Featuring
Prof. David Zhang & Dr Vincent Ng

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SMART COMPUTING
Drives Innovation
Interview with Prof. David Zhang

Could you brief us about your education background?

I graduated in Computer Science from Peking University. I received my MSc in 1982 and my PhD in 1985 in Computer Science from the Harbin Institute of Technology (HIT), respectively. From 1986 to 1988 I was a Postdoctoral Fellow at Tsinghua University. In 1994, I received my second PhD in Electrical and Computer Engineering from the University of Waterloo, Canada.

You are a world leading researcher in biometrics, why did you pick these areas as your core focus and what are your major contributions?

I have been working on biometrics and related areas like pattern recognition since 1980. I am the founding director of the Biometrics Technology Centre (UGC/CRC) supported by the Hong Kong SAR Government in 1998. We have developed two significant things in the world: one is palmprint recognition, and other is about medical biometrics. Their original ideas are from Chinese culture. For palmprint, we learned from palmistry in Chinese, which had some good knowledge about palmprint features for individual identification. Traditional Chinese Medicine (TCM) has a long and rich history over thousands of years. It has formed a deep and immense knowledge of medical science, theory, diagnostic methods, prescriptions and cures. It is a wonder that TCM doctors could cure countless patients without any assistant apparatus but only a physical examination. The four methods of diagnosis consist of observation, auscultation and olfaction, interrogation, pulse taking and palpation. However, these diagnosis methods are not suitable for our modern requirements. As a result, it is necessary to develop our research to solve these problems. The research team has
published a lot of papers on the related topics, developed several Biocomputing systems, and completed some project awarded afterwards. These are powerful evidence of the solid research background of the group. With the support of an integrated center, the research gains will be furthered. BRC, as one of the few complex bio-computing centers in the world, is sure to occupy a leading position in bio-computing field from the very beginning. The research results will provide a practical solution to the problems that are currently of importance and are growing in complexity. If the objectives of BRC are successfully achieved, they will represent a significant advancement in the area of bio-computing technology and will impact positively the set of tools currently utilized by various industries, especially by security applications.

How will the technologies of these areas develop further and move forward in the future?

Even there are many biometrics technologies and systems like fingerprint and face recognition, but we still need some good biometrics with highly accuracy and anti-counterfeiting. Palmprint authentication should be one of these best technologies.

Also, people may take more and more attention to healthcare. Our medical biometrics could do some body checking without painful and invasive treatment. We are putting our efforts into maintaining a few large databases to international standards, such as those on palmprints and tongues, which are open to all researchers. It is also driving multi-disciplinary research and collaboration with parties worldwide. As interest increases in the use of biometrics to verify identity, and demand grows for biometric identification to enhance security, biometrics technologies are emerging as powerful tools that incorporate other advanced IT technologies for various applications. Looking forward, we are moving in the direction of further development through technology transfers to support industrial applications and exploring new biometric solutions to practical problems for the benefit of society.
You have been chosen as one of the most influential scientific minds by Thomson Reuters recently, can you describe your journey to success?

The only thing I think that I may be a hard worker. Since 1980, I have been working on academic parts. I like my work very much and I am so interested in my research. I believe that research is the beginning of every technological advance, every life that has been improved, and every disease that has been successfully treated. I keep passion and find aims in my work, then the ultimate achievement is to take progressive steps daily to achieve that goal. Every day I remind myself about my goal and should do some work for achieving it.

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

In my daily life, I will teach classes, conduct research, attend seminars, review others’ research, mentor students and interact with other professionals all over the world. The diversity of the activities makes the job interesting. I work hard, keep passion and find aims in my work, the ultimate achievement is to take progressive steps daily to achieve that goal. Every day I remind myself about my goal and should do some work for achieving it. This give me the real sense of happiness, which is the real achievement in my daily work. Being a professor is unique and challenged, in that I investigate issues and topics that I find interesting and that have strong potential to lead advance study. There is relatively no structure put on the topics that I can research and learn about. Each research project and each class taught is a different experience. I can always improve my teaching and find new things to research, which also bring me a great sense of achievement. Although research might be boring as a researcher, it is to have research output that gives me the greatest sense of achievement in my work, having monographs published and paper highly cited, getting international impact and granted patents, having honors and training a lot of distinguished persons. I believe that research is the beginning of every technological advance, and the technology is changing our lives. So I hope my endeavor can help make our world a better place to live.
In your view, what is the role of computing in innovation and technology?

