A:

Q:

Prof. Keith Chan

Dr Wang Qixin

Envision Future COMPUTING Computing for the FUTURE
A: Could you share with us your educational background?

Q: In 2001, I went to University of Illinois at Urbana-Champaign (UIUC) and joined the Department of Computer Science under the supervision of Prof. Lui Sha in the Real-Time and Embedded Systems Lab. Then in 2008, I received my PhD with major focus on Real-Time Networking.

Before UIUC, I got my Master of Engineering (2001) and Bachelor of Engineering (1999) degrees from the Department of Computer Science and Technology, Tsinghua University. I also obtained a Bachelor of Economics (Minor) on Enterprise Management at School of Economics and Management from Tsinghua University in 1999. This management course proves to be useful when I supervise the students.

A: What are your research interests and how did you get into these areas?

Q: I have been working on real-time wireless networks and real-time switched networks for long time. I got into these streams, partly because I met my life mentors: when I was in the Real-Time and Embedded System lab, I fortunately met Prof. Jennifer Hou, who works in networking and collaborated closely with Prof. Lui Sha. In the later days in UIUC, the Medical Device Plug-and-Play (MDPnP) program director approached my lab, asking if we could help them solve various problems in medical device collaboration. And this began my work on medical Cyber-Physical Systems (CPS).
A: So, You have been working on Cyber-Physical Systems. Could you tell what it is about, and share us your insights and major trends in this field?

Q: CPS refers to all systems that involves tight coupling of computer (cyber) and physical systems with system integration being the major challenge. Cyber-physical systems means that the computer sub-system does run individually anymore, it has become a part of a more holistic system that involves other domains of knowledge. To build a cyber-physical system, computer engineers have to work with professionals from other backgrounds. For example, in medical CPS, computer engineers work with doctors and nurses to acquire the necessary information. These professionals have disparate training backgrounds, and use their own modeling languages, analysis tools, and thinking logics. It’s difficult for them to communicate with the professionals in another area on issues like such as how to employ specific medical knowledge into computer programs. However they have to solve the difficulty as to build the CPS and overcome the major challenge – the system integration challenge.

I don’t think there is a panacea solution to this challenge. Indeed we have to approach the challenge from various aspects: many research areas can contribute. Let me give some examples, architecture being one. A good architecture shall be able to segregate a big CPS system integration problem into several smaller orthogonal tasks. In this way, we can decrease the complexity of the system integration. For this kind of system architecture design, we often need to consider the cyber-physical systems’ domain specific knowledge. For instance, by exploiting the domain specific knowledge of Lyapunov stability theory, we can isolate computerized control CPS into several sub-systems. Even if one sub-system malfunctions, the damage is confined to that sub-systems.

Another example I will quote here is ‘formal methods,’ or in a more general sense, knowledge representation. For computer scientists, we have our way of describing the computer sub-system of a CPS; for other professionals, they have their ways to describe their aspects of the CPS. How to merge these disparate models and descriptions, and the corresponding analysis tools is another important research topic for addressing the CPS system integration challenge. The challenge, might probably involve many other areas like programming language, data mining, information retrieval, natural language processing human-computer interface etc.. These can all help to improve the situation.

A: What are your main techniques and contributions in this field?

Q: I have worked on two topics.

The first one is a software architecture, named “ORTEGA” (On-demand Real-Time GuAr), for control CPS. This architecture utilizes the control domain specific knowledge of Lyapunov stability theory. This theory can give us a stability region. As long as the CPS system’s states are within this stability region, the system will always be safe. Based on this, the ORTEGA architecture can isolate the work of control engineers and computer engineers. The control engineers may write buggy programs, but these buggy programs cannot make the whole control CPS system fail. This paper is published in IEEE Transactions on Industrial Informatics in 2008 and it got the best paper award for this transaction in year 2008.

We have recently published another piece of work on medical CPS, in which we are trying to use formal methods to improve the dependability of medical CPS.
Hybrid systems automata, the tool to start with, allows us to describe both the discrete computer software logic and the continuous feedback control used in the collaborating medical devices. However, when using the hybrid systems automata to describe the patients, we reached a dead end; unlike classic feedback control which can be described with differential equations, the patient, representing a very complicated biochemical system, does not have a good offline model. For example after morphine injection, a patient’s blood oxygen level can still be affected by many other factors and not just the medicine itself – emotion is also accountable. How can we mathematically model emotion?

