Abstract:

Wireless communications poses some fundamental challenges to machine learning (ML). Due to high mobility, wireless links exhibit ephemeral and highly dynamic nature; moreover, the links are corrupted by noise and are in general exposed to interference, while wireless resources (spectrum and energy) are scarce. All this may greatly limit the capacity of wireless networks. Since data (including measurement data) is not available at a single point but distributed among different locations, there is a strong need for distributed ML algorithms that efficiently use the scarce wireless resources in 5G networks. Moreover, the new ML methods need to provide robust results based on small data sets and under latency constraints.

In this talk, we will discuss why ML has the potential for substantially enhancing current radio access networks (RAN) solutions, and we will give an overview of promising techniques and algorithmic approaches for overcoming the above mentioned challenges in 5G networks. We argue in favor of hybrid-driven methods that combine purely data-driven ML algorithms with classical model-based approaches, while making use of the available expert knowledge. In particular, it is in general necessary to exploit structures in the wireless channel, transmission signals and various functions such as load maps. We will consider both kernel-based methods and deep neural networks.

Biography:

Slawomir Stanczak studied electrical engineering with specialization in control theory at the Wroclaw University of Technology and at the Technical University of Berlin (TU Berlin). He received the Dipl.-Ing. degree in 1998 and the Dr.-Ing. degree (summa cum laude) in electrical engineering in 2003, both from TU Berlin; the Habilitation degree (venia legendi) followed in 2006. Since 2015, he has been a Full Professor for network information theory with TU Berlin and the head of the Wireless Communications and Networks department. Prof. Stanczak has been involved in research and development activities in wireless communications since 1997. In 2004 and 2007, he was a Visiting Professor with RWTH Aachen University and in 2008, he was a Visiting Scientist with Stanford University, Stanford, CA, USA. He is a co-author of two books and more than 200 peer-reviewed journal articles and conference papers in the area of information theory, wireless communications, signal processing and machine learning. Prof. Stanczak received research fellowships from the German Research Foundation and the Best Paper Award from the German Communication Engineering Society in 2014. He was a Co-chair of the 14th International Workshop on Signal Processing Advances in Wireless Communications (SPAWC 2013). Between 2009 and 2011, he was an Associate Editor of the European Transactions for Telecommunications (information theory) and an Associate Editor of the IEEE Transactions on Signal Processing between 2012 and 2015.