

S H A R I N G
@ C O M P



Featuring
Dr Lou Wei & Dr Fiona Liu



Interview with Dr Lou Wei

Could you highlight your education background?


I received my Bachelor of Engineering degree in Electronic Engineering in 1995 after five years' study at Tsinghua University, and then spent another three years at Beijing University of Posts and Telecommunications to receive my Master of Engineering degree in Communication and

Information System. I started my PhD study at Florida Atlantic University in 2000 and obtained my PhD in Computer Engineering in 2004. After graduation, I joined the department as an assistant professor.

We learn that your research interests are wireless ad hoc and sensor networks, peer to peer networks, mobile computing, and computer networks, have any incidents or people inspired you to start working in these areas?

My PhD research topic was in the area of wireless ad hoc networks. I had some good research results published in this area. It was quite natural for me to continue working in this area after graduation. As a typical application scenario of wireless ad hoc networks, wireless sensor networks became an extremely hot topic at that time, which attracted a large

amount of networking/distributed system guys to pour in this field. I chose this area and proposed some important research problems to explore. After getting several grants from the government and university, I could start my research in this area.



At that time, watching movies over Internet abruptly became popular in China as well as in Hong Kong due to the advancement of peer to peer streaming technologies. However, the popularity of this new application greatly weakened the foundation of the business model of movie industries as, for most of the time, the free movies that people watched over the Internet were infringed copies. This brought an intense conflict of interest among the content service providers (CSPs), internet service providers (ISPs) and end users. As both CSPs and ISPs lost money due to the peer to peer streaming applications, the whole industry faced the challenge that called for a new business model to resolve this disharmony. I observed this disharmony and wrote a

GRF proposal to investigate this issue. With the support of a GRF fund, we modeled the problem as a tri-partite game and used the game theory principle to solve it. We also extended our study to the mobile peer to peer streaming scenario and designed an effective scheme based on advanced economic principles.

I also got a GRF fund to study the routing and cache management of delay tolerant networks. We proposed to leverage the group feature to deliver messages and manage the messages in caches. Our mechanisms were designed for mobile sensor network applications. We also applied similar ideas to vehicular ad hoc networks and found that they were also effective.

Could you tell us some of your memorable and remarkable learning, teaching and research experiences?

Being a teacher, I have experienced many highs and lows in my teaching career. Many remarkable moments made me feel so happy and affirm that I had chosen the right career. I also had frustrated days where I questioned myself if being a teacher was a wise choice. After more than ten years of teaching, I should say that my good days outshine my bad days.

One event stands above the rest when I look back my past teaching life. I still remembered the experiences when I supervised my first FYP student Nick. At that time, I just joined the department. I rarely knew anything about the general background of Hong Kong students as well as their strengths and weaknesses. I proposed a research oriented topic that required the student read many research papers, build theoretical models, and conduct numerical experiments. This project could train the student how to start doing research, but might not be most useful to those undergraduates who decided to go to industries directly. After having the first meeting with Nick, I thought that he might not have the interest to do the project well, as Nick neither planned to continue his postgraduate study nor was equipped with

enough knowledge and skills to work on this project. Soon I found that I underestimated the potentials of our students. Although Nick was really lack of the background knowledge, he showed his discipline and spent much time in picking up the knowledge by reading the list of references I gave him. We had frequently met during the whole year, so I could always well know the progress he made and easily figure out the difficulties he encountered. Besides the discussion about the FYP project, our discussion went beyond the academic context. Nick was open-minded and warm-hearted. He shared with me his personal stories and growing up experience, which was a reflection of Hong Kong's unique culture. Nick told me that he grew up in Mong Kok, his father and elder brother were both police officers. He also said that the famous movie series Young and Dangerous were kind of true and deserved to be watched. Moreover, Nick introduced me free Cantonese tutors and recommended me the best websites for buying flight tickets. He even promised me to drive me around in the future when he had a car. Though Nick did not keep his promise to drive me around after so many years, I still remembered my happiness when he dropped by

my office several years later after his graduation. I would be glad that, through Nick, I had not only supervised a student for a project, but also built confidences in our students' abilities through my first-hand experiences.

Another memorable experience was about supervising students who were not the best students. Working with the best students is definitely a joyful experience; however, working with those not-so-good students is another story. I used to be quite a bit upset and easily lose my temper at those

students who performed lower than my expectation. Yet, I started to change my mind when I supervised a student who had some inborn disabilities. After many years of training, the student finally graduated and found a good research position. Through this experience, I learned much about teaching and instructing students who may not perform the best as we wish. I realized that students come to me to learn, as a teacher, it is my responsibility to not only find ways to motivate them to learn, but also be prepared to accept their limits and failures.



Can you briefly describe your current research? What is the impact and future trends of your research?