But then we notice that, instead of modeling the patient offline, if we model him/her online within a time horizon of several seconds or minutes, we can actually assume the patient to be a linear system. The traditional offline model checking now becomes an online fault prediction tool for medical CPS.

This work is very interesting in the sense that it combines real-time, hybrid system model checking, and dependability disciplines together under the name of medical CPS. Probably because of this, this work is going to be presented at ICCPS 2012, the top conference in CPS.

A: What is the impact of your research and your future plan?
Q: Our paper on ORTEGA won the IEEE Transactions on Industrial Informatics 2008 Best Paper Award, as I mentioned. Our medical CPS paper on online model checking is going to be presented at ICCPS 2012, which is the flagship conference for CPS. The methods proposed in this ICCPS paper will open a new problem space that can foster synergy from real-time, model checking, and CPS communities.

It is particularly useful for medical and chemical CPS dependability, as they are both highly non-linear systems, and involve slow reactions which allow online model checking.

I think medical CPS is important for Hong Kong and the Mainland, with both regions soon facing aging population issues. It is predicted that by 2030, over 30% of the population in Hong Kong and the Mainland will be over 60. China is particularly dealing with the long time one-child policy consequences in 10 to 20 years. By then on average, every working adult will be supporting two seniors. The only solution is to increase the efficiency of health care via automation. Computer science can contribute a great part to meet this demand.

A: Do you have collaborations with the others and your experiences?
Q: I have several collaborations, including medical CPS with Prof. Lui Sha, control CPS with Dr Xue Liu; and with Dr Rong Zheng on wireless networking, Dr Lei Bu on model checking. I have also collaborated with Dr Liu Yan, Fiona on adapting classic multimedia algorithms for resource constrained embedded systems.

To summarize, to collaborate, we have to make up some win-win scenarios that we can complement each other. For example, when you want to dive into a new area, to carry out some inter-disciplinary research, then it becomes one of the best moments for you to find collaborators. When professionals from different backgrounds sit together, you can discover many original topics/ideas that are inter-disciplinary.
A: You did your PhD under Prof. Lui Sha in top-tier computing lab. Tell us how this benefits you.

Q: It does benefit me a lot and really broadens my mind! Prof. Lui Sha is a classic old-school researcher and gentleman, who sets up very high-standard role models for me in many aspects.

One aspect is on the research attitudes, or I'd better say, objectives: what should be the right objectives for research. Many people work on research for making a living; I am partly one of them (grin), partly, not all. But Prof. Sha's research objectives has two folds, for himself, it is really for fun; for others, it is to make a difference, to make the world a better place.

There are several ramifications due to these objectives.

One is that he is very demanding about the choice of research topics. Some researchers would like to publish as many papers as possible. But for Prof. Sha, it is the opposite! When we propose a paper topic, he may often advise us not to work on it, because either the topic is not useful enough, or not original enough.

He ever told us there are four categories of papers: 1) the best kind are those that can open a new area with inspirations for a lot of follow-ups, and really make positive impacts to the society; 2) The second best are those that can have very broad applicability, e.g., some fundamental theories; 3) The third category are those that can unify a lots of existing theories, techniques, frameworks; 4) the last ones he would want to write, which are still publishable, but are at the bottom of the list, are those incremental works, which extend some existing ideas. For the fourth category of papers, you have to dedicate a lot of effort to make the paper a real valuable paper, yet the impact for this kind of paper is not comparable to the other three categories.

The other ramification is a healthy mentality. Doing research is tough. But if you choose a topic that is useful, original, interesting, and fits your expertise, you feel you are doing something worthwhile, valuable, and fun. Then you can enjoy your research process. In contrast, if you write paper just for the purpose of publishing it, research can really become a torture, a waste of one's life.

Prof. Sha also has his special way on managing a research group. There is a saying in academia that managing a research group is like herding sheep, an analogy on the task's difficulty. Prof. Sha, however, takes one step further, and jokes about an analogy on herding cats, as kitties always think "why should I do that?". "You cannot force your group members to do what you want. Because if you do that, people will run away; and usually the smarter ones run faster," he ever said. Prof. Sha's philosophy and his way of management still boil down to the choice of research topic. If the topic is really useful, original, and fits the person's expertise, you foster the person's self-motivation. In that way you can save a lot of energy on management.

A: Do you think you are a CAT?

Q: Yes! I AM a cat and I really enjoy my life in UIUC.
A: Could you share with us your educational background?

