Feedback Deep Neural Network for Image Recognition

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Abstract

Deep convolutional neural networks have been proven to be a very powerful method in computer vision. In this paper, we will briefly introduce the background of feedbacks in the human visual cortex, which motivates us to develop a computational feedback mechanism in the deep neural networks in the past several weeks. The feedback philosophy helps us to visualize the neural network and understand deeper on how deep neural network works, especially for the deep convolutional neural networks. The feedback framework is also extended to re-train the neural networks to better explore the properties of the natural images to avoid overfitting as well as improve the image recognition accuracy. We show will discuss the plans on future improving the feedback neural network architectures.

1. Introduction

- Deep Convolutional Neural Networks
- Feedback Neural Networks
- Benefit of Feedbacks
- Main Contribution
- Paper organization

2. Related Work

- Visualizing and Understanding Neural Network
- An Intriguing Property of Neural Networks
- Neural Networks for Localization
- Neural Networks for Multi-task Learning
- Deep Boltzman Machine (DBM)
- Deformable Part Based Models (DPM)

3. Feedback Neural Network

3.1. Deconvolutional Neural Networks

- Fully Connected Layer
- Max Pooling Layer
- Convolutional Layer
- Rectified Linear Layer
- General Layer

3.2. The feedback model

3.3. Inference with Feedback

- Discrete activiation hidden variables
- Continuous acitivation hidden variables
- Iterativ Method for Inference

3.4. Training with Feedback

- EM for discrete activiation hidden variables
- EM for continuous acitviation hidden variables

4. Experiments

4.1. Dataset

4.2. Experiment Details

- Only set feedback on RELU layer
- Train multi-class feedback model with hidden variable sharing

4.3. Visualization of feedbacks

A figure shows Feedback vs No-Feedback visualization on fc8

Key story: Feedback surpress noise and extract salient part region and contexts

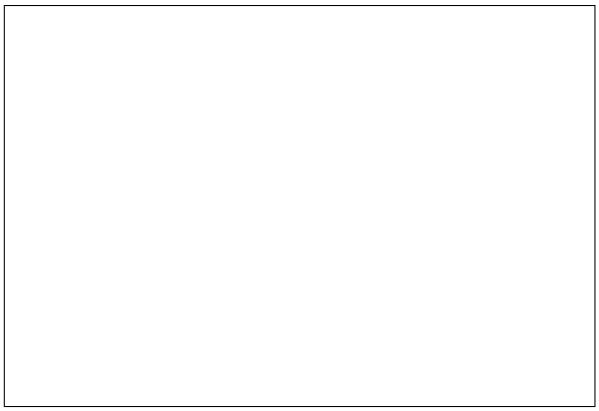

Figure 1. Example of caption. It is set in Roman so that mathematics (always set in Roman: $B \sin A = A \sin B$) may be included without an ugly clash.

4.4. Where to Add Feedback

A figure shows Feedback vs No-Feedback visualization on conv5 etc.

Key story: 1. Not all layers need feedback 2. Feedback surpress noisefor high level layers

4.5. Are the Activation Similar for different classes

A figure shows Feedback visualization on fc8 for different classes

Key story: 1. Feedbacks are different for different classes in the same image. 2. Some similar classes share similar feedbacks

4.6. Are feedback helpful for recognition?

4.7. Are feedback useful for localization

A figure shows Feedback visualization for different object classes for the same image (a little similar to above)

4.8. Are feedback robust to noise

A figure shows Feedback visualization for an image producing a different class label than ground truth (similar as the ïntriguing propertyp̈aper)

4.9. How iterative update changes visualization

A figure shows the visualization with update iteration

4.10. Are feedback helpful for multi-task learning?

References