 for the validation set and 420 images for the test set.

Pneumonia constitutes a large proportion of patient mortality and is difficult to detect for people without the means and access to a radiologist. With CheXNet, researchers have developed an algorithm that detects pneumonia from frontal view chest X-ray images. Their performance exceeds even those of practicing radiologists.

With such a high level of automation, CheXNet might be able to provide access to expertise in medical imaging where radiologists are hard to reach.

REFERENCES:

1. https://www.mathworks.com/discovery/deep-learning.html