GPU Accelerated Deep Convolutional Neural Network for Face Recognition

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Introduction

With its crucial social and cultural implication, lots of literatures have studied the techniques of face recognition. However, there is still a big gap between conventional descriptors-based face recognition system and human visual system.

In recent years, the availability of large volume of training data sets and increasing computational resources enable the booming of learning-based face recognition methods. Among them, Convolutional Neural Network (CNN) has significantly improved the performance of face recognition. CNN is a type of feed-forward neural network where each layers of neurons execute a convolution of the input data with a collection of filters. Deep CNN is CNN with more layers, in which each layer encodes progress from low-level details to high-level concepts. This yields a rich, hierarchical representation of the perceptual problem. As a result, the depth brings abstraction and invariance thus improves the recognition performance but also needs exponentially more computation for training. The intensive computation requirement of deep CNN as well as its underlying intuition of decomposition make it suitable for being accelerated using GPU.

Approach

I will follow the referenced paper[1] to achieve face recognition, the steps include data collection, CNN architecture definition, CNN training and parameter tuning. Since the focus of this project is GPU acceleration, I will implement my own version of cuda code that carries out the CNN computation on GPU, and compare the performance with the existing libraries(cuDNN etc). All the computation will be implemented under the framework of Caffe, which is a open-source framework for deep learning. In Caffe, the code for a deep model follows its layered and compositional structure for modularity. The Net has Layers, and the computations of the Net are delegated to the Layers. All deep model computations are framed as layer types like convolution, pooling, nonlinearities, and so on. My work will be writing CUDA code to implement the computation for different layers.

Goals

1. Implement CNN related computation using CUDA under Caffe framework.
2. Train a deep CNN with large scale data and achieve face recognition.
3. Compare the performance with existing methods.

References

[1]Parkhi, Omkar M., Andrea Vedaldi, and Andrew Zisserman. "Deep face recognition." *Proceedings of the British Machine Vision* (2015).

[2]Evan Shelhamer, Deep Learning for Computer Vision with Caffe and cuDNN, http://devblogs.nvidia.com/parallelforall/deep-learning-computer-vision-caffe-cudnn/