My current research mainly focuses on the area of wireless networking. I explore the possibility of making use of the cross-layer design methodology to tackle various performance inefficiency issues in wireless networks. For example, wireless local area networks (WLANs) use so-called carrier sense multiple access (CSMA) mechanism to allow mobile devices to compete for the wireless channel access. This mechanism is a totally distributed mechanism, but it bears low channel utilization when the mobile devices become highly dense, due to frequent packet transmission collisions. The hidden terminal and exposed

terminal problems are typical problematic scenarios that address the performance degradation of CSMA mechanism. The solutions to both problems are all based on certain simplified system models. In our research, we explore a novel cross-layer mechanism to solve both problems which can greatly increase the network throughput of WLANs. Another example of performance inefficiency issue in WLANs that relates to the CSMA mechanism is the energy wastage due to cause that the mobile devices have to continuously listen to the wireless channel to know if the channel is free to use or if there are some packets sent to them. A device,

when detecting that a packet is transmitted in the wireless channel, has to first receive the whole packet and then check the destination address field of the packet. If the packet is not sent to the device itself, this packet will be dropped. This process continuously wastes much energy consumption, especially when the network becomes dense or the network traffic load is high. A typical problematic consequence is that it will easily drain out the mobile device's battery power if the device is placed in a Wi-Fi enabled public area for hours.

For this issue, we still explore a PHY-MAC cross-layered mechanism to solve it.

As my research in this area involves a lot of physical layer's algorithm design and implementation, and may need to further implement and test them with FPGAs, it will definitely bring me big challenges and motivate me to move away from my comfort zone. Luckily, some industrial companies are interested in collaborating with me to continue this research.

What gives you the strongest sense of achievement in your work?

To be a qualified university teacher, we are expected to spend enough efforts on teaching, research, and service. It is our responsibilities to do our best work in all these aspects. It would become a bonus if we could also enjoy the process during the work. To me, I like the experience that I could turn a rough idea or some pieces of thoughts into a meaningful work and finally "sell" it out to the academic society, after a long and most of the time painful striving effort. The academic society is never lack of intelligent and diligent researchers, who spend all their time on looking for new ideas. It is furiously competitive for us to have an innovative idea that can be recognized by world-leading researchers. Thus, each time when I have got a work accepted by top conferences or journals, I always feel the strongest sense of achievement.

Besides the sense of achievement in self-academic recognition, I also feel enjoyable to coach my students. It is a great experience for me to cultivate a highly motivated novice to become a confident and experienced researcher. Since I have accompanied my students to experience

the whole journey of research and study, I have observed the changes that they learned to become criticized and at the same time appreciated other researchers' work, the improvements they made to rectify problems and enhance their ideas, the days they stayed overnight to meet deadlines, the frustrations they felt about reviewers' harsh comments, and the delights they felt when their work had finally been published. I always feel very happy when I witness my students' maturity and succeed in their study and career. At that time, I am proud of being a teacher, a coach, and even a trusted friend of my students.



Have you encountered any difficulties in teaching? How did you overcome the challenges?

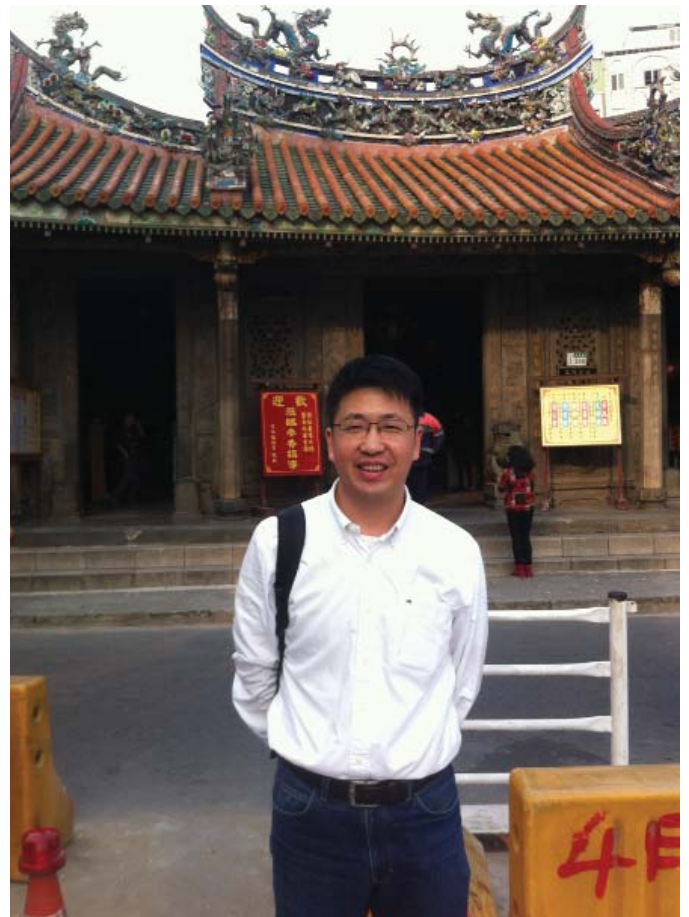
I have met some difficulties in teaching at PolyU. I think a good and effective teaching style is related to students' backgrounds, learning habits, and learning expectations. Different from those students I used to meet during my student life, the students of this generation are quite realistic, they prefer to learn "useful" knowledge only. Meanwhile, they seem very busy and do not have time to read textbooks after class. Thus, teachers have to be very considerate and get well prepared for the lectures so that useful knowledge can be effectively delivered to students during the class.