K: My Undergraduate majors were in Computer Science (CS) & Statistics and they were offered by the Faculty of Mathematics at the University of Waterloo (UW). There were only two Faculties of Mathematics in the world and CS students were given a unique Bachelor of Mathematics (B.Math.) degree. I chose Statistics because I had always liked numbers. In fact, I originally applied to go into graduate programs in statistics after I graduated. The Artificial Intelligence (AI) research group at UW in my days focused almost entirely on Logic Programming which was not something I was interested and I had not thought of going for a PhD in AI. It was until I spoke to a professor in Systems Design Engineering at UW that I found out that the areas of pattern recognition and machine learning deal also with data a lot. I thought these areas were interesting and I decided therefore to go into Systems Design Engineering for my PhD. I do not regret for not taking statistics as I still get to deal with data except that I do not use mathematical or statistical techniques but computational techniques and, instead of mathematical correctness, I also have to be concerned with computational efficiency. Computing in the past deals with the storage and retrieval of data but now, it deals a lot with the discovering of patterns in very large data sets. I thought my background in CS, mathematics and statistics allows me to pursue research in the new eras.

A: What areas have you been researching into, and how did you get into these areas?

K: My research areas are in data mining, computational intelligence and software engineering.

I worked first in the area of machine learning. Specifically, I worked on problems related to inductive learning. The area of inductive learning is concerned with generalization from data. To be able to generalize, one has to be able to discover common patterns. For example, if one is given the data related to when and where the sun is seen to rise every day, then very soon, one should be able to generalize and conclude that “the sun rises in the East every morning”. This is how one can learn “inductively”. The area of machine learning used to be a very popular research area in mid to early nineties. However, people who worked in machine learning, especially those who worked in inductive learning, created a new research area which has become even more popular than machine learning until this day. This new research area has become known as “knowledge discovery in databases” (KDD) after an AAAI workshop in 1989. Since the publishing of a short paper in VLDB in 1991, KDD had also become known as data mining. Many researchers who used to work in inductive learning have started to call their research data mining. The differences between machine learning and data mining, in my opinion, are related to the amount of data they are supposed to deal with.
Some machine learning algorithms are only feasible with a very small data set and cannot be considered data mining algorithms but those machine learning algorithms can be used efficiently with relatively large data sets, they can be considered also as data mining algorithms. For example, the k-means algorithm, and the ID3 algorithm, etc., are found in both data mining and machine learning text books.

Data mining can have many applications in many areas. For example, in a departmental seminar on cloud computing that I attended last week, we were told by the speaker that a total of about 200GB of data was collected from some cloud service provider for his experiments. Given the data, the speaker's research team attempted to predict bandwidth usage and tried to come up with a fee charging model for cloud services. The problem was probably a common problem but what was interesting was that, despite having over 200GB of data, only 5,000 data points were used when the researchers of the team tried to find a model to predict bandwidth. Most of the 200GB of data were not used. I guess the reason why they were not using the rest of the other data was that the researchers had only considered using the ARIMA model. The problem with ARIMA is that it can only take into consideration one variable at a time and it can predict future values of a variable based on its past values. To predict bandwidth usage with ARIMA therefore means that only past bandwidth data were considered. In other words, even though bandwidth usage might be dependent on other factors, they are not taken into consideration by ARIMA models. Hence, even if CPU and storage, etc. may be factors that can affect bandwidth usage, they cannot be included in a prediction model as obtained through ARIMA. In my opinion, a prediction model for bandwidth usage can probably be best obtained with the use of data mining algorithms as many of them can take into consideration multiple variables or factors. Also, they do not require noise to be assumed to be Gaussian. Such an assumption for ARIMA and other regression model, in my opinion, is usually not valid.

Having said all these, how data mining algorithms can be used to predict bandwidth usage is not trivial. This is because we are talking about data set size measured not in Gigabytes but in Terabytes or even Petabytes. If such data are allowed to run on a single server, exploiting one single processor, it will take a long time for the whole set of data to be processed. One approach to tackle this problem is to perform sampling but this is not desirable as we have to cope with sampling errors and will have to ignore the rich information provided by a complete set of data. To avoid these problems, we need data mining algorithms that can run on parallel machines and are able to discover patterns in data in an incremental fashion. A lot of the data that people obtain from real world applications are non-stationary in nature. In other words, the patterns you can find in such data do changes. Even if you are given one additional data point, you need to re-do data mining from the beginning if the algorithm concerned is non-incremental.

