Schedule, Titles and Abstracts

Zoom ID: 963 7376 5258
Password: 260765

Beijing GMT+8 (UK GMT+1)	Speaker	Title
15:30-16:20 (8:30--9:20am)	Bin Dong (PKU)	Data- and Task-Driven CT Imaging by Deep Learning
16:20--17:10 (9:20--10:10am)	Harold Oberhauser (Oxford)	Nonlinear Independent Component Analysis with Signature Cumulants
17:10--18:00 (10:10-11:00am)	Shujian Liao (UCL)	Learning SDEs using RNN with log-signature features
18-:00-19:30 (11:00am -- 12:30pm)	Dinner/Lunch break	
19:30--20:20 (12:30--13:20)	Chenglong Bao (Tsinghua)	Unsupervised deep learning for image denoising and segmentation: beyond Gaussian likelihood
20:20--21:10 (13:20--14:10)	Kevin Schlegel (UCL)	Signature methodology in the real world
21:10--22:00 (14:10--15:00)	Xin Zhang (SCUT)	Infant Cognitive Scores Prediction based on Path Signature Features of Longitudinal Structural MRI Data

Abstracts:

Chenglong Bao

Title: Unsupervised deep learning for image denoising and segmentation: beyond Gaussian likelihood

Abstract: Deep neural networks have obtained remarkable results in image processing. However, its success requires a large number of high quality training samples. In this talk, we will discuss an unsupervised approach that exploits the advantages of deep neural networks and traditional model-based approaches. This approach requires no training samples except the input image and does not need pretraining. Extensive experiments on real image have validated the advantages of the proposed method.

Bin Dong

Title: Data- and Task-Driven CT Imaging by Deep Learning

Abstract: In this talk, I will start with a brief review of the dynamics and optimal control perspective on deep learning (including supervised learning, reinforcement learning, and meta-learning). Then, I will present some of our recent studies on how this perspective may help us to advance CT imaging and image-based diagnosis further. Specifically, I will focus on our thoughts on how to combine the wisdom from mathematical modeling with ideas from deep learning. Such combination leads to new data-driven/task-driven image reconstruction models and new data-driven scanning strategies for CT imaging, and with a potential to be generalized to other imaging modalities.

Shujian Liao

Title: Learning SDEs using RNN with log-signature features

Abstract: Learning a function of streamed data through evaluation is an important question in many scientific areas. The difficulty comes from the high frequency of the driven stream. Motivated by the numerical approximation theory of the stochastic differential equations, we introduce a novel approach (Logsig-RNN) combining the log-signature as representations of streamed data and the recurrent neural network (RNN). The ability of the former is to manage high-frequency streams and extract spatial-temporal features efficiently. By testing on various datasets, i.e. synthetic data, NTU RGB+D 120 action data and Chalearn 2013 gesture data, we show our proposed approach achieved competitive accuracy with high efficiency and robustness.

Harold Oberhauser

Title: Nonlinear Independent Component Analysis with Signature Cumulants

Abstract: A classical inference problem is to recover a multidimensional source process with independent coordinates from a transformation of this process. We study the case when this transformation is non-linear and use so-called signature cumulants as contrast function for deep neural networks. Joint works with Patric Bonnier and Alexander Schell.

Kevin Schlegel

Title: Signature methodology in the real world

Abstract: In this talk I will discuss an application of path signature feature methodology for human action recognition to the problem of health and safety in public places. This talk will largely be concerned about some of the challenges one may face when applying signature methods to complex real world problems. I will be giving an overview of the whole process from preparing and curating the data to final results on the example of recognizing unsafe behaviours of people on escalators. Along the way I will highlight various challenges and questions arising from the process.

Xin Zhang

Title: Infant Cognitive Scores Prediction based on Path Signature Features of Longitudinal Structural MRI Data

Abstract: Path signature has unique advantages on extracting high order differential features of sequential data. Our team has been studying the path signature theory and actively applied it to various applications, including infant cognitive score prediction, human motion recognition, hand-written character recognition, hand-written text line recognition and writer identification etc. In this talk, I will share our most recent works on infant cognitive score prediction using learnable path signature features and simple deep learning models. The cognitive score can reveal individual's abilities on intelligence, motion, language abilities. Recent research discovered that the cognitive ability is closely related with individual's cortical structure and its development. We have proposed two frameworks to predict the cognitive score with different path signature features. For the first framework, we construct the temporal path signature along the age growth and extract signature features from longitudinal structural MRI data. By incorporating the cortical temporal path signature into the multi-stream deep learning model, the individual cognitive score can be predicted, even with missing data issues. For the second framework, we propose the learnable path signature algorithm to compute the developmental feature. Further, we obtain the brain region-wise development graph for the first two-year infant. Then we have employed the graph convolutional network for the score prediction. These two frameworks have been tested on two in-house cognitive data sets and reached the state-of-the-art results.