After many years' teaching, I gradually understand the learning habits and expectations of our students, through various contacts with them and feedbacks from them. I also

learned many useful skills for effective teaching from reading books and attending workshops. Meanwhile, I had been assigned to teach the subjects that I have the most expertise. Moreover, I received many valuable advises from our colleagues. Now, I feel better to give an effective teaching to our students. Of course, I still have a long way to go. I need to further consider more about our students' diversified backgrounds and learning expectations, and design even more flexible and customized lectures to meet students' need. Furthermore, I want to embed some advanced teaching and learning methodologies, such as massive open online courses (MOOC) or flipped classrooms, into my class so that our students' learning experiences can be enriched.

Could you brief us about your future research plan and the major trends in these fields?

As the Hong Kong Government has announced to adopt a smart city approach for urban development, and the university also chooses smart cities as a strategic direction for sustainable urban development, in the future, I would also like to align my research interest with this theme. There are many fields related to smart-city technologies and applications that I can participate in, for example, the next generation network infrastructure for smart cities, the massive Internet of Things, smart grids, intelligent public transportation systems. I have some pieces of work in these fields and would like to do further research and development in these fields.





Interview with Dr Fiona Liu

Could you share with us your education background?

I received my bachelor degree from Department of Electronic Engineering at Southeast University, my major was in wireless communication. I obtained my master degree from Nanjing University, majoring in management. After that, I pursued my PhD in multimedia computing and machine learning from Department of Computer Science at Columbia University in the U.S.

After my graduation, I joined Intel Corp and I was a group leader of a project for multimedia e-learning system. In this project, I utilized video, annotation, and audio to provide self-study lessons for pre-Intermediate English learners. I received special recognition award because of my excellent performance.

Has there been any experience from your graduate study which benefits your whole career path? Please elaborate.

For research, interest is the best teacher. This is what I have learned in my graduate study at Columbia University. I like discovering the theory behind a phenomenon, which is my main research motivation. I am passionate about working on the research projects I am really interested in. I enjoy spending time and effort in doing surveys, discussing ideas, and presenting findings, thus, the workload from research is not a burden for me. I am delighted to say that I select a suitable career.

I seldom work on the topics I am not very interested in. Of course, I may suffer from the lack of funding and publications if my research interests are not attractive to the public. It is great if I can be recognized by the academics, but it is not the most important thing to me. It is of paramount importance to have some researchers conducting groundbreaking research to drive the progress of the whole society.

What are your research interests? What inspired you to devote yourself into these areas?

My research interests include multimedia computing, machine learning, and brain modeling. I enjoyed working with my PhD advisor at Columbia University, Prof. John Kender, who influenced me a lot in my research area selection. Prof. Kender worked on artificial intelligence under the supervision of Prof. Dabbala Rajagopal Reddy, who received

Turing Award in 1994.

Prof. Kender is a forerunner of computer vision. He has a high level of curiosity and is never afraid of failure. Inspired by him, I was dedicated to devoting myself to the research of multimedia computing using machine learning techniques and cognitive science findings.



Could you give us an example that computer technology contributes to the solving of real world problem?

My research team has worked on utilizing computational models to discover the relationship between music and emotion. As known, music can evoke strong emotions. This amazing ability has fascinated the researchers in different fields to discover the nature of music and emotion. Psychologists propose the hypotheses of the correlation between musical components and emotion types based

on life experiences, for example, flowing rhythm elicits happiness, and then design psychological paradigms to testify their hypotheses. Psychological research in the last couple of decades has showed us that there exists a high correlation between music signal and emotional response. Music signal influences the production of neurotransmitters, such as Noradrenaline and Dopamine, which leads to various

emotions. Some musical components, such as rhythm and melody, can evoke certain kinds of emotions, like happy and fear, when the component value falls in a range.

Laboratory findings on the relationship between music and emotion have wide therapeutic applications in fields such as mood disorders, schizophrenia, children's autism, senile diseases, and pain control. However, the underlying mechanism remains unanswered: what are the intrinsic features in music signal evoke various emotion responses? Are they the previously identified musical components? Whether those musical components form a comprehensive set of influential correlates contributing to evoking emotions? What is the interrelationship of those musical components, independent or redundant? Current research methodology

Could you share with us your current research?

