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## Machine Learning in NextG Networks via Generative Adversarial Networks

#AI #NextG #Machine #Learning #Adversarial #Networks

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Generative Adversarial Networks (GANs) implement Machine Learning (ML) algorithms that have the ability to address competitive resource allocation problems together with detection and mitigation of anomalous behavior. In this talk, we discuss their use in next-generation (NextG) communications within the context of cognitive networks to address i) spectrum sharing, ii) detecting anomalies, and iii) mitigating security attacks. GANs have the following advantages. First, they can learn and synthesize field data, which can be costly, time consuming, and non-repeatable. Second, they enable pre-training classifiers by using semi-supervised data. Third, they facilitate increased resolution. Fourth, they enable recovering corrupted bits in the spectrum. The talk will provide basics of GANs, a comparative discussion on different kinds of GANs, performance measures for GANs in computer vision and image processing as well as wireless applications, a number of datasets for wireless applications, performance measures for general classifiers, a survey of the literature on GANs for i)–iii) above, some simulation results, and future research directions. In the spectrum sharing problem, connections to cognitive wireless networks are established. Simulation results show that a particular GAN implementation is better than a convolutional auto encoder for an outlier detection problem in spectrum sensing.

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## Speakers

**Ender Ayanoglu**



Biography:

Ender Ayanoglu received the Ph.D. degree from Stanford University, Stanford, CA in 1986, in electrical engineering. He was with the Communications Systems Research Laboratory, part of AT&T Bell Laboratories, Holmdel, NJ until 1996, and Bell Labs, Lucent Technologies until 1999. From 1999 until 2002, he was a Systems Architect at Cisco Systems, Inc., San Jose, CA. Since 2002, he has been a Professor in the Department of Electrical Engineering and Computer Science, University of California, Irvine, Irvine, CA, where he served as the Director of the Center for Pervasive Communications and Computing and held the Conexant-Broadcom Endowed Chair during 2002-2010. His past accomplishments include invention of the 56K modems, characterization of wavelength conversion gain in Wavelength Division Multiplexed (WDM) systems, and diversity coding, a technique for link failure recovery in communication networks employing erasure coding introduced in 1990, prior to the publication of the first papers on network coding. During 2000-2001, he served as the founding chair of the IEEE-ISTO Broadband Wireless Internet Forum (BWIF), an industry standards organization which developed and built a broadband wireless system employing Orthogonal Frequency Division Multiplexing (OFDM) and a Medium Access Control (MAC) algorithm that provides Quality-of-Service (QoS) guarantees. This system is the precursor of today's Fourth and Fifth Generation (4G and 5G) cellular wireless systems. From 1993 until 2014, Dr. Ayanoglu was an Editor, and since January 2014 is a Senior Editor of the IEEE Transactions on Communications. He served as the Editor-in-Chief of the IEEE Transactions on Communications from 2004 to 2008. From January 2015 until December 2016 he served as the Editor-in-Chief of the IEEE Journal on Selected Areas in Communications - Series on Green Communications and Networking. This series published three special issues with record number of papers. He led the efforts to start the IEEE Transactions on Green Communications and Networking and served as its Founding Editor-in-Chief from August 2016 to August 2020. From 1990 to 2002, he served on the Executive Committee of the IEEE Communications Society Communication Theory Committee, and from 1999 to 2002, was its Chair. Dr. Ayanoglu is the recipient of the IEEE Communications Society Stephen O. Rice Prize Paper Award in 1995, the IEEE Communications Society Best Tutorial Paper Award in 1997, the IEEE Communications Society Communication Theory Technical Committee Outstanding Service Award in 2014, and the IEEE Communications Society Joseph LoCicero Award for outstanding contributions to IEEE Communications Society Journals as Editor, Editor-in-Chief (EiC), and the founding EiC in 2023.. He has been an IEEE Fellow since 1998. He served as an IEEE Communications Society Distinguished Lecturer in 2022-2023. He is serving a second term as the IEEE Communications Society Distinguished Lecturer in 2024-2025.

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