

(1) Effective Multi-Query Expansions: Robust Landmark Retrieval

**Yang Wang**

**School of Computer Science & Engineering, UNSW**

&

(2) Networked bandits with disjoint linear payoffs

**Meng Fang**

**The University of Melbourne**

Thursday 19th November 2:00pm - 3:00pm

K17\_113 (seminar room)

**Abstract (1)**

Given a query photo issued by a user (q-user), the landmark retrieval is to return a set of photos with their landmarks similar to those of the query, while the existing studies on the landmark retrieval focus on exploiting geometries of landmarks for similarity matches between candidate photos and a query photo. We observe that the same landmarks provided by different users may convey different geometry information depending on the viewpoints and/or angles, and may subsequently yield very different results. In fact, dealing with the landmarks with shapes caused by the photography of q-users is often nontrivial and has never been studied.

Motivated by this, in this talk, we introduce a novel framework, namely multi-query expansions, to retrieve semantically robust landmarks by two steps. Firstly, we identify the top-k photos regarding the latent topics of a query landmark to construct multi-query set so as to remedy its possible shape. For this purpose, we significantly extend the techniques of Latent Dirichlet Allocation. Secondly, we propose a novel technique to generate the robust yet compact pattern set from the multi-query photos. To ensure redundancy-free and enhance the efficiency, we adopt the existing minimum-description-length-principle based pattern mining techniques to remove similar query photos from the (k+1) selected query photos. Then, a landmark retrieval rule is developed to calculate the ranking scores between mined pattern set and each photo in the database, which are ranked to serve as the final ranking list of landmark retrieval. Extensive experiments are conducted on real-world landmark datasets, validating the significantly higher accuracy of our approach.

This work is published as a full paper on ACM Multimedia 2015.

**Abstract (2)**

In this talk, we discuss `networked bandits', a new bandit problem where a set of interrelated arms varies over time and, given the contextual information that selects one arm, invokes other correlated arms. This problem remains under-investigated, in spite of its applicability to many practical problems. For instance, in social networks, an arm can obtain payoffs from both the selected user and its relations since they often share the content through the network. We examine whether it is possible to obtain multiple payoffs from several correlated arms based on the relationships. In particular, we formalize the networked bandit problem and propose an algorithm that considers not only the selected arm, but also the relationships between arms. Our algorithm is `optimism in face of uncertainty' style, in that it decides an arm depending on integrated confidence sets constructed from historical data. We analyze the performance in simulation experiments and on two real-world offline datasets. The experimental results demonstrate our algorithm's effectiveness in the networked bandit setting.

This work is published as a full paper on ACM KDD 2014.

**Yang Wang's bio**

Yang Wang obtained his PhD degree from the University of New South Wales (UNSW), Kensington, Australia in 2015, advised by Scientia Prof. Xuemin Lin. He is currently a postdoctoral research associate at Database Research Group, UNSW. Yang's current research interests lie in Data Mining over visual data objects located on complex multi-view spaces. So far, he has published more than 20 research papers (including one book chapter), most of which have appeared in the competitive venues, such as ACM Multimedia, ACM SIGIR, ACM CIKM, IEEE ICDM, IEEE TIP, IEEE TNNLS and KAIS. Yang is the recipient of Best Reseach Paper Runner-up Award for PAKDD 2014. He has been the Program Committee Member for Research Scientific Track of ECMLPKDD 2014 and ECMLPKDD 2015.

**Meng Fang's bio**

Meng Fang obtained his PhD degree from The University of Technology, Sydney (UTS) advised by Prof. Dacheng Tao in Nov 2015, and is currently a postdoctoral researcher at the University of Melbourne, Victoria, Australia. Prior to that, he experienced a research intern at microsoft research asia, beijing, China.

His research interests include Data Mining, Machine Learning and Pattern Recognition. Meng's work has been extensively published on the top venues, which include ACM KDD, ACM CIKM, IEEE ICDM, IEEE TKDE, Data Mining and Knowledge Discovery (DAMI), SIAM DM (SDM) and ECMLPKDD. He is the recipient of Piero Zamperoni Best Student Paper Award for ICPR 2012, and reported on IAPR (The International Association for Pattern Recognition) newsletter for the next generation excellent researcher.



