

IEEE ICC 2021: Student Grant Application

Statement of Purpose

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24 April, 2021

1 Enrollment

Doctor of Philosophy (PhD), School of Electrical & Computer Engineering,
Purdue University, West Lafayette, IN [[June 2020 - Present](#)]

2 My Research & Technical Symposia Impact

My past and current research interests are detailed here – along with the impact of attending relevant IEEE ICC 2021 Technical Symposia on them.

- **DARPA Spectrum Collaboration Challenge (SC2) & MS Thesis:**
 - Adaptive, Intelligent Spectrum Sensing & Dynamic Channel Access in Cognitive Radio Networks: **HMMs and Approximate POMDPs**;
 - **E2E Cognitive Radio Design**: Cross-Layer Optimization strategies (MCS Adaptation, Rate Adaptation, Tx Power Control, Hybrid ARQ, Prioritized Flow Scheduling, Channel & Bandwidth Allocation, and Multi-hop Routing);
 - **Over-The-Air Implementation** of our Cognitive Radio Network on the NSF POWDER Testbed (USRP X310s and USRP B210s) in the CBRS Spectrum (3.4GHz - 3.8GHz);
 - **Symposia Impact**: Spectrum Sensing & User Detection (CRAIN-1)
 - * Presenting our paper titled, “Learning-based Cognitive Radio Access via Randomized Point-Based Approximate POMDPs”
 - * Extremely interested in perusing the research on CPD-driven Spectral Cartography (G Zhang, et al.) and Grant-Free NOMA via Generative Neural Networks (Y Zou, et al.)

- **NSF EARS, NSF POWDER, NSF AERPAW, & PhD Research:**
 - Adaptive, Multi-Tier Scheduling and Trajectory Optimization for **Power-Constrained UAV Relays**: Hierarchical Competitive Swarm Optimization, Rate Adaptation, SMDP Formulation, and Multiple UAV settings with additional Control Heuristics;
 - **28GHz Propagation Modeling** in Urban and Suburban Radio Envs on the NSF POWDER Testbed: Custom Horn Antennas & Up/Down Converter Design, Sliding Correlator Channel Sounder, and a Fully Autonomous Antenna Rotating Platform for Beam Tracking;
 - **mmWave Communications**: Algorithms enriched by the Radio Env Map constructed from the 28GHz Measurement Campaign data;
 - **mMIMO** (Sounder, Beacon Beam-Sweeping): Experiments on the NSF POWDER Testbed (Skylark mMIMO: Iris SDRs, Faros Hub, 64x64 BS), and Laboratory Implementations using pi-radio SDRs;
 - **3D Coverage**: A Joint-Optimization Problem constituting Trajectory Optimization for Power-Constrained UAV Relays, and Positioning & Scheduling Optimization for HAPs and LEOs, in Next-Generation Multi-Tier Heterogeneous Networks;
 - **V2X Implementation** of our mmWave Communication Systems, and Scheduling & Trajectory Optimization for Power-Constrained UAV Relays on the NSF AERPAW Testbed;
 - **Symposia Impact and Associated Interested Papers:**
 - * UAVs-II (MWN-6) and Satellite Networking-I (SAC-SSC-2)
 - RSS based UAV-BS Mobility Mgmt via Policy Gradient DRL (M Khoshkholgh, et al.)
 - Network Simulator for Large Low Earth Orbit Satellite Nets (B S Kempton and Anton Riedl)
 - Optimizing Data Transmission in High Altitude Balloon Nets with Multi-beam Directional Antennas (Y Wang, et al.)
 - * mmWave and TeraHertz Networks (MWN-11)
 - A Full-Stack Framework for Antenna and Beamforming Eval in mmWave 5G NR (M Lecci, et al.)
 - * mmWave and MIMO (SAC-MLC-2)
 - DeepRx MIMO: Convolutional MIMO Detection with Learned Multiplicative Transformations (D Korpi, et al.)

3 Coursework

Stochastic Processes, Queuing Theory, Estimation & Detection Theory, Convex & Non-Convex Optimization, Lumped System Theory, Mobile Communication Networks, Real Analysis & Measure Theory, Algorithms, and Error Control Coding.

4 Statement on Conference Attendance

In addition to presenting our paper titled, “Learning-based Cognitive Radio Access via Randomized Point-Based Approximate POMDPs” at the CRAIN-1 symposium, I am looking forward to learn more about the exciting research endeavors that are set to be detailed by researchers from both academia and industry.

Firstly, in the arena of cognitive radio networks, I am excited to study more about CPD-based Spectral Cartography and Grant-Free NOMA via Generative Neural Networks.

Secondly, in the domain of UAV communications & mobility management, I cannot wait to learn more about the use of Policy Gradient Deep RL for UAV Mobility Orchestration. I am also looking forward to peruse the capabilities & the performance of the Network Simulator for Large Low-Earth Orbit Satellite Networks – and potentially use it in my PhD research.

Finally, focusing on mmWave communications and MIMO, I am thrilled to be able to listen to presentations on DeepRx MIMO and mmWave 5G NR Antenna & Beamforming Evaluation Framework.

The privilege and opportunity to listen to these works presented by researchers and industry professionals is something for which I am truly grateful.