Exploiting Physical Layer Effects for 5G Random Access Optimization

Among new challenges introduced by M2M communication, the large number of devices and the strict latency and reliability requirements stress the conventional cellular networks. In a traditional LTE-A system, dense cells experience an overload in the connection establishment phase: Random Access Procedure, making it impossible to meet the latency requirements for some M2M applications. Hence, novel techniques for optimizing performance w.r.t. reliability or latency have to be developed [1,2] for targeting 5G Random Access.

Random access problem is typically viewed as a purely Medium Access Control (MAC) layer problem. However, MAC layer abstractions and models (such as collision channel model) are often sub-optimal in real scenarios. In this thesis, a student is expected to study how physical layer effects (e.g., detection error or capture effect) can be utilized to develop better random access protocols. Real measurement and simulation-generated data has be to be analyzed, an approach to predict the effects with machine learning or estimation techniques has to be developed.

Following skills are required:

- Understanding of wireless communication and radio access networks, especially medium access control.
- Basic skills with probability theory and combinatorics.
- Programming and implementation skills in Python and Matlab.
- Machine learning experience is a plus.

Related papers:


For details, please apply via email with the brief CV and grade transcript directly to Mikhail Vilgelm

Dr. Mikhail Vilgelm (mikhail.vilgelm@tum.de)