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Human Activity Recognition using Kinetic Energy Harvesting

**Professor Mahbub Hassan**

**School of Computer Science & Engineering, UNSW**

Thursday 12th November 2:00pm - 3:00pm

K17\_113 (seminar room)

**Abstract**

Human activity recognition (HAR) using tiny unobtrusive wearable devices is expected to bring transformational benefits in various domains, including healthcare, intelligent transport, smart living, military, and security. To be pervasive, these future wearable devices are expected to power themselves from the tiny amount of energy that could be potentially harvested from the environment. Unfortunately, conventional HAR relies on accelerometers to continuously sample human motion (acceleration), which requires significant power supply relative to what could be harvested. Instead of using accelerometer, we propose use of kinetic energy harvesting data as a new source of information to realise HAR. The proposed use of power data for classifying human activities is motivated by the fact that different activities produce kinetic energy in a different way leaving their signatures in the harvested power. By not using accelerometer, a significant percentage of limited harvestable energy can be saved and utilised for other value-added functions. To demonstrate the feasibility of the proposed energy-based HAR, we have built a prototype using off-the-shelf piezoelectric energy harvesters and conducted experiments with real subjects. This talk will present results from these experiments highlighting the opportunities and challenges of energy-based HAR for next generation wearable internet of things. This work has just been published in 2015 September-October issue of IEEE Internet Computing under the title “Energy-harvesting Wearables for Activity-Aware Services”.

**Bio**

Mahbub Hassan is a Full Professor in the School of Computer Science and Engineering, the University of New South Wales, Sydney, Australia. He is a Distinguished Lecturer of IEEE (COMSOC) for 2013-2016.  He worked as Visiting Professor at Osaka University, Japan, in 2011 and University of Nantes, France, in 2005. He is currently an Editor of IEEE Communications Surveys and Tutorial and has previously served as Guest Editor for IEEE Network and Associate Technical Editor for IEEE Communications Magazine. He has co-authored three books, one US patent, and over 150 refereed articles. Professor Hassan has earned a PhD from Monash University, Australia, and an MSc from University of Victoria, Canada, both in Computer Science. His current research interests include nanoscale communication and networking, self-powered wireless communication, novel uses of energy harvesting in wearable devices, and opportunistic networking. More information about Professor Hassan is available from <http://www.cse.unsw.edu.au/~mahbub>.



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Engineering molecular communication

**Associate Professor Chun Tung Chou**

**School of Computer Science & Engineering, UNSW**

Thursday 5th November 2:00pm - 3:00pm

K17\_113 (seminar room)

**Abstract**

What is life? You can view a living cell simply as a soup of chemical molecules, but a living cell can sense the environment, make decisions, repair itself, communicate with other cells and do many other amazing things. From a computing perspective, a cell can be thought of as a computation and communication device. Cells realise computation and communication by using networks of chemical reactions (which are also known as molecular circuits) and transport. Chemical reactions are inherently stochastic, so a research question in biology is to understand how cells use molecules and chemical reactions to compute and communicate. With the development of synthetic biology, there is now an opportunity to engineer novel molecular circuits and bio-nano devices, which are based on biological materials rather than silicon. These novel bio-nano devices can potentially revolutionise many application areas, especially medicine. With this background in mind, our research aims to develop a framework to understand, analyse and engineer molecular communication. In this seminar, we examine molecular communication from an information theory point of view. Inspired by temporal coding found in living cells, we formulate an optimal decoding problem with a pair of molecular circuit based transmitter and receiver. By using optimal Bayesian inference, we derive the optimal decoder in the form of a bank of analogue filters. An important insight from our solution is that molecular communication is event-based with information communicated through binding and unbinding events. We will also discuss the problems of signal and molecular circuit design.

This talk is predominantly based on these two publications: (1) A Markovian approach to the optimal demodulation of diffusion-based molecular communication networks. IEEE Trans. on Communications, Oct 2015. (2) Maximum a posteriori decoding for diffusion-based molecular communication using analog filters. IEEE Trans on Nanotechnology, Dec 2015.

**Bio**

Chun Tung Chou is an Associate Professor at the School of Computer Science and Engineering, UNSW. His current research interests are in molecular and nanoscale communication, compressive sensing and embedded computing. He has published over 150 papers on various aspects of networks, computing and control. He has an MA from Oxford and a PhD from Cambridge. He will serve as a Program Co-chair for the 3rd ACM International Conference on Nanoscale Computing and Communication in 2016.



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**Dr Edwin V. Bonilla**

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Dear All,

CSE Seminar series this Thursday 29 October at 2pm at  K17\_113 (seminar Room). Lijun Chang will be presenting 'Optimal and Scalable Algorithms for Graph Processing’. Please see details below.

