

Master thesis

Learning Device-Invariant Representations for IR-Spectra

Our team, our mission:

We are a young and interdisciplinary team that forms the interface between research and industry through a variety of different projects around the promising topic of sensor technology. A major research topic over the last years has been placed on the application of different machine learning techniques to the different challenges in chemical sensing and trace gas analysis. What sets us apart is the ability to do research on the full system – from simulation to system design and development to actual testing in our laboratory.

Our offices and the lab are located in the Tech Base, which was newly built in 2016 - directly opposite the Faculty of Mechanical Engineering at the OTH Regensburg.

Topic:

Recent improvements in unsupervised representation learning have enabled computer vision models to learn impressive classification skills with just very few labeled examples. Those models have been pretrained to learn highly expressive representations from unlabeled examples using contrastive loss.¹ The simple approach, to have similar representations for similar images goes a long way.

In infra-red spectroscopy cross device differences often lead to highly expensive calibration procedures for each device. Many different scaling and normalization approaches have been invented to cope with the problem of cross device measurement differences. Learning representations which are invariant to the device used to collect this specific sample yields high value for many industry projects.

In this thesis you will explore the literature on unsupervised representation learning and contrastive loss as one of those techniques. You will implement and evaluate it on an infra-red spectroscopy dataset and compare it to other approaches.

Prerequisites:

- Master student in the field of informatics or machine learning
- Inscribed at OTH Regensburg or TU Munich
- Some knowledge in machine learning, statistics and neural networks
- Programming experience in python
- Interest in the application of machine learning techniques in the real world

The thesis can be done at TU Munich (Faculty of Informatics or Physics) or the OTH Regensburg. The work can be done remotely or on site.

Please send your application and questions to:

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¹ Chen, T., Kornblith, S., Norouzi, M., & Hinton, G. (2020, November). A simple framework for contrastive learning of visual representations. In *International conference on machine learning* (pp. 1597-1607). PMLR.