Network Science and Graph Computing

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12:00–1:00 pm, Thursday, Nov. 21, 2013, KHE119

ABSTRACT

In the Big Data era, data are linked and form large graphs. Traditional IT system was designed to process independent data. Analyses are mostly done by considering i.i.d. scenario. Processing connected data has been a big challenge. From the scientific aspect, Network as a new inter-disciplinary scientific field is emerging. Entities -- people, information, societies, nations, devices -- connect to each other and form all kinds of intertwined networks. Researchers from multiple disciplines -- electrical engineering, computer science, sociology, public health, economy, management, politics, laws, arts, physics, math, etc. -- are interacting with each other to build up common grounds of network science. Network theories are being formed for describing the dynamics, behaviors, and structures. A systematic mathematical formalism that enables predictions of network behavior and network interactions is also emerging. Trans-disciplinary approaches are usually required to lay the foundations of this science and to develop the requisite tools. Like 'Computer Science' was coined as an academic discipline in the 1950s and the first computer science course was taught by IBMers in Columbia University in 1947, we are now envisioning the emerging of 'Network Science'.

Graph Computing is the "tool" for Network Science. It is for storing, processing, analyzing, and visualizing connected data. I am going to introduce my team's work on System G, which is the first complete software stack for all aspects of Graph Analytics. Different combination of System G components can be selected to fit different solution needs. Graphs may be large or small, static or dynamic, topological or semantic, properties or Bayesian. System G is flexible to allow solutions to pick the components they need while providing common APIs for different layers. These flexibilities are especially suited for Big Data in the Service and Cloud environment.

BIOGRAPHY

Dr. Ching–Yung Lin is leading the Network Science Department at IBM T. J. Watson Research Center on the research of Graph Computing and Computational Social & Cognitive Sciences. He received his Ph.D. from Columbia University in 2000 in Electrical Engineering. He was also an Affiliate Assistant/Associate Professor in the University of Washington 2003–2009, and an Adjunct Associate/Full Professor in Columbia University since 2005. Ching–Yung was the first IEEE Fellow cited for contribution on Network Science. He is leading more than 40 Ph.D. researchers in worldwide IBM Research Labs and 8 U.S. universities, to advance fundamental and applied research on (1) Network Graph Database, Middleware/Hardware, Analytics and Visualization, and (2) Social and Cognitive Science including Multimodality Behavioral Understanding, Organization Collaboration, Cognitive Security, and Commerce. Ching–Yung’s project teams won the Best Paper Awards of 2012 ACM Intl. Conf. on Information and Knowledge Management (CIKM) and 2013 IEEE Intl. Cong. on Big Data (BigData). He is a recipient of 2011 AIS Intl. Conf. on Information System (ICIS) Best Theme Paper Award and 2003 IEEE CAS Society Young Author Award. His research and invention was featured by BusinessWeek magazine four times, including being the Top Story of the Week in April 2009, and was selected to be the Best Practice and Industry Leader for Expertise Location by APQC in 2013. He was the Editor of the Interactive Magazines (EIM) of the IEEE Communications Society (2004–2006), and a Guest Editor of the Proceedings of IEEE -- Special Issue on Digital Rights Management 2004, the EURASIP Journal on Applied Digital Signal Processing -- Special Issue on Visual Sensor Network 2006, the IEEE Trans. on Multimedia -- Special Issue on Communities and Media Computing 2009, the IEEE Journal on Selected Area in Communications -- Special Issue on Network Science 2013, and the Journal of Multimedia -- Special Issue on Social Multimedia Computing 2013. Ching–Yung was the Chair of the IEEE ICME 2009 and the Chair of CAS Society Multimedia TC 2010–2011, the Chair of Steering Committee of ACM SIG Health Informatics (IHI) 2009–2012, and is representing the CAS Society to form the new IEEE Trans. on Network Science and Engineering. He was a keynote speaker at the Web 2.0 Expo at New York Javitz Center in 2009 and is a member of the Academy of Management. Professor Goh’s interest in the education of scientist-entrepreneurs led her to introduce a non-credit series in 2004, which led to what is now known as Entrepreneurship101 at MaRS, the flagship entrepreneur training program of the MaRS Discovery District, with over 1500 registered attendees annually. In 2012, as Director of the IOS, she introduced Techno2010, a one-month intensive training program specifically geared for university scientists intending to build a tech-based company. Techno2010, 2011 and 2012 have led to the creation of over 35 start-ups based on the results of scientific research, many of which now have sales and follow-on funding.