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Université Mohammed V de Rabat

Seminar for PHD Students

Next Generation Digital Systems: The Convergence of AI, Blockchain, and Quantum Computing

IC Technology and computing: Past, present, and future

Moderator : Amine Berqia

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Next Generation Digital Systems: The Convergence of AI, Blockchain, and Quantum Computing
Ismail Khalil

Abstract: The world is rapidly evolving towards a digital future, with advances in technology transforming the way we live, work, and learn. The convergence of artificial intelligence (AI), blockchain, and quantum computing represents a significant leap in the development of digital systems. This talk will explore the impact of these cutting-edge technologies on education, economy, finance, and health.

AI has already started to revolutionize the education sector by offering personalized learning experiences and automating administrative tasks. In the economy, AI is transforming the way we work, enabling businesses to make data-driven decisions and automate processes. Meanwhile, blockchain technology is transforming the financial sector by providing a decentralized and secure platform for transactions, while quantum computing is unlocking new possibilities in areas such as drug discovery and cryptography.

The talk will discuss the benefits and challenges associated with each of these technologies and explore their potential applications in education, economy, finance, and health. Furthermore, it will highlight the need for a multidisciplinary approach to harness the full potential of these technologies and address ethical and societal concerns.

The talk will conclude by providing insights into the intersection of AI, blockchain, and quantum computing and their impact on the future of digital systems. The talk will be of interest to anyone interested in the future of technology and its potential to transform our lives.

About the speaker

Ismail Khalil
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Ismail Khalil is currently serving as the deputy head of the institute of telecooperation at Johanes Kepler University Linz, Austria, since October 2002. In addition, he is an Adjunct Professor at the Faculty of Science and Technology (FST), Syarif Hidayatullah State University Jakarta, Indonesia. He is also the President of the Web Applications Society (@WAS). Dr. Khalil is a distinguished scholar with an impressive academic background. He holds a PhD in Computer Engineering and received his habilitation degree in Applied Computer Science for his work on agents interaction in ubiquitous environments in May 2008. He has extensive experience teaching, consulting, and conducting research in artificial Intelligence, mobile, cloud, edge Computing, agent technologies, and web intelligence, with a keen interest in the broader business, social, and policy implications associated with emerging information technologies. Prior to joining Johannes Kepler University Linz, he was a research fellow at the Intelligent Systems Group at Utrecht University, Netherlands from 2001-2002, and the project manager of the AgenCom project at the Software Competence Center Hagenberg Austria from 2000-2001. Dr. Khalil has authored around 150 scientific publications, books, and book chapters, and serves as the Editor-in-Chief of five international journals and two book series. His work has been published and presented at various conferences and workshops and received widespread recognition and acclaim. Dr. Khalil's significant contributions to the field of computer engineering have earned him a reputation as a thought leader in the industry. He continues to inspire and motivate students and researchers alike, and his work has helped shape the direction of the field.

