テンソル学習ユニット
Tensor Learning Unit

趙 啓斌
Qibin Zhao

Outline

Objectives

- Study the underlying principle of tensor methods
- Develop the advanced machine learning technology using tensor representation and decomposition
- Explore the potential applications of tensor methods

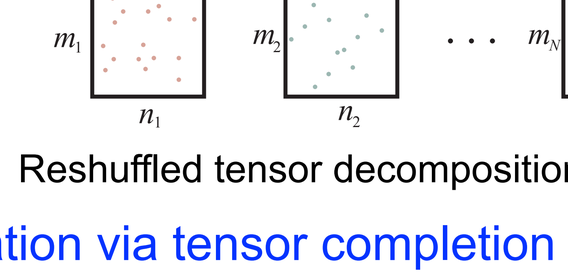
Members

- Postdoc researcher (2), Part-timer (2)
- Visiting researcher (4)
- Student intern (4)

Tensor Networks for Data Representation

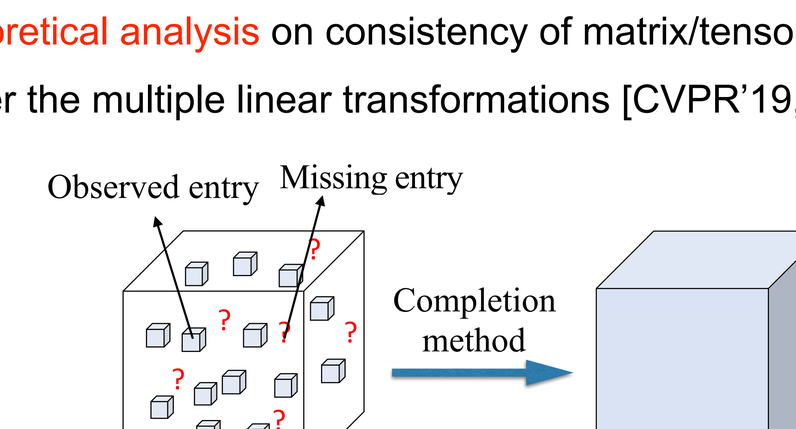
Tensor decomposition model, theory and algorithm

- Tensor ring decomposition model for high-dimensional data with an efficient and compact representation [ICASSP'19]



Tensor ring decomposition

- Scalable tensor ring algorithms for large-scale data using the sketching trick [ICASSP'19]
- Reshuffled tensor decomposition for exact recovery of latent components with theoretical guarantee



Reshuffled tensor decomposition

Data imputation via tensor completion

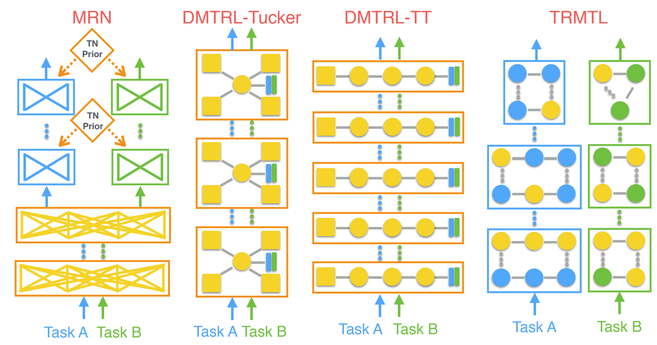
- Improve generalization ability of the missing value prediction for a high-order tensor by imposing the proper regularizer on the latent cores [AAAI'19]
- Scalable algorithms based on tensor ring model for large-scale data imputation using SGD optimization
- Theoretical analysis on consistency of matrix/tensor completion under the multiple linear transformations [CVPR'19, Oral]

Tensor completion

Tensor Networks for Model Representation

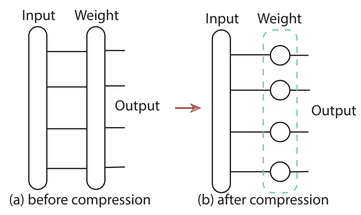
Deep multi-task learning with heterogenous networks via tensor ring network

- Multiple sources/modalities of data
- Heterogenous network structure for each individual task
- Flexible information sharing mechanism



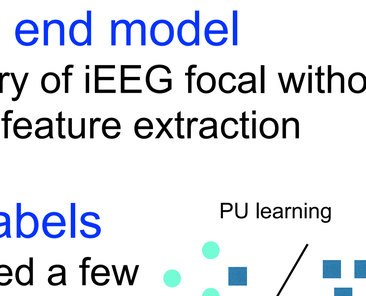
Compression of model parameters by random shuffling low-rank representation [ICASSP'19]

- Discover that convolutional kernels can be compressed by randomly-shuffled low-rank representation without significant performance loss.



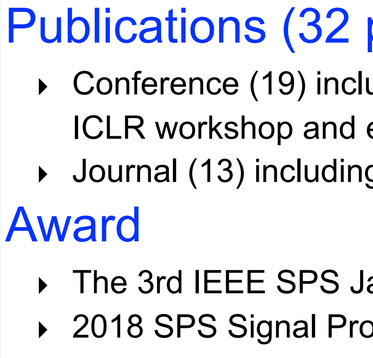
Positive-unlabelled learning with generative adversarial networks [IJCAI'18]

- Integration of multiple deep generative models based on GAN to perform PU learning, which requires less labelled positive data



AI Support for Epileptic Diagnosis

Mission: Automatic localization of epileptic focal from iEEG signals as a support technology for doctors



Situation: Doctors diagnose epilepsy by visual judgment based on iEEG.

順天堂

- **High accuracy**
  Entropies of different frequency bands for feature extraction and CNN for classification
- **End to end model**
  Discovery of iEEG focal without handcraft feature extraction
- **Less labels**
  Only need a few labelled data by PU learning

EPILEPSYAI JST CREST

Future work: reliability and universality

Achievements in FY2018

Publications (32 papers)

- Conference (19) including AAAI, IJCAI, CVPR, ICASSP, NeurIPS Workshop, ICLR workshop and etc
- Journal (13) including IEEE TNNLS, Signal Processing and etc

Award

- The 3rd IEEE SPS Japan Best Paper Award
- 2018 SPS Signal Processing Magazine Best Paper