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Tuesday, May 26 15:00 - 17:00

TUT I: Tutorial 1: On the Security of Wireless Systems: A Cyber-Physical System Perspective

Prof. Gunes Karabulut Kurt, Istanbul Technical University, Turkey

Chair: Toktam Mahmoodi (King's College London, United Kingdom (Great Britain))

The user demand and data transmission rates are ever-increasing in wireless communication networks. However, due to the broadcast nature of wireless links, connections are inherently risky. In recent years, advances in the field of secure wireless communications have been made in the physical layer including beamforming and artificial interference approaches. However, these works are yet to be used for cyber-physical systems (CPS), which will enable us to interconnect all elements of industrial production processes. CPSs contain stringent requirements such as a maximum allowed latency, in addition to the commonly known metrics as security capacity. Existing Physical Layer (PHY) security solutions fail to address these requirements. This tutorial will address the requirements that are necessary to establish a secure CPS communications framework, along with an overview of the state-of-the-art and open challenges. A generalized problem description will be provided, and the theoretical performance limits will be overviewed. Attack types and current tools for secure wireless system designs will be covered. Application-based requirements for the CPS systems will be addressed. The promise of machine learning solutions will be highlighted. The tutorial will be concluded with a future outlook and current open issues.

TUT III: Tutorial 3: Moving Towards Zero-Touch Automation, A Key Enabler for 6G: Addressing the Training Data Sparsity/Scarcity Challenge

Prof. Ali Imran, Director AI4Networks Research Center, William H. Barkow Presidential (Associate) Professor, ECE, The University of Oklahoma, USA, CTA AISON

Chair: Albena Mihovska (SDSU, USA)

Despite the recent success of AI for enabling automation in other domains, in mobile networks attempts towards AI powered zero touch automation are hampered by a fundamental challenge: The sparsity and scarcity of the training data in mobile networks. Unlike many other native applications of AI, real cellular data for training AI is generally both scarce and sparse. This is because operators generally do not test a wide range of parameters on live network, and whatever data they have cannot be extracted and shared easily. This limits the utility of some of the most powerful AI tools such as DNN for solving many practical problems in mobile networks; Without addressing this challenge explicitly and timely, despite the hype and hopes, full potential of AI cannot be harnessed for mobile networks. Leveraging insights from presenter's heavy involvement in several cutting-edge projects on the topic, the goal of this tutorial is to share promising approaches for addressing the data sparsity challenge to ultimately enable zero touch automation in 6G. Some of the approaches to be discussed include, domain aware data augmentation methods for cellular network data, use of generative adversarial networks (GANs), leveraging different types of network geometries and novel methods for realistic synthetic data generation to address the sparsity challenge. The tutorial will conclude with introduction of new real problems of mobile industry interest that require AI based solutions and potential solution approaches and opportunities therein to trigger the much-needed focused research effort towards zero touch automation.

Tuesday, May 26 17:00 - 19:00

TUT II: Tutorial 2: Civil drones traffic management: Wireless communication for safe UAV

Evgenii (Genia) Vinogradov, KU Leuven, Belgium Franco Minucci, KU Leuven, Belgium Aymen Fakhreddine, Lakeside Labs, Austria

Chair: Lela Mirtskhulava, Lm. (Iv. Javakhishvili Tbilisi State University & San Diego State University Georgia, Georgia)

Unmanned Aerial Vehicle (UAV)-enabled solutions are becoming very popular. UAVs (or drones) are attractive owing to their flexibility and potential cost efficiency in comparison with conventional aircraft. While in some countries drones are perceived as "game changers" and "development enablers", in other areas, the public is rather concerned about safety and security issues aroused by the UAV-use. Moreover, it is not fully understood how the wide-scale drones' applications will influence conventional Air Traffic Management (ATM). National and supranational authorities (e.g., Federal Aviation Administration - FAA, European Union Aviation Safety Agency - EASA, International Civil Aviation Organization - ICAO) and industrial actors (Amazon, Google, DJI) are now developing systems for UAV Traffic Management. These services and products are vital for establishing trust between the authorities, the public, and industry. As it is anticipated that UTM and ATM systems will, at some point, coincide or overlap, the common terminology and approaches are vital. Given UAVs mobility, high speed and adaptive altitude, the communication with UAVs will have to rely on several technologies to ensure the targeted reliability. Cellular networks and LWAN could potentially be good candidates. This tutorial will shed lights on how connecting UAVs via several popular technologies ranging from WiFi (and others, part 2) to cellular networks (part 3). We will discuss the technical challenges that drone-connected networks research has to deal with. We report and discuss throughput, interference and handover measurements for an aerial drone connected the aforementioned networks.

The tutorial consists of three main parts. The first part (given by E. Vinogradov) is dedicated to describing the traffic management system architecture, requirements, terminology, and services. Moreover, he will give a quick overview of existing technologies that can be useful for aerial deconfliction. In the second part, F. Minucci will focus wireless technologies used for the tactical (while flying) deconfliction: ADS-B, p2p LoRa, WiFi, FLARM. These technologies require only on-board equipment. The use of ground infrastructure will be investigated by A. Fakhreddine in the third part of the tutorial on the example of using LTE-A. The second and third parts are mostly based on the extensive measurement campaigns.