For example, there have been some work done mining Twitter data for sentiments and mood. To be able to discover patterns and changes in patterns, you need to be able to collect Twitter data every day. If you would like to monitor changes over a certain period of time, you need to keep collecting such data every day. There will be roughly over 1 million Tweets that you can collect every day and talking about doing data mining and re-doing data mining every time you have new data, you will find it impossible. You cannot use decision tree based approaches. You will have to consider implementing ANN or SVM on parallel machines. Alternatively, one can also consider the Apriori Algorithm.
These data mining algorithms are also incremental and are therefore more suitable for data mining problems involving big data. However, each of these algorithms has their pros and cons and in my opinion, they are not very suitable for the mining of such data as Tweeter and they cannot be used to handle structural data. There still much room for research to develop effective algorithms that can run on parallel machines and can learn incrementally and be able to detect for changing patterns real-time.

Machine Learning used to be considered an area within Artificial Intelligence (AI). While AI is a discipline in Computing, Machine intelligence (MI) is never one even though it is part of PAMI. I think this is interesting but no one knows why exactly. While MI is never very popular as an independent research discipline, CI or Computational Intelligence has been quite popular. CI has been used to refer to research related to ANN, fuzzy systems and evolutionary computation. A world congress on computational intelligence (WCCI) has been held once every three years since 1995 and the WCCI is composed of three conferences, IEEE ICNN, ICFS and ICEC. These conferences are held separately otherwise. Other than data mining, I also work in Computational Intelligence. More specifically, I have been applying techniques in Computational Intelligence in data mining.

Other than data mining, I also work in a totally different area of Software Engineering. The reason why I have had an interest in software engineering was a result of my working for IBM’s software development laboratory for four years immediately after I graduated from my PhD studies. I was involved in several very large projects to develop software products for other developers in all parts of the world. Having worked on these projects, I realize how difficult managing a large software projects is and I have a feeling as to what needs to be improved to make it easier for a very large software project to be better controlled. I have since developed an interest for software engineering as a research area.

Since I joined the department, I have looked into such software engineering problems as project and process management, ISO 9000 and CMM, software requirement analysis and agile software development. All these are related more to software management and it is this area that I am especially interested in. The problem with doing research in software engineering is that it is difficult if you do not work with a company who is willing to provide support to you by allowing you to do some experiments there. Also, getting papers related to management issues published are relatively more difficult. This is mainly because many of these management issues cannot be proven. For example, the area of Extreme programming (XP) is published first only as a book. It cannot be published as an academic idea as many of the ideas XP is concerned cannot be proven with simple experiments. XP has recently become more popular as people are desperately looking for models better than the Waterfall model when it comes to controlling software projects. As people are not sure if ISO 9000 and CMM approaches really work well, they are more willing to look at ad hoc approaches. This is especially the case when people start to claim that agile software development practices actually work. Since the IEEE Transactions on Software Engineering began to publish papers related to agile software practices, I can see that more people are investigating into the area. I personally find it interesting to investigate how good these practices are. Are they really better? If so, how much better are they? Should these practices be followed in a particular way to achieve the most desired results? For example, some researchers in agile software development advocated stand-up meetings everyday. Is it really good by itself? Does it need to be combined with a formal sit-down meeting under some cases?
I also find the idea of pair programming interesting but I was not sure if one plus one is actually better than two. If not, then why should we consider pair programming. A search of the literature seems to imply that pair programming is not always better. It does not even give you an increase productivity not to mention quality. To find out, I had asked a student to do some experiments with real programmers (most of the other research work involves. We discovered that pair programming could well be sometimes effective and sometimes not. When it comes to pair programming, some studies find one plus one bigger than two whereas some others find one plus one less than two. To find out why there is such a discrepancy, we had carried out some studies. We discovered that, as pair programming also involves program design, it can well make a lot of difference when it comes to whether or not there is one or two programmers working together. We discovered that two novices can work together to produce more than two but two experts may not be able to do so. This findings, in the end, was accepted for publication in the IEEE transaction on software engineering which we were quite surprised as the IEEE TSE did not usually publish paper on experiments involving programmers like what we had done. They used to favor papers that are concerned with methodologies that can be expressed in formal notations.

