NTU-Kobe Joint Workshop on Data Science

November 23, 2017
Z201-202, Graduate School of Science, Kobe University

PROGRAM

November 23 (Thursday)

9:30– 9:40	**Masa-Hiko Saito** (Kobe University, Japan), **Ling San** (Nanyang Technological University, Singapore) Opening speeches
9:40–10:20	**Cai Jianfei** (Nanyang Technological University, Singapore) Learning-based 3D Visual Recognition and Reconstruction
10:20–11:00	**Seiichi Ozawa** (Kobe University, Japan) Recent Challenges to Cybersecurity and Privacy-Preserving Data Mining Using Machine Learning
11:10–11:50	**Lin Guosheng** (Nanyang Technological University, Singapore) Learning Deep Convolutional Networks for Visual Scene Understanding
11:50–12:40	**Lunch**
12:40–13:20	**Ryo Nishide** (Kobe University, Japan) Extracting Breeding Cows from Monitored Camera Image Data
13:20–14:00	**Bei Xiaohui** (Nanyang Technological University, Singapore) Learning Market Parameters using Aggregate Demand Queries
14:00–14:20	**Coffee Break**
14:20–15:00	**Tetsuya Takiguchi** (Kobe University, Japan) Voice Conversion Based on Non-negative Matrix Factorization
15:00–15:40	**Patrick Pun Chi Seng** (Nanyang Technological University, Singapore) High-Dimensional Portfolio Selection with DECODE
15:50–16:30	**Tsutomu Terada** (Kobe University, Japan) Wearable Sensing and Information Presentation Considering Psychological Effects
16:30–16:40	**Lam Khin Yong** (Nanyang Technological University, Singapore) Closing speech

Organizers

- Ling San, Chee Yeow Meng (Nanyang Technological University, Singapore)
- Masa-Hiko Saito, Seiichi Ozawa (Kobe University)

Supported by
Nanyang Technological University, Singapore and Kobe University, Japan

Abstracts

Cai Jianfei (Nanyang Technological University, Singapore)

Learning-based 3D Visual Recognition and Reconstruction

With the great success of applying deep learning in image classification, object detection and semantic segmentation, deep learning has also been applied for 3D visual recognition and computing. However, unlike 2D images, learning-based 3D visual computing has its unique challenges such as diverse data formats, distinct data modality, large data volume and lack of large-scale well-labelled data. In this talk, I will introduce some of our recent works on learning-based 3D visual computing including multi-model feature fusion frameworks for RGB-D object recognition, RGB-D scene classification and our very recent work on learning based 3D face reconstruction.

Seiichi Ozawa (Kobe University, Japan)

Recent Challenges to Cybersecurity and Privacy-Preserving Data Mining Using Machine Learning

This presentation gives a brief introduction to our machine learning approaches to cybersecurity and privacy-preserving data mining (PPDM). A mission of our current cybersecurity projects is to construct a large-scale monitoring system to detect cyberattacks on the Internet through Darknet Traffic Analysis, and to construct an AI crawling system to monitor cybersecurity products dark marketplaces on the Tor hidden service. I briefly show an interesting observation of the darknet traffic before the source code of a notorious IoT malware called 'Mirai' was first opened in September 2016. In our darknet analysis, the frequent pattern mining was performed to a large set of TCP SYN packets collected from July 1st 2016 to September 30th 2016 with the NICT /16 darknet sensor. On the other hand, the purpose of our PPDDM project is to provide a secure cloud outsourcing platform for client users who requests an analysist to sensitive data including privacy information. Currently, we are developing a Privacy Preserving Extreme Learning Machine (PP-ELM) using additively homomorphic encryption, which supports summation on encrypted data. In order to handle the learning over encrypted data efficiently, we propose a three participants model as an implementation of PP-ELM; data contributors, an outsourced server, and a data analyst. We show a simple experimental result using a relatively small benchmark dataset for the performance evaluation.