Drinks and nibbles afterwards.

Cheers,

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Edwin

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Title.

Optimal and Scalable Algorithms for Graph Processing

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Abstract.

With the proliferation of graph applications and the recent advent of Big Data, research efforts have been devoted towards many fundamental problems in managing and analysing big graph data. In this talk, I focus on two graph processing problems, computing Steiner components with maximum connectivity (SMCC) and top-k tree pattern matching, and propose optimal and scalable algorithms for these two problems, respectively. 1) Given a set q of query vertices in a graph G, the problem of computing SMCC is to find the maximum induced subgraph g of G such that g contains q and g has the maximum connectivity. To accommodate online query processing, we present an efficient algorithm based on a novel index such that the algorithm runs in linear time regarding the result size; thus, the algorithm is optimal since it needs at least linear time to output the result. To build the index, we extend the existing techniques to accommodate batch processing and computation sharing. 2) Given a rooted tree T, the problem of top-k tree pattern matching is to compute the top-k matches of T in a directed graph G based on the twig-pattern matching semantics. Based on the principle of Lawler’s procedure, we present a novel and optimal enumeration paradigm that runs in O(n\_T + log k) time in each round where n\_T is the number of nodes in T. Considering that the time complexity to output a match of T is O(n\_T) and n\_T < log k in practice, our enumeration technique is optimal. Moreover, the cost of generating top-1 match of T in our algorithm is O(m\_R) where m\_R is the number of edges in the transitive closure of a data graph G involving all relevant nodes to T. O(m\_R) is also optimal in the worst case without pre-knowledge of G. Consequently, our algorithm is optimal with the running time O(m\_R + k (n\_T + log k)).

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Bio.

Lijun Chang is currently an ARC DECRA fellow at the Database Group at University of New South Wales. He received his B.Eng. in computer science and technology from Renmin University of China in 2007, and Ph.D. in Systems Engineering and Engineering Management from Chinese University of Hong Kong in 2011. His research interests are in the fields of big graph (network) analytics, with a focus on designing I/O efficient algorithms and distributed algorithms (including MapReduce, Pregel, etc.) for massive graph analysis, and devising practical algorithms and theoretical foundations for graph search problems in database and data mining. He has published over 30 papers in top-tier Database conferences and journals, including 5 SIGMOD papers, 5 VLDB papers, 5 ICDE papers, 1 KDD paper, 5 VLDB Journal papers, 2 TKDE papers, and 1 Algorithmica paper.

When: Thursday 22 October 1:00pm - 2:00pm

Where: K17\_113 (CSE Seminar Room)

Who: Steven Edouard, Rita Zhang and Felix Riesberg

Title: Coding in the Open

\*\*\* Abstract \*\*\*

Rita, Steven and Felix are Open Source Engineers at Microsoft, hacking away with engineering teams, open source communities, and startups. With more than 1100 projects open sourced, they can usually be found on GitHub, collaborating on hard development problems with other brave engineers and companies working in the open.

In this talk, they will candidly and openly talk about how open source is used inside the company, how they team up with communities outside the Microsoft ecosystem, and how they code to make developers working in a bunch of diverse environments happy.

\*\*\* About the Speakers \*\*\*

Felix Rieseberg is an Open Source Engineer based in San Francisco, working on sophisticated web app development, modern DevOps workflows, and cross-platform development. Previously, he provided engineering guidance to startups in the Silicon Valley, worked as a developer evangelist with Microsoft Germany, and was editor in chief for one of Europe’s biggest Apple magazines. He holds a Master of Science from University of Oxford’s Internet Institute and is famous for eating way too much ice cream. ([felixrieseberg.com](http://felixrieseberg.com/))

Rita Zhang is an open source engineer/architect in San Francisco, working on strategic engagements with customers and partners using emerging open source technologies, and sharing technical collaterals with the open source community. Prior to that, she was an architect at GE delivering features for Industrial internet and was an Enterprise consultant with Microsoft Consulting Services. During her spare time, she develops new smart home gadgets for her startup. ([ritazh.com](http://ritazh.com/))

Steven Edouard is a Software Engineer based out of San Francisco, focusing on open source integrations with Microsoft Azure. In addition to open source projects, he also assists Y-Combinator companies with getting their deployments running on Azure. Steven was previously a test engineer on the .NET runtime team. He is a hacker at heart and in his free time he works on fun side projects. Aside from engineering Steven enjoys sailing in San Francisco Bay. ([stevenedouard.com](http://stevenedouard.com/))