The ability to create and benefit from innovation plays a central role in income, employment and quality of life. Not only do innovations contribute to prosperity, but they are also increasingly important in addressing many computing challenges. Research-based competence plays an increasingly important role in the development of innovations and new technology. It is important to understand how, and under what conditions, research-based expertise can contribute to prosperity and address these challenges. What's happening in the access control system when you put your palm on it and then the door opens? How can a system give you your health suggestion by just capturing an image of your tongues? What makes our mobile devices do all the things they do? What's happening beneath the screen? People develop these innovative ideas and figure out how to make them happen so effortlessly for the user by computing. Coming up with ingenious ideas that have never been done before, and figuring out how to harness innovations with complex mathematics and technology to make them happen, are the challenges and passions of people majoring in computing.

Computer Science is the most creative and diverse of all the technology fields. If you can imagine an outcome, computing will give you the tools to create it. Computing is such a basic and necessary tool in our daily life now that I can't imagine how innovation and technology will carry on well without it.
Could you brief us about your education background?

I finished my primary and secondary school education in Hong Kong back in the 70’s. My first time in a co-ed school was the year in a university in Hong Kong. Then, I moved to Canada and completed my bachelor, master and doctorate degrees there. I obtained a double major in my undergraduate study focusing on computer science and mathematics. With the support of Natural Sciences and Engineering Research Council of Canada (NSERC), I studied my master degree in Waterloo and returned to Vancouver working as a statistician in a research hospital. It took eight years for me to complete my PhD study as a part-time student during which I enjoyed a lot. I joined the Department of Computing in 1994.

What are your recent research interests and how did you develop these interests? Please highlight the major trends in these topic areas?

During my undergraduate and master studies, my focus was on distributed systems and computer graphics. I started to work on the bioinformatics and database areas because of job requirements, and my PhD work was about concurrency control of spatial data. In the past years, I have been working on data mining, collaborative systems on web, and bioinformatics. Recently, I have been interested in teaching and learning and database work, thus, my focus is learning analytics for understanding student learning behaviors and their engagement levels. With the increasing influence of Massive Open Online Courses (MOOC)/ Small Private Online Course (SPOC), massive student data sources, including online and offline data, are now available. Big data techniques and models can be exploited for data transformations, model building, and behavioral analysis. Currently, we have a number of on-going projects partnering with different colleagues, including one from QEF on IT education.

Another active research of mine is social media analysis which was motivated from my involvement in anti-drugs and anti-smoking projects. In the past years, I have been awarded four projects funded by the Beat Drugs Fund. All these projects
have been using social media as a means to communicate and disseminate healthy lifestyle information to young students. Our team has been collecting social media contents, such as from Facebook, HK Forum, and Weibo, and developed platform/tools for detecting any potential drug abuse cases. The tool has been used by social workers and teachers for assisting their care of young people. It has been my pleasure to receive the President Award of Services in recognizing the above work.

What are the impacts of your research to the society in the long run?

As our motto says, “To learn and to apply, for the benefit of mankind”, our goal is to have the research work helping people. It is believed that by understanding students more through learning analytics, we can design better classes, subjects, curriculum, and other learning activities. The research results would also contribute as part of the data science area.

We learn that you are active in external activities, consultancy work and professional services, could you share with us more about your contributions and leadership?

It has been thankful of COMP and PolyU that have provided me many opportunities to serve outside PolyU. Besides involving in international research communities, I have been active in consultancy work and professional services. Every year, with the support of COMP and Esquel-Y.L. Yang Education Foundation, service learning trips have been organized to places including, Xinjiang, Guilin, and Guangzhou. With a strong interest in education, I started my service in the Hong Kong Examination and Assessment Authority in 1995. During these years, I have been a maker, a moderator, a chief examiner, and a council member of the Public Examination Board. My involvement extends to the curriculum design of the New Senior Secondary (NSS) Information and Communication Technology (ICT) subject and now is a member of a government secondary school management board.