Lin Guosheng (Nanyang Technological University, Singapore)

Learning Deep Convolutional Networks for Visual Scene Understanding

Automated understanding and analyzing the content of scene images and videos is a fundamental and challenging problem for computer vision research, which is the essential component in many emerging applications including intelligent video surveillance, autonomous robots or vehicles, content based image retrieval, aerial image analysis in remote sensing, just to name a few. Recently deep Convolutional Neural Nets (CNNs) have demonstrated outstanding performance in semantic segmentation which is a core task towards visual scene understanding. In this talk, I will present our recent CNN based methods for accurate semantic segmentation. We exploit representations at multiple levels of abstraction for high-resolution output and employ residual connections with identity mappings for all network components, such that gradients can be directly propagated through short-range and long-range residual connections allowing for both effective and efficient end-to-end training.

Ryo Nishide (Kobe University, Japan)

Extracting Breeding Cows from Monitored Camera Image Data

The extraction of knowledge from large amount of data plays an important role in improving productivity in recent agriculture. In the livestock field, methods for analyzing various data (e.g., growth and body condition data), which are collected from an individual livestock, have been developed to improve the management efficiency. Our project team has been working on the exploration of measurement and analysis method to extract information which contributes to raise productivity of breeding cows, and the development of innovative growth management technology by examining the interaction of breeding cows. On this occasion, I would like to introduce two recent topics of our research: (i) estimation of calf weight from fixed-point stereo camera images using three-dimensional successive cylindrical model, and (ii) detecting and tracking breeding cows from bird's eye video of pasture. Our goal is to grasp the growth status, health and stress conditions of cows by integrating multiple technologies such as image processing, GPS, and various sensory data.

Bei Xiaohui (Nanyang Technological University, Singapore)

Learning Market Parameters using Aggregate Demand Queries

We study efficient algorithms for a natural learning problem in markets. There is one seller with m divisible goods and n buyers with unknown individual utility functions and budgets of money. The seller can repeatedly announce prices and observe aggregate demand bundles requested by the buyers. The goal of the seller is to learn the utility functions and budgets of the buyers. Our scenario falls into the classic domain of "revealed preference" analysis. Problems with revealed preference have recently started to attract increased interest in computer science due to their fundamental nature in understanding customer behavior in electronic markets. The goal of revealed preference analysis is to observe rational agent behavior, to explain it using a suitable model for the utility functions, and to predict future agent behavior. Our results are the first polynomialtime algorithms to learn utility and budget parameters via revealed preference queries in classic Fisher markets with multiple buyers. Our analysis concentrates on linear, CES, and Leontief markets, which are the most prominent classes studied in the literature. Some of our results extend to general Arrow-Debreu exchange markets.

Tetsuya Takiguchi (Kobe University, Japan)

Voice Conversion Based on Non-negative Matrix Factorization

Voice conversion (VC) is a technique for converting specific information in speech, while preserving the other information in the utterance. The most popular VC application is speaker conversion, which converts a source speaker's voice individuality to that of a specified target speaker, while preserving the linguistic information. VC has also been applied to emotion conversion. In recent years, exemplar-based VC, which is a non-statistical approach, has been attracting interest. In this talk, I will introduce exemplar-based VC using non-negative matrix factorization that has some advantages to noise-robustness, small-parallel corpus (training data), many-to-many (arbitrary speakers) VC, and multi-modal VC.

Patrick Pun Chi Seng (Nanyang Technological University, Singapore)

High-Dimensional Portfolio Selection with DECODE

This paper investigates the high-dimensional portfolio selection problem in which the number of risky assets is greater than the number of observation times. It is well known that the theoretically optimal portfolios, subject to estimation errors, perform poorly in many empirical studies, especially in the presence of lots of assets. This paper proposes a novel statistical learning framework, called Descent-based Calibrated Optimal Direct Estimation (DECODE), which is free of tuning parameters and directly estimates effective parameters appearing in the optimal portfolios. The resulting DECODE portfolios are sparse, which realize data-driven selection of favourable assets. The advantages of the DECODE approach also include its computational superiority (much faster than those with cross-validation) and its applicability for high-dimensional cases and non-Gaussian distributions of asset returns. This paper proves the consistency results for the DECODE approach. Numerical and empirical studies are conducted to compare the performances of DECODE and other existing competitor schemes. If time permits, I will briefly discuss about the further applications of DECODE in Finance.

Tsutomu Terada (Kobe University, Japan)

Wearable Sensing and Information Presentation Considering Psychological Effects

We have developed many techniques of sensing and information presentation in wearable computing environments, to improve the quality of life and the quality of professional works.