

Wireless Communications

Foundations – Systems – Explorations

Guevara Noubir
Northeastern University

Course Setup

- Lectures on foundations and overview of emerging directions
- Topics
 - Wireless communication
 - Synthetic biology
- Papers reading with presentations
- Research project

Wireless Networks

- Foundations of wireless communication
 - Information theory: channel capacity; coding; major theorems (e.g., capacity, channel / source coding separation, distributed compression), network information theory
- Recent applications
 - Network coding; MIMO systems; ad hoc networks capacity; P2P applications

Bio-Enabled Comm. & Comp.

- **Basics of biology:** amino acids, nucleic acids, DNA, RNA, and protein structures. The central dogma of molecular biology, relation to information flow, etc.
- Application of information theory to Information content of DNA/RNA sequences
- **Synthetic biology for computation and communication:** basics of biotechnology, bio-bricks, and DNA origami
- **Bio-computation and communication mechanisms:** DNA computing, stochastic chemical reaction networks, digital logic and memory for/from biological devices, quorum sensing, molecular communication and inter-cellular signaling, magnetic nano-particles
- **Miscellaneous:** extremophiles, electrocytes

Potential Projects

- SWARM Extreme (brain computer interface for robust control of a swarm of flying robots)
- Biologically-enabled wireless sensor networks (electro-magnetic waves for interacting with biological and synthetically biological processes)
- High capacity ubiquitous wireless networks (decentralized high density AP on MIMO physical layers)
- Wireless sensor networks for building's structural monitoring
- Security in wireless and mobile networks (jamming/MITM, zero-error channels, incentive mechanisms for bandwidth sharing)



Emotiv Brain Computer Interface



Parrot AR Drone



Bio-film (E. Coli)