IC Technology and computing: Past, present, and future

Said Hamdioui

Abstract: No one can deny the fact that we rely heavily on electronic systems in our daily life. It is almost impossible to imagine a day without your smart phone, computers, TV or even our coffee-machines. Without electronics, business/work couldn't continue any more, the quality of education would degenerate, and the life quality probably turn back to the 18th century. Moreover, the wide spread of internet being able to generate huge data sets, combined with the introduction with powerful computing platforms (e.g., GPU based) being able to deliver significantly high computing throughput, have enabled the deployment of Artificial intelligence (AI) starting from 2010 on. AI has now evolved into a technology that is revolutionizing the world in many application domains. Electronics are made accessible and affordable for almost everyone in the globe due to technology scaling, and the deployment of AI for real applications is made feasible due to advances in computer architecture hardware. Nevertheless, both the technology scaling and computer architectures are facing major challenges calling for new innovations and breakthroughs in order sustain and extend the use of electronics and AI at large, but then at affordable cost. For instance, IC scaling is making the devices less reliable, while deploying AI for edge applications is extremely demanding in terms of energy efficiencies that today's computer architectures cannot deliver. This talk addresses the CMOS device technology scaling as a financial model and its impact on different aspects of IC, as well as emerging device technologies and their potential in enabling alterative computing paradigms. The talk starts first with highlighting the fundamental invention that made the electronic system a reality: from transistors to Integrated Circuits (ICs). Then, the talk addresses the basics of scaling, together with its impact on integration density, performance, power and in particular reliability. Thereafter, the technology outlook is analyzed in order to extract future challenges, both for near and long terms. IC realization process will be (re)defined while considering the technology trends and business pressure, and ways for the realization of future chips will be discussed. The talk thereafter gives an overview of emerging devices and how they will enable not only huge storage but also energy efficient computing paradigms needed to deploy AI at large (e.g., for edge Internet-of-things (IoT) devices). The major bottlenecks of today's computer architectures will be highlighted. A classification of the sate-of-the art computer architectures will be given while highlighting how the trends is going toward computation-in-memory (CIM) architectures. The concept of CIM based is discussed and logic and arithmetic circuit designs using such devices and how they enable such architectures are covered. The strong dependency of application domains on the selection of appropriate CIM architecture and its building blocks, as well as the huge potential of CIM (in realizing order of magnitude improvement in terms of energy efficiency) are illustrated based on some case studies and chip prototypes. Future CIM challenges including architectures, design, test, and reliability are highlighted.

About the speaker

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Said Hamdioui (http://www.ce.ewi.tudelft.nl/hamdioui) is currently head of the Quantum and Computer Engineering department of the Delft University of Technology, the Netherlands. He is also co-founder and CEO of Cognitive-IC, a start-up focusing on hardware dependability solutions. Hamdioui received the MSEE and PhD degrees (both with honors) from TUDelft. Prior to joining TUDelft as a professor, Hamdioui worked for Intel Corporation (Califorina, USA), Philips Semiconductors R&D (Crolles, France) and Philips/ NXP Semiconductors (Nijmegen, The Netherlands). His research focuses on two domains: emerging technologies and computing paradigms (including memristors for logic and storage, in-memory-computing, neuromorphic computing, low power HW architecture for edge AI, etc.), and hardware dependability (including Testability, Reliability, Hardware Security Hamdioui owns two patents, has published one book and contributed to other two, and had co-authored over 250 conference and journal papers. He has consulted for many worldwide semiconductor companies such as Intel, Atmel, Renesas, etc. He delivered dozens of keynote speeches, distinguished lectures, and invited presentations and tutorial at major international forums/conferences/schools and at leading semiconductor companies. Hamdioui served as Associate Editor of IEEE Transactions on VLSI Systems VLSI (2015-2018), and he was on the editorial board of Microelectronic Reliability Journal (2019-2020) and of the Journal of Electronic Testing - Theory and Applications JETTA (2011-2019). He is current a member of Editorial Board of ACM Journal on Emerging Technologies in Computing Systems (2020-present) and of IEEE Design & Test (2013-present). Hamdioui is the recipient of many international/national awards. E.g., he is the recipient of European Design Automation Association (EDAA) Outstanding Dissertation Award in 2003, the European Commission Components and Systems Innovation Award for most innovative H2020 project at European Forum for Electronic Components and Systems in 2020, HiPEAC Technology Transfer Award in 2015 and 2022, etc. In addition, he received many Best Paper Awards and nominations at many leading international conferences (e.g., Design Automation and Test in Europe DATE, International test Conference ITC, IEEE Computer Society Annual Symposium on VLSI, IEEE International Conference on Computer Design, IEEE European Test Symposium, etc.). Moreover, he was appointed as an IEEE Circuits and Systems Society (CASS) Distinguished Lecturer for 2021-2022/ He is a leading member of Cadence Academic Network on Dependability and Design-for-Testability, a member of AENEAS Scientific Committee Council (AENEAS =Association for European NanoElectronics Activities), and a Senior member of the IEEE.