A: What are the applications and the main techniques you have developed/used?
K: My research focus has been more on the development of algorithms to solve data mining or machine learning problems. Sometimes, I will begin work with attempts to solve a particular problem in a particular application area. In the past, I have developed data mining algorithms for discretization, classification, clustering, sequential analysis and graph mining and have used them in a diversity of application areas including those in banking and finance, marketing and CRM, etc. My focus has recently been mainly on the development of graph mining and sequential pattern mining algorithms. The reason why I am interested in developing such algorithms are mainly because there are very big needs for effective such algorithms in the areas of social computing and bioinformatics. Graph mining algorithms can be used to discover patterns in social or biological networks. Existing algorithms are not very computationally efficient. They can perhaps handle graphs with 1000 to 1500 nodes that are 50% connected but for very large networks like those commonly encountered in social media, we need more efficient algorithms. These algorithms may have to be able to exploit parallel architectures but also be able to discover patterns incrementally without having to redo graph mining using all new and old data again. For further research along this direction, we will have to get students to not only perform research in algorithm design but also actually implement the algorithm.

A: Your current research focuses on data mining, could you share insights or the major trends in this field?
K: With various forms of Social Media becomes more and more popular, data mining is becoming more important. In fact, a new term has been in use recently when people refer to the data mining of social media data. It is known as Big Data Analytics. Many popular data mining algorithms, even though they have been shown to be very effective with the tasks that they are tackling now, are not very efficient with very big data. Consider, for example, the volume of Twitter or facebook data that one can collect everyday, it is not possible for many of the existing data mining algorithms to handle if they are sequential algorithms. For such algorithms to be useful, they have to be able to exploit parallel architecture. In addition, they also need to be able to discover patterns or change of patterns in real time.
This means that, when new data are received, the algorithm has to be able to perform data mining incrementally in such a way that dynamic changes in patterns need to be discovered without having to re-do data mining with all the data. Not many data mining algorithms are able to meet these requirements and there is a need for such algorithms to be developed.

A: Could you tell us about your contributions and its impact?
K: I think contributions of research and its impact to the academic community can be determined to some extent by citation indices. On the non-academic side, I think contributions can be determined by how social and industrial impacts the research brings about. On the academic side, I have checked that I have an H-index of 22 which means that 22 of my research papers have more than 22 citations. Several of my papers have received more than 100 citations and they are all related to the work I have done on data mining. Some of the work that I have done that are more receptive involve an algorithm I have developed for discretization of continuous into discrete data. This algorithm was considered useful as many data mining and machine learning algorithms are developed to handle discrete data. In real world, however, most data collected are usually mixed continuous and discrete. For many of the popular algorithms to work, one has to find ways to transform continuous data to discrete data. The algorithm we proposed allows this to be done by minimizing loss of information during the process.

On impact measured with citation, it may not be very useful as an algorithm in the research lab can only make minimal real impact even if it has very high citation. Real impact, in my opinion, can only be made when an algorithm can be adopted to solve problems in the real world. For this reason, I have always tried to find real world problems that I can solve with what I developed. This is why I am particularly interested in industrial projects through ITF grants and consultancy projects. In the past, I have managed to use the algorithms I developed in data mining to solve real problems. Most recently, I have used some of them in the development of a knowledge management system for a company. I hope the company can make it available for use by the general public.

A: We know you are also active in providing consultancy services; could you share your experiences with us?
K: My consultancy projects are all related to data mining or software engineering. I do not have time to go around approaching different people to negotiate for projects. Almost all these projects were obtained by referral. They were referred to me by friends and old clients and even by old students who are familiar with my research. So, there is nothing that I can say regarding marketing as I have not been doing any!

My experience with consultancy projects is quite positive as many of them are very interesting. Very often, if a project is begun as a very small one but in some cases, the projects that came afterwards became very large ones. More recently, after I have completed one project, the client company asked if I could continue. Given the very large scale of the project, I suggested that the company try to apply for Innovation and Technology Fund (ITF) and the company agreed. In fact, they are willing to contribute 2.5 million for us to apply for matching fund from ITF.

Other than discretization, I have attempted to make use of computational intelligence techniques with data mining. We are probably among the first one to propose the mining of fuzzy association rules and to use evolutionary computation in data mining. The papers we published related to the work have received some attention!
Not all consultancy project leads to bigger projects but for most of the data mining projects that I am involved in, I can get very useful data that can be used for publication. When I decide whether or not to take on a consultancy project, I would look at how interesting and useful it is to my research and teaching. If it does not lead to new ideas for publications or bigger projects, it can lead to useful case study that I can use in class. If it leads to neither, then I will not take on a project.

A: What are your plans for future research?
K: My research focus has been more on the development of algorithms to solve data mining or machine learning problems. Sometimes, I will begin work with attempts to solve a particular problem in a particular application area. In the past, I have developed data mining algorithms for discretization, classification, clustering, sequential analysis and graph mining and have used them in a diversity of application areas including those in banking and finance, marketing and CRM, etc.

