IEEE Transactions on Microwave Theory and Techniques

Special Issue

AI and Machine Learning Based Technologies for Microwaves

Machine learning and AI have experienced phenomenal success in the past decade in signal processing, image and speech recognition, robotics, autonomous systems and more. This success is also coupled with the expanding applications of machine learning and AI in broad areas of science and engineering. The microwave community is among the earliest in exploring machine learning and artificial neural networks (ANN) for wireless and wireline electronic device, circuit and system designs. In recent years, there is a significant increase in the interests and activities in applying machine learning and AI not only at device/circuit level modeling and design, but also at system and higher-level applications. Stimulated research and applications leads to novel methodologies of microwave oriented machine learning techniques, such as new ANN, support vector machine and Gaussian process based approaches, automated modeling, deep learning; in addition to an expanding scope of microwave problems that are addressed by machine learning and AI, from electromagnetic structural modeling and design, multi-physics modeling, microwave filter/multiplexer design, GaN HEMT modeling, PA behavioral modeling, digital predistortion design, oscillator design, SIW diagnosis, MEM sensor modeling, design of high-speed VLSI packages and microsystems, wireless power transfer, MIMO transmitter design and more. Further applications of machine learning at system level are creating breakthrough capabilities of microwave systems, such as electromagnetic-based image reconstruction for medical or security applications, and dynamic spectrum allocation for next generation wireless systems.

This special issue will bring the subject into focus, creating a forum for researchers and engineers. The special issue aims to stimulate in-depth overviews, thought-provoking formulations, novel methodologies and applications. Topics include, but are not limited to:

- Electromagnetic parameterized modeling and optimization using machine learning
- Nonlinear device and circuit behavioral modeling using machine learning
- Novel machine learning/AI paradigm and knowledge-based methods to microwave design
- Evolutionary algorithms for microwave design optimization
- Cognition-aided design exploiting cognitive science approaches for microwave design
- Application of machine learning for uncertainty quantification and yield optimization
- Machine learning and AI oriented multi-physics modeling for high power devices and high-speed microsystem structures
- Dynamic neural network methods for VCO design
- Machine learning for SIC/SIW modeling and diagnosis
- ANN for modeling and design of high-speed interconnect systems, IC power delivery networks, and I/O drivers/receivers in VLSI packages
- Application of machine learning to modeling RFIC inductors, and embedded passives
- Machine learning methods in design of microwave filters/multiplexers, such as waveguide filters, SIW filters, dielectric resonator filters, reconfigurable filters, and more
- Application of machine learning to modeling of sensors, and MEM devices
- Application of machine learning in device noise modeling, and behavioral modeling such as HBT modeling, and GaN HEMT modeling with electrothermal and trapping effects
- Application of machine learning to PA modeling and digital predistortion design

- Application of machine learning to transmitter/receiver design including design of MIMO transmitters, wideband receiver calibration and more
- Application of machine learning for modeling and design for wireless power transfer
- Application of machine learning for modeling and design of microsystems with 3-D heterogeneous integrated circuits technology
- Machine learning approach to electromagnetic/microwave-based image reconstruction, sensing, gesture recognition and applications for health-monitoring, medical or security systems
- Machine learning for automotive radar detection, object localization, classification and applications in autonomous systems
- Intelligent RF system design, machine learning for signal detection and classification, spectrum monitoring, dynamic spectrum allocation, and channel optimization; AI in wireless systems, modulation identification, and RF fingerprinting
- Emerging applications of machine learning and AI for wireless systems from megahertz to terahertz.

Authors should consult the link https://www.mtt.org/author-information-transactions/ for submission instructions.

The submission deadline is **February 26, 2022**. Expected publication August 2022.

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