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IEEE Journal of Selected Topics in Signal Processing: Special Issue on Machine Learning for Cognition in Radio Communications and Radar (ML-CR^2)

While machine learning is achieving ground breaking success in speech recognition, computer vision, natural language processing and business analytics, its impact on radio communications, and on the associated problem area in signal processing, has been less pronounced mainly due to the lack of 'big data' and big applications. However, in the era of the Fifth Generation (5G) cellular systems and Internet-of-Things (IoT), some significant changes are under way. For example, as 5G cellular systems demand huge capacity, massive connectivity, high reliability and low latency, acquiring adequate resources to operate such systems is difficult and novel models and algorithms are needed to help improve spectrum utilization by leveraging large-scale databases, full of context and information. These databases can be sourced from handheld devices, network infrastructure, and the environment, such as typical user trajectories provided by vehicular traffic management systems. In addition, government agencies are now willing to share their spectrum with commercial users. The 3550-3650 MHz band is identified for spectrum sharing between military radars and communication systems. This requires cognition both in communication systems and radars. There is also a general trend toward cognitive radars as the next generation of environment-adaptive radars with unprecedented spectral and behavioral agility. A natural approach to handling all this is the development of efficient machine learning algorithms, which, combined with traditional signal processing methods, will allow for the automation of cognitive functionality both in radars and radio communication networks. There are nontrivial challenges and open questions in the application of machine learning to RF environments starting with the fact that, as opposed to speech recognition and computer vision where the output of machine cognition can be readily compared and verified against human auditory and visual perception, no such option is available for radio signals. The main goal of this Special Issue is to raise awareness of this emerging interdisciplinary research area, and to showcase the existing state-of-the-art and its current and future challenges. Topics of interest include (but are not limited to):

- Machine learning for blind channel and signal characterization
- Machine learning for source separation
- Deep learning for RF signal classification
- Machine learning for channel decoding
- Machine learning for RF-based geolocation and signal association
- Distributed multi-agent learning in collaborative radio networks
- Machine learning-based antenna selection
- Reinforcement Learning in wireless networks
- Machine learning of the topology and structural properties of radio networks
- Joint optimization and learning of spectrum usage dynamics and spectrum access control
- Privacy-preserving machine learning for cognitive radio
- Machine learning for cognitive technologies in 5G cellular networks
- Non-parametric Bayesian machine learning for temporal clustering of spectral activity
- Machine learning for activity recognition of partially observable wireless network nodes
- Machine learning in cognitive radars for spectrum sharing with communication devices
- Machine learning for passive radars
- Machine learning for Bayesian target characterization
- Machine learning for cognitive radar characterization and for radar waveform design

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