Develop efficient techniques to model and analyze the cooperation & competition of secondary users

Techniques
- Markov model bank (MMB): a Markov model for each user, interacting through interference
- Network decomposition for complexity reduction, exploiting spatial-, channel- and user-decorrelations
- Closed-form throughput expressions, related to special polynomial roots

Representative Results
Two groups of secondary users competing for spectrum access. Throughput is derived as:

\[ R_{ij} = \sum_{k=1}^{N} \log_2 \left( 1 + \gamma_k (k-i+j) \right) \]

\[ = \log_2 \left( 1 + \frac{1}{\sigma^2} \sum_{k=1}^{N} G_{ij} \right) \]

- Wireless Dijkstra’s algorithm: finds optimal multi-hop path efficiently in arbitrarily large wireless networks
- Resolve a major limitation of multi-hop relaying: time-sharing of channel by relays

Future Directions
Mitigate mutual interference among different paths, or different networks such as 5G and WiFi.