Deep Neural Network

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***Abstract*—Deep learning is part of a broader family of machine learning methods based on learning representations of data. Various deep learning architectures such as deep neural networks, convolutional deep neural networks, deep belief networks and recurrent neural networks have been applied to fields like computer vision, automatic speech recognition, natural language processing, audio recognition and bioinformatics where they have been shown to produce state-of-the-art results on various tasks. This report is a summary of the implementation of DNN on a database of flowers.**

Keywords: Deep learning, Convolutional Neural Network (CNN)

I. Introduction

A neural network in which the number of node layers through which data passes are more than 3 (including input and output) is qualified as deep neural network.

In deep-learning network, each layer of nodes trains on a distinct set of features based on the previous layers output. The further you advance into the neural net, the more complex the features your nodes can recognize, since they aggregate and recombine features from the previous layer.

II. Transfer Learning

In the context of machine learning, given a good objective and training, we can reuse parts of a model trained in one domain to solve problems in different domains. This is called transfer learning.

In practice, we dont usually train an entire DCNN from scratch with random initialization. This is because it is relatively rare to have a dataset of sufficient size that is required for the depth of network required. Instead, it is common to pre-train a DCNN on a very large dataset and then use the trained DCNN weights either as an initialization or a fixed feature extractor for the task of interest.

III. Terminologies

Training accuracy:

The training accuracy shows the percentage of the images used in the current training batch that were labeled with the correct class.

Validation accuracy:

The validation accuracy is the precision (percentage of correctly-labelled images) on a randomly-selected group of images from a different set. Lower the validation accuracy, less general the network will be.

Cross entropy:

Cross entropy is a loss function that gives a glimpse into how well the learning process is progressing.

Softmax function:

Softmax function is used for multiclass classification, so it is the extension of logistic regression which is used in multinomial logistic regression.

IV. Advantages and Disadvantages of DNN

Advantages:

- Significantly outperforms other solutions in domains like speech, language, vision, playing games like Go etc.
- Reduces the need for feature engineering, one of the most time-consuming parts of machine learning practice.

Disadvantages:

- Requires a large amount of data.
- Is computationally very expensive to train.
- Does not have strong theoretical foundation.
- What is learned is not easy to comprehend. Other classifiers (e.g. decision trees, logistic regression etc) make it much easier to understand whats going on.

V. Results

DNN was implemented using TensorFlow on a database of flowers. Following are the results. Columns represent number of iterations while rows represent a particular image. The values in cells represent the accuracy of an image in that row.

Flower/No. of Iterations	200	500	2000
Daisy	73.7	80.9	89.2
Daisy2	96.7	98.3	99.2
Rose	83	93.1	98.2
Rose2	97.4	99.3	99.9
Tulip	72	81.4	90

References

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