Editorial: Special Topic on Machine Learning for Wireless Networks

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Guest Editor

Success in applying deep learning in speech recognition had triggered a resurgence of interests in deep learning, starting around 2010. Since then, deep learning has been applied with remarkable results to many problems, such as image recognition, speech and image synthesis, natural language processing, finance and artificial intelligence such as game playing. The success owes much to the availability of large amount of data, improved computational capabilities, and advances in algorithms.

As a specific form of machine learning, the success of deep learning demonstrates the tremendous power and versatility of machine learning in providing alternative solutions to a large array of problems. From a communication and networking engineer's perspective, it is only natural to consider applying machine learning, and deep learning more specifically, to engineering problems in communication and networking. There is a somewhat natural divide among the researchers and practitioners in the area. While some researchers have embraced machine learning enthusiastically, viewing it as yet another powerful tool to have in the tool chest, others are doubtful as to how much benefit these tools can offer, insisting on a model-based approach that has been very successful so far.

It is our hope that this special issue can add to the debate and discussion between these schools of thoughts, by providing a few more data points which demonstrates some more successes of using machine learning in solving engineering problems, and in doing so, may also reveals some shortcomings of such approaches (hopefully to a smaller extent), for example in the requirement of large amount of data, the complexity of the algorithms, and the lack of interpretability of the obtained designs.

The special issues includes a paper by Zöchmann, titled "A Framework for Active Learning of Beam Alignment in Vehicular Millimetre Wave Communications by Onboard Sensors", which proposes a Doppler bearing tracking regression algorithm that tracks the strongest multipath components for antenna beam alignment in vehicular millimetre wave communications. The obtained geometric information enables active learning algorithm to select interesting training data. The papers "A Novel Real-time System for Traffic Flow Classification and Prediction" and "A Network Traffic Prediction Method Based on LSTM" apply machine learning to the problem of network traffic prediction, where the former one uses dynamic time wrapping, XGBoost and wavelet transform, while the latter uses more recent long short-term memory (LSTM) networks. The paper "Potential Off-Grid User Prediction System Based on Spark" advertises a comprehensive machine learning based system for predicting user churning behaviors. Last but not least, the paper "Detecting Abnormal Start-Ups, Unusual Resource Consumptions of the Smart Phone: A Deep Learning Approach" proposes to use LSTM for detecting cell phone application behaviors, which although is not a communication/network problem, fits well the general theme of applying machine learning to engineering design.

We hope the readers will enjoy the special issue and can decide for themselves which side of the fence they choose to reside. It is entirely acceptable to tear down the fence and adopt a model-based machine learning approach as well.

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