IEEE Microwave Magazine

Special Issue on

Machine Learning in Microwave Engineering

Sponsoring Technical Committees:

> MTT-1 (IEEE MTT-S Technical Committee on Field Theory and Computation)
> MTT-2 (IEEE MTT-S Technical Committee on Design Automation)

Summary:

The remarkable advances in the available computational power over the past few years, and those anticipated to come, have propelled machine learning algorithms (some developed decades ago) to the forefront of R&D in a wide and diverse range of fields: from medicine to autonomous vehicles and robotics. As the interest in the algorithms deepens, new algorithmic and theoretical developments are reported and applications are explored. These are assisted by the availability of open-source software tools and libraries, such as Google's TensorFlow and PyTorch.

This issue will focus on the relevance and importance of machine learning for microwave engineers and their CAD tools, as used in industry and academia. We are combining a review of the field, its rich past in the microwave community (where artificial neural networks -ANNshave been used as tools for microwave device modeling for many years) and its prospects, as developments in "deep learning" push the envelope of traditional ANNs even further, creating new opportunities to be harnessed.

The topic of this issue is timely, relevant and important to the MTT community. Machine learning is recognized as an area that is playing a key role in deepening our understanding and expanding the applications of various technologies, from medicine to image processing to robotics. Some of the machine learning techniques, notably artificial neural networks, have been well known and widely applied in the microwave community for many years. However, as the field is expanding, new opportunities are created. For example, it may be possible for multilayer neural networks to "learn" the complete physics of various microwave problems, as opposed to just the dependence of the S-parameters of a transistor on its geometric and material parameters.

Also, a microwave engineer may be wondering: how do I harness these opportunities in machine learning? Indeed, there are several open-source packages that are useful when one enters the field. And lastly: how do we tell apart hope from hype? The issue is aimed at addressing these questions, by combining a review of past machine learning related activities in MTT-S, current opportunities and future prospects.

The special issue will build on a very successful workshop, held in IMS2019, and will include feature articles from the workshop contributors, Q.J. Zhang, M. Swaminathan, Z. Peng, L. Zhang and C. Sarris in addition to papers from other submissions.

The special issue is expected to appear in 2021.

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