IMAGE CLASSIFICATION USING SELF-TAUGHT LEARNING FOR FEATURE DISCOVERY

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ABSTRACT
Deep Learning has produced results which match the benchmark results in many object classification tasks. Deep Belief Networks are a class of deep neural networks, composed of numerous hidden layers with connections across layers and no connections between neurons in the same layer. Convolutional deep belief networks (CDBNs) with probabilistic max pooling provide a translational invariant hierarchical generative model supporting both top-down and bottom-up inference. The advantages of CDBNs are used for image classification using a new semi-supervised technique called Self-Taught Learning. In our project, we experiment with CDBNs for classification of Caltech 101 dataset.

INTRODUCTION
• Convolutional Neural Networks are known for their ability to exploit the 2-D nature of images in contrast to neural networks and Deep Belief Networks make use of pre-training phase to improve results while classification.
• Convolutional deep belief networks combine the positives of both the state of the art models to get even better performance. Probabilistic max pooling provides a translational invariant hierarchical generative model supporting both top-down and bottom-up inference.
• Raina et al. proposed the concept of Self-Taught Learning in 2007.
  - Labelled data—generally difficult to obtain
  - Unlabelled data—abundant and cheap
• Self-Taught Learning makes use of unlabelled data to learn a generic representation of images using Sparse coding which can be later used to learn features from the labelled images.

CONVOLUTIONAL DEEP BELIEF NETWORK
Multiple layers of CRIBMs

ALGORITHM
Using only labeled data
1. Train CDBN on labeled dataset
2. Use learnt weights to extract features
3. Classify using SVM (linear kernel).

Self-Taught learning
1. Train CDBN on unlabeled dataset of natural images
2. Use learnt weights to extract features from labeled dataset
3. Classify using SVM

DATASET
ImageNet (NIH) Natural Objects Dataset as source of unlabeled data
- Cropped to Uniform Size 150X200
Caltech 101(10) dataset for labeled images - 5 objects
- Elephant
- Leopard
- Car
- Motorbike
- Airplane
30 images were used as labeled images of each class
- 20 were used for training
- 10 were used for testing

RESULTS

ACCURACY

CONCLUSIONS
• Self-Taught Learning is a very effective technique when the size of labeled datasets is very small
• Convolutional Deep Belief Networks are known for learning very good/hierarchical representations of inputs at different levels
• The complexity of implementing CDBNs is high, and generally different implementations end up producing different results
• There are a lot of hyper parameters which need to be initialized and can play an influencing role in the results

REFERENCES
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