



Zürich, July 15, 2020

MSc Basic Module

Title: Implementing deconvolution to visualize and understand Convolutional Neural Networks

Convolutional Neural Networks (CNN) models achieve state-of-the-art performances in many computer vision tasks such as image classifications, object detection and face recognition. However, the reason why CNN models perform well is an open issue.

Zeiler and Fergus [2] propose a method that uses the deconvolution process to discover and visualize the features that contribute to the classification performance. Feature maps are the result of convolutional layers and the features can be traced back to pixels of the input images. The deconvolution process consists of deconv, unrelu and unpooling operations that map features back to pixels, which is the opposite of convolutional networks.

The goal of this Master Basic Module is to implement and describe the deconvolution process proposed by Zeiler and Fergus [2].

Tasks:

1. Study the work of Zeiler and Fergus [2] and implement the proposed method in Python. The implementation should include:
 - (a) convolution, relu, pooling components
 - (b) deconv, unrelu, unpooling components
2. Demonstrate and explain the classifications of the provided dataset
3. Compare your solution with the PyTorch implementation [1]
4. Describe your work in a technical report. The report should include a running example that demonstrates all the core components and include sample code fragments.



References

- [1] <https://github.com/huybery/VisualizingCNN>. (visited on 12 July, 2020).
- [2] M. D. Zeiler and R. Fergus. Visualizing and understanding convolutional networks. In *13th European conference on computer vision, ECCV 2014, Zurich, Switzerland, September 6-12, 2014*, pages 818–833, 2014.

Supervisor: Qing Chen (qing@ifi.uzh.ch)

Start date: 13.07.2020

End date: 15.08.2020

Oral exam date: 18.08.2020, 4pm

University of Zurich
Department of Informatics

A handwritten signature in black ink, appearing to read 'Michael Böhlen'.

Prof. Dr. Michael Böhlen
Professor