Proposal for Deep Learning in Computer Vision Practical Course

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1 Motivation

Deep learning is a quickly evolving field that has already beaten many previous state-of-the-art results in machine learning tasks such as image classification, object detection, speech recognition, document classification and more. To understand deep learning it is not only necessary to learn the theoretical foundations and ideas but also to get hands on experience with novel architectures, software frameworks and datasets. Therefore, the *Deep Learning in Computer Vision* practical course offers a perfect opportunity to gain firsthand experience and apply what we have learned so far. Furthermore, its focus on understanding deep networks instead of merely chasing benchmarks makes this course especially exciting, since robustness and reliability of computer vision applications will play an important role in future research.

2 Prior Experience

The following quickly summarizes our prior experience in the field of deep learning:

Dominik Straub

- Deep Learning: Architectures and Methods course (TU Darmstadt), including practical project *Natural Image Statistics and Autoencoders*
- Applied Cognitive Modeling course (TU Darmstadt): implemented a version of *Bayesian Conditional Density Estimation* [1] in PyTorch

Fabian XYZ

Steven Lang

- Deep Learning on Visual Data course (JGU Mainz), including practical project *Deep Feature Interpolation* [2] implemented in TensorFlow [1]
- Integration of Deeplearning4j into the Weka software [2]

3 Favored Topics and Motivation

Priority 1: Sample Free Bayesian SegNets Bayesian approaches in deep learning are currently under investigated and are not included in classical deep learning introduction literature, which makes it a good topic to dive into.

Priority 2: Using Atrous convolutions for monocular depth estimation TODO: Add Motivation

References

[1] George Papamakarios and Iain Murray. Fast *epsilon*-free Inference of Simulation Models with Bayesian Conditional Density Estimation. 2016. http://arxiv.org/abs/1605.06376.

[2] Paul Upchurch, Jacob R. Gardner, Kavita Bala, Robert Pless, Noah Snavely, and Kilian Q. Weinberger. Deep feature interpolation for image content changes. *CoRR*, abs/1611.05507, 2016.

[1] `https://github.com/steven-lang/dfi-tensorflow`
[2] `https://github.com/Waikato/wekaDeeplearning4j`