Machine Learning and Artificial Intelligence in Future Wireless Networks: A WWRF Perspective

Abstract:

Existing and future wireless communications systems generate large amounts of data every day which can be utilized by artificial Intelligence (AI) and Machine Learning (ML) techniques to generate actionable insight and insight based QoS provisioning. AI and ML techniques have also achieved major breakthroughs both in technology and use cases for applications in wireless communications. ML is viewed as a means to derive desired outcomes based on, which is called AI. AI is transformative and will be embedded in each component of the overall chain of the future communications systems, notably starting with the 5G standard. It is envisioned that AI will be an integral part of future wireless communication systems, including the operations, network management and service provision layers. However, one need to be aware that this AI proliferation and pervasiveness can generate potential risks and entanglement which will need to be solved, by careful planning during the introduction of AI. Nevertheless, we can expect AI in each device to process data close to the source to complement the cloud, especially for latency-sensitive and mission-critical applications. This intelligence at the micro level will need to be abstracted to the higher levels for macro control and holistic view of the network. AI in the device will also be useful when the device is disconnected from the network and the cloud. Machine Learning is an approach to process huge amount of data that is collected with a purpose and is fed back into the system for automatic fine-tuning.

The introduction of AI does come with some challenges and controversies, which may slow down its adoption. The first challenge may be the difficulty to arrive at a common definition and interface standards, which suggests the need for standardization and interoperability testing. The other concerns may be:

- to fully understand the real benefits of AI and agree on KPIs to compare the performance of the various approaches
- issues of privacy, security and ethics
- people in the industry may perceive AI as a potential threat to their livelihood

Eventually, the AI proponents will have to deal with the above challenges, but even if AI advocates can overcome these barriers, the need to adapt existing operations processes will be a heavy, cumbersome and tedious task that will have to be weighed against the benefits which AI is expected to bring to future complex wireless systems.

The last obstacle will be the expected transparency of AI. Indeed, delivering AI as a black box may be enough in some cases for basic actions (such as how to optimize parameter settings during a roll-out phase) but would not be acceptable during the optimization or healing phases. Operators who could not be in the position to explain what happened and why it happened could be caught up in explaining to

the public, regulators and may suffer legal consequences. Therefore, it would be necessary to be able to work towards explainable AI models and provide information to all stakeholders. In short, for AI in wireless networks to be successful, the above key issues would need to be addressed.

In this presentation, members of the Wireless World Research Forum (WWRF) present the recent work they have done in the area of AI and ML applied to future communication systems. This includes the impact of AI in different domains, such as spectrum management, radio resource management, RAN and operations and management. We will also present the leading ML techniques and system architectures for AI. Lastly, we deliberate some of the softer issues of applying machine learning and AI in wireless networks as far as the social and legal implications are concerned.