Basically, I would like to continue to work on data mining and software engineering. For data mining, I have always been working on the developing of effective algorithms and would like to continue to do so. Specifically, I would like to look into developing graph mining and data stream mining algorithms. The reason why I would like to choose such focus is mainly because there are many possible applications that such algorithms can have. I am thinking in particular of applications in bioinformatics and social computing.

For bioinformatics, there are many things that can be done that can allow one to make big impacts. I have been working on the problem of computational drug design. For a drug to be effective, it has to interact with appropriate proteins. In designing a new drug, we therefore need to know what proteins it is expected to interact with. This can be discovered by mining for hidden patterns in drug protein interactions so that we may know what drug components may interact with what protein domains. With such knowledge, when we know what proteins a drug is supposed to interact with, we may be able to begin the design process by putting together components such drug is expected to have based on that of the previous drugs that interact with those proteins. Other than drug design, I have also been developing graph mining algorithms to try to identify protein complexes from protein-protein interaction networks.

The graph mining algorithms developed originally to identify protein complexes can be easily adapted for pattern discovery in social networking which is another area that I have a lot of interests in. One project that I am working on is to investigate into the possibility of predicting stock price movements based on email connectivity and traffic volume. We tested our hypotheses using a set of email data obtained from Enron. I am collaborating with Carol Ou, our ex-colleagues, on this project. Carol has an MIS background. She thinks that what we had discovered can be of interest to some MIS journals. So, we have written up the results for a paper we intend to submit to an MIS journal.

Other than data mining and its application areas, I have always had an interest in software engineering research. In particular, since more than 10 years ago, when eXtreme Programming (XP) was first proposed, I have already developed an interest in it. I have investigated into different aspects of the practices proposed under XP, such as Test Driven Development and Pair Programming. I found these ideas very interesting and may well be very useful. I spent several years at the development lab of IBM and found the development of very large scale project very difficult. The more rigorous approach
advocated by such standards as CMM and ISO9000 was expensive as there was a lot of requirement for very careful documentation but the documents produced in the end does not get read by other people. It is for this reason that I thought there should be a more flexible approach to management large scale project. The XP advocates a less formal approach which sounds very useful to me. I have published some papers related to XP and would like to continue to work in the area of Agile Software Development, which has become very popular as an alternative to the traditional waterfall model. However, progress of work in this area for me is slow as it is very difficult to find research students that have sufficient industrial experience to take on research project in this area.

**A:** As the Acting Dean of Student, could you share your views about university education?

**K:** I have been appointed as the Acting Dean of Students only since the end of August 2011. The responsibilities of the Dean of Students are to serve and develop students according to the vision and mission of PolyU. We would like to provide additional opportunities outside of the classrooms for students to develop themselves. Through the various offices under the Dean of Students, we have organized different events and activities for career developments, counseling and personal development, learning enhancement, finance assistance, hall education etc. We have been organizing social and cultural events to encourage local and nonlocal students to interact more with each other. We will also continue to organize the music programs during lunch time for all students to appreciate.

In addition, we have also been organizing non-academic talks that are of general interests to all students. For example, we are planning to offer a number of talks in a series tentatively called the “Road to successes”. Currently, we are negotiating with Jeremy Lin for a possible talk to PolyU students as part of this series. Apart from this, we are looking into social entrepreneurship which is something that I believe is worth promoting among our students. On one hand, a student can learn all the essentials to become an entrepreneur, and on the other hand, they can help the underprivileged. For computing students in particular, it is easier for them to become an entrepreneur because the opportunity cost is smaller and they do not need a lot of capital to start a business. Social entrepreneurship is inter-disciplinary and is difficult for a single department to do too much. The DSO may provide some coordination and can get things going by liaising with different faculties and schools.

**A:** Over the years, you have been taken a lot of admin duties, how could you manage to keep doing research and producing high quality publications?

**K:** I am always very disciplined and I think this is important for someone to serve the profession or the university and to do research at the same time. I have requested my assistant to try to avoid as much as possible meetings after 4pm so that I can meet with my research students, read literature, write papers and proposals. I have also been serving on the Program Committees of many conferences and from time to time. Within the two hours every day, I also need to review submissions for different journals. To be able to contribute to the academic community, the two-hours-a-day is very important to me. Of course, it is not always possible for me to find two hours every day but I have been trying my best.