For consultancy work, together with COMP and PolyU colleagues, I participated in and led a number of projects working with HKSAR government departments and companies, such as the Social Welfare Department, the Immigration Department, the Employment and Manpower Bureau, the Civil Service Training and Development Institute, and the Quality Education Funds. There are collaborations with different NGOs and hospitals as well. Most of the time, I serve on their committees and provide advice on IT training, system development, website designs and constructions, and advisory services. In 2013, I joined HKIE as a fellow member and became the Chairman of the Information Technology Division till now.
What is your approach to teaching and student development?

It is believed that our students should not only be academically sound. Regardless of academic performance, learning behaviors, or cultural backgrounds, I care for my students consistently and wholeheartedly. I would like my students to have intellectual and comprehensive development as well so that they can put theories into practice and contribute to the community. With that belief, I have employed the “FOCAL” approach in the teaching and learning development.

F.O.C.A.L., taken as a single word, is an apt description of the view on teaching and learning. Separately, each letter also represents a critical element in teaching and learning approach of the current and past effort.

- **Fostering**: encourage students of different backgrounds for the enrichment of learning experience and growth;
- **Opportunities**: develop and create new opportunities for students to be excel and well prepared for their career advancement;
- **Connection**: broaden the views of our students, connect them with different groups of people for better learning and professional development, as well as coaching them as part of our community;
- **Application**: continually develop new teaching and learning methodologies, curriculum, subject syllabi for students to learn professional knowledge and generic skills for handling real-life problems;
- **Learning**: disseminate and share the good practices of teaching and learning experience in PolyU and the community.

Could you share some of your achievements in enriching students’ learning experience?

Good teaching and learning start with well-planned curriculum and adopting good teaching pedagogy. Peer learning, in the form of peer assessment or open presentations, has frequently been practiced, and my students are asked to present their answers in classes for sharing. Although students may not be able to provide correct answers immediately, they can have deep learning during presentations, and gain just-in-time explanations from the lecturer. To further strengthen students’ interactions in class, flipped classroom arrangement has been evolved in some classes of my subjects. Students are formed into groups with members from different levels and backgrounds so that they can complement and learn from each other.
I have been working with different colleagues in COMP and other places for innovative teaching and learning methodologies. With the support of the Teaching and Learning project funds, we experimented with flipped classroom teaching in Spring 2015. By adopting tools such as OpenEdX and PeerWise, different teaching pedagogies can be applied for better learning enrichment. For example, with OpenEdX, sets of materials, including video clips, mini-tests and animations are provided to students for supporting our flipped classes. Peerwise is used for students to answer and discuss questions created by their peers, giving students a new perspective on learning.

I am eager to create opportunities for students to learn and be excelled. Since 2014, I have been a key member of our department’s Challengers Program, which is an extra-curriculum program for students’ all-roundness development. Since then, I have organized, coached and led teams of students to participate in competitions, such as IEEE Extreme Programming 2015 (Ranked 55th out of over 2000 teams globally), Asian Supercomputing Challenges 2014 (First Class Award), Wuxi Outsourcing Competition 2013 (Entrepreneurial Star Award) and Taiwan Innovation Contest 2013. I have also led some exchange trips such as Tianjin International Summer Camp 2013, Sichuan Microsoft Summer Camp 2014, Beijing Jiaotong University Summer Camp 2014 and Taiwan Tamkang University Summer Camp 2015.

It has been long realized that an individual can only have a limited scope of achievements. It is essential for students to enrich their learning experience by connecting to real-world problems. Other than bringing actual business scenarios to my classes from companies and organizations, a team of us have developed a multidisciplinary student project for students in COMP, SHTML and ELC since 2011. Under this joint effort, different modes of blended learning can be adopted and good feedbacks have been collected from our students.

Our effort does not stop within PolyU. Internationalization is important for students. For the past two years, I have been actively working to establish different types of international connections for COMP students. Besides regular exchange opportunities, we have set up departmental international student projects with Tsukuba University in Japan and Tamkang University in Taiwan. Students from different universities formed into different teams, and they worked together towards the same project goal.

To have a better impact, besides assigned teaching duties, I have participated in different professional groups, such as CoP of e-learning in PolyU, HKEAA (as examiner), and CDI/EDB (as curriculum development member), to learn and share teaching methodologies and curriculum design. I have initiated, led, and engaged in different activities and Teaching and Learning projects in PolyU, Education Bureau and Quality Education Fund.