I am most interested in simulating unconscious learning of human beings using a computer. According to the degree of consciousness involvement, human learning involves information processing in both explicit and implicit manners. The explicit learning, with full involvement of consciousness, is guided by targets or/and rules, such as learning of mathematics in schools. The implicit learning, however, acquires new information without clear intention of doing it.

Our everyday experience suggests that learning without consciousness is a ubiquitous phenomenon, e.g., social or aesthetic judgments are greatly influenced by such implicit cognition. It has also been argued that intuition, a most amazing part of human intelligence, is one of the end products of implicit learning. Research on psychology indicates that implicit learning plays an important role in human visual perception. Due to the limitation of cognitive resources, only a small subset of visual information is available to conscious awareness at any given moment while the large quantity is learned in implicit ways. Implicit learning is found more advantageous in perceiving high discriminability information, speeding up the target search, and adapting to vague regularities of the world. These distinct merits offer

in psychology limits the great progress to answer these questions.

Hence, we explore a deep model, a powerful computational technology, to provide systematic and quantitative analysis of the relationship between music signals and emotion responses. We form a team with researchers working in computer science, psychology, and clinical treatment. The findings of this project lay a theoretical foundation of multimedia signal processing, affective computing, and data mining. Moreover, the research outcomes show great commercial potential for many therapeutic applications. Under current social atmosphere, this project will directly benefit the local society by sustaining the emotional health of the population.

great potentials to improve effectiveness, efficiency, robustness of machine visual cognition. It has also been validated that contextual cueing, a kind of implicit learning result of human beings, can improve the performance of machine visual cognition if the context is given as the prior knowledge. However, the work of making computer automatically learn in implicit manner is limited when compared with the extensive study of simulating explicit learning. Therefore, my current research project intends to fill in the gap in the field. Our research team is composed of scholars from both computer science and brain science. Our preliminary work validates the feasibility of improving machine visual cognition by modeling implicit learning.





Could you brief us about your future research plan?

My research team targets to investigate novel computational models, such as deep learning models, by referencing brain structure and mind process. Besides, we aim to discover the secrets of the human brain by exploring information technologies, such as brain imaging techniques. Moreover, we will work on the investigation of computer-based brain exercises via brain imaging techniques.

The brain is the most important part of human's body, which not only maintains the daily operation of the body but also makes human beings different from animals. However, in most cases, a human cannot utilize the ability of brain effectively. For example, thousands absurd ideas appear every time every day in our brains, which occupy limited consciousness resources. It is also the common experiences of many persons that we feel regret for our bad temper when some unexpected things occur. It has been considered an ultimate problem of human being that how to control the brain better.

In the last thousand years, biologist, psychologist, educationalists and religious believers have studied and practice. Unfortunately, the results were far from satisfactory because of the lack of systematic analysis and quantitative assessment. Even meditation, which has been widely accepted by modern medical science in practical therapy, is also in a very initial research stage. Hence, we will explore the

novel brain imaging based techniques to 1) validate that the brain exercises can improve the brain ability systematically and quantitatively; 2) identify that the concrete relationship between different brain exercises to different brain functions; 3) design the information system to help the brain exercise.

For the impact, this cross-area research project will make important contributions to artificial intelligence, brain imaging, cognitive computing, and medical science. We will develop the software to demo the subjects' brain activities in the natural status and after a period of brain exercise. For the possibility of producing world-leading outputs, brain exercise has a long history in eastern culture and has attracted more and more attention by western society. It shows great potentials in brain functions development, brain disorders rehabilitation, and mood problems therapy. Moreover, it may develop into a new research area in computer science.



Brain Wave Collection and Analysis via EEG

We know that you have been the principle investigator of over 10 projects and awarded the best paper awards for several times, could you tell us your experience about conducting effective project and writing good research papers?

Teamwork is the key to the success of projects. I have developed a good relationship with my research students and we have built long term collaboration. Research paper is one of the main ways for us to communicate with researchers working in the same areas. It is not difficult to deliver a high-quality research paper if the research we work on is excellent.



Could you share with us your philosophy of education?

Talent cultivation is one of the most important roles of universities. I prefer to motivate my students finding a solution instead of providing the solution directly. One of my former PhD students, who is now an assistant professor at the Hong Kong Baptist University, told me that the best gift I gave him is the passion for research.



For contributions and enquiries, please contact:

Ms Agueda Chau x4239
 Ms Christine Liu x7274

Editorial Board:

Prof. Jiannong Cao
 Ms Agueda Chau
 Ms Christine Liu

Design:
 Mr Derek Ma

Department of Computing
 The Hong Kong Polytechnic University
www.comp.polyu.edu.hk

