5G (ENCQOR) Academic Technology Development Program Challenge Statement

Spatial and Temporal Prediction of Wireless Communication Channels for 5G Communication Systems

Challenge Launch Date	September 25, 2018
Challenge Deadline	~~October 23, 2018 at 2PM EST~~ Deadline extended to November 13, 2018 at 2PM EST Late submissions will not be accepted
Challenge Statement	Exploiting the correlation properties of wireless channels in the temporal, spatial, and frequency domains can significantly reduce the overhead required for channel estimation in Massive MIMO systems. The challenge focuses on solving the following problems for 5G systems: 1- Estimation of the second-order statistics, e.g., the covariance matrix, of the downlink channel using noisy measurements of the uplink channel in frequency-division duplex systems with large duplex gap. 2- Estimation and temporal tracking of uplink MIMO channels when only channel estimates of one MISO channel are available. The available uplink channel estimates can be obtained for example from uplink sounding signals transmitted from one UE antenna. 3- Simultaneous exploration/exploitation of the downlink channel using the channel state information (CSI) feedback signals available in 5G systems, e.g., channel quality indicator (CQI), precoding matrix indicator (PMI), and rank indicator (RI).
Project Partner	Ericsson Canada Inc.
Timeline	2 years
Available funding	Up to $100,000 CAD (to support 2 graduate students for 2 years)
Applicant Type	Ontario based College/University
Location	• Algorithm development can be done remotely at the Applicant Institution

	• Verification and implementation of the algorithms should be done at Ericsson site in Ottawa.
Project Details	• Developing uplink/downlink frequency transformation algorithms for the second-order statistics of the channel for frequency division duplex systems. • Developing channel prediction algorithms for MIMO channels using the channel estimates of one MISO channel. • Designing adaptive downlink beamforming algorithms for exploration/exploitation of downlink channels using the feedback signals from the UE. • Practical assumptions on the system and the channel should be considered, e.g., following 3GPP standards. • The developed algorithms should have manageable computational complexity to enable their implementation in practical 5G systems.
Project Goals/ Outcomes	Deliverables: 1- Technical reports containing detailed description of the developed algorithms. 2- Performance analysis through numerical simulations for 5G SCM channels. 3- Matlab- or Java- based implementation of the developed algorithms Solving the challenge will result in several intellectual properties, e.g., patents, that would be relevant to 5G communication systems. Ericsson should be among the owners of the developed intellectual properties. The project should also result in several journal and conference publications.
Applicant Capabilities	• Research team of one professor + 2 graduate students. • Experience in the design of algorithms for practical wireless communication systems.
Additional Information	The performance of the developed algorithms should be validated using 5G system simulators available at Ericsson. For this purpose, the research team would have to spend considerable time at Ericsson site in Ottawa.