Neural Networks has had a long history and a large amount of research is going on since 1940. It has undergone many changes since the first proposal which is a single-layered neural perceptron in 1957. It is inspired by biological neurons in the brain and it is a mere linear model, which caused a backlash. During the 1980s inspired by cognitive science, people found that a large number of simple computational units networked together can achieve intelligent behavior. In this period backpropagation got introduced which is being used even in modern deep neural networks, and proposed architectures which are inspiring but people soon lost interest due to lack of computational resources and advancement in the field of Machine learning. Since 2006 there is much hype in Deep Learning, and Introduction of AlexNet in 2012 which won the IMAGENET competition by a huge margin has decreased the Top-5 error rate from 26.1% to 15.3%, garnered much attention in the field of computer vision and shifted much of research from classical computer vision.

Advancement in the field of deep learning is mainly due to modern trends in hardware, faster network connectivity, large datasets, large-scale distributed computing, and more importantly complex architectures. These things have improved the accuracy many times compared to previous methods which used machine learning and hand designed features.

Firstly, faster CPU and adjunct of GPU made deep neural networks training possible and this is the main reason for the success of the Neural networks. GPU's are specially built for performing mathematical computations with thousands of cores compared to few tens of cores in CPU's. Apart from GPU's, fast networks, Memory and distributed computing has allowed to train huge architectures with a large amount of data efficiently.

Secondly, an increase in the dataset size also played a key role. Algorithms reaching human performance on complex tasks today were similar to algorithms struggled to solve toy-problems in the 1980s, though the model we train has changed. As of 2016, a rough rule of thumb is that a supervised learning example can give an acceptable performance with 5000 labeled examples and exceeds human performance with 10 Million labeled examples. Research is still going on to get better results with smaller datasets and a large quantity of unlabeled data for supervised or unsupervised learning.

Thirdly, improvements in architecture and advancements in algorithms have had also played a key part. We can observe that the networks have become complex both in object classification as well as detection tasks. Notably, the number of layers has increased in VGG, connections became complex in GoogleNet and ResNet, the introduction of new layers like Dropout, Batch Normalization, and Deconvolution layer. Apart from those in classification, detection networks also evolved from using proposals from other algorithms to generating proposals by RPN in Faster R-CNN and totally elimination proposals in YOLO and SSD. When it comes to training algorithms Backpropagation and Stochastic Gradient Decent remained untouched. SGD remained as the backbone of deep neural networks, but many variants were developed which gave better results like SGD with momentum, RMSprop, AdaGrad, and ADAM. Now ADAM is most popular algorithms which used adaptive moments and learning rate.

Deep learning has seen tremendous growth in recent years in its popularity and usefulness. The years ahead are full of challenges and opportunities to improve deep learning even further.

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