TUT IV: Tutorial 4: Satellite Communications: present and future

Prof. Arie Reichman, Ariel University and Ayecka Communication Systems

Chair: Mehmet Ulema (Manhattan College, USA)

After more than 60 years of history, the satellite communication continues to grow in all terms of capacity, number of systems and users and applications competing and cooperating with wireless communications. The latest challenges are high throughput satellite (HTS) systems using GEO satellites and multi beam Ka band technology and 'newspace' LEO Constellation systems that would provide low latency global Internet access at high data rates.

The satellite communication has unique features that make it vital and growing mean of communication. This tutorial is meant to provide the audience an overview of present satellite communication methods and systems, how it works and its application. The focus is to present the new goals with GEO and MEO and LEO satellites. This tutorial will be suitable for all those engineers who wish to learn the present methods of satellite communication based on international standards at different frequency bands and the future systems that are under development. After completing this tutorial, you will be able to understand the types of satellite communication in the present and in the future, its performance and applications.

Wednesday, May 27 15:00 - 16:00

Opening and Keynote: Opening and Keynote-I

Complex Networks
Prof. Ljiljana Trajkovic (Simon Fraser University, Burnaby, British Columbia, Canada)

Chair: Mehmet Ulema (Manhattan College, USA)

The Internet, social networks, power grids, gene regulatory networks, neuronal systems, food webs, social systems, and networks emanating from augmented and virtual reality platforms are all examples of complex networks. Collection and analysis of data from these networks is essential for their understanding. Traffic traces collected from various deployed communication networks and the Internet have been used to characterize and model network traffic, analyze network topologies, and classify network anomalies. Data mining and statistical analysis of network data have been employed to determine traffic loads, analyze patterns of users' behavior, and predict future network traffic while spectral graph theory has been applied to analyze network topologies and capture historical trends in their development. Recent machine learning techniques have proved valuable for predicting anomalous traffic behavior and for classifying anomalies in complex networks. Further applications of these tools will help improve our understanding of the underlying mechanisms that govern behavior, improve their performance, and enhance their security of social networks such as Facebook, LinkedIn, Twitter, Internet blogs, forums, and websites.

Wednesday, May 27 16:00 - 17:30

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Keynote II: Keynote II

Wireless Access Architecture: The Next 20 Years
Prof. Halim Yanikomeroglu (Carleton University, Ottawa, Canada)

Chair: Burak Kantarci (University of Ottawa, Canada)

The wireless community has been occupied by the 5G related developments for the last many years. As 5G moves from the standardization phase to the deployment phase, a new brainstorming endeavour has started for the subsequent generation (6G) wireless networks. The roots of today's wireless access architecture (the terrestrial 4G & 5G cellular network) go back to 1940s. The access architecture has evolved substantially over the decades. However, rapid developments in a number of domains outside telecommunications, including those in aerospace and satellite industries as well as in artificial intelligence, will likely result in a disruptive transformation in the wireless access architecture in the next 20 years. In this talk, an ultra-agile, dynamic, distributed, and partly-autonomous vertical heterogeneous network (VHetNet) architecture with very low earth orbit satellites (VLEOs), high-altitude platform stations (HAPS), and drone BSs for almost-ubiquitous super-connectivity will be presented. In this disruptive setting, free-space optical (FSO) communications will play an important role in addition to the legacy radio communications. In the absence of a clear technology roadmap, the talk has, to a certain extent, an exploratory view point to stimulate further thinking and creativity in ICT research and innovation.

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Friday, May 29 15:00 - 16:00

Keynote III: Keynote III

AI-based Automation for Beyond 5G Networks
Xavier Costa-Pérez, (5G Networks R&D, NEC Laboratories Europe)

Chair: Larysa S. Globa (National Technical University of Ukraine "KPI", Ukraine)

AI-based automation allows service providers to reduce CAPEX and OPEX costs and offer, via proper abstractions, infrastructure resources (radio, networking, computing) to vertical sectors traditionally alien to the telco industry (e.g., automotive, health, construction). In this talk we will review AI-enabled automation solutions and explore the concept of resources overbooking to maximize the revenue of infrastructure providers. Hierarchical control plane solutions will be considered to manage the network in an automated manner. Then, some early implementations of proof-of-concepts will be reviewed to evaluate the automation gains potential. Finally, we will illustrate how such automation solutions can be used in Beyond 5G networks comprising industry verticals.

Friday, May 29 16:30 - 17:30

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Chair: Andrii A. Astrakhantsev (National Technical University of Ukraine Igor Sikorsky Kyiv Polytechnic Institute & Samsung R&D Institute Ukraine, Ukraine)

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SDN: Software Defined Networking

Chair: Alexander D. Gelman (NETovations, USA)

SS IV: Special Session - Recent Results in Wireless Communications IV

Chair: Evgeny Khorov (IITP RAS, Russia)