



My name is **Serdar Yüksel** and I am a Professor in the Department of Mathematics and Statistics at Queen's University.

My research focuses on **stochastic control theory**, **probability theory** and **information theory**, and **their applications**. Some of the problems we work on are the following:

Problem 1 Stochastic Control and Analysis in Complex Systems. Many stochastic systems are complex, with incomplete models, incorrect priors, non-Markovian dynamics, and with only partial or decentralized information. These may include incompletely specified dynamics where a decision maker may have full state information or partial information, or multi-agent systems with decentralized and local information, and with either discrete-time or continuous-time dynamics. Our group develops probability and control theoretic methods to arrive at near optimal solutions for such complex systems, and their robustness and approximation properties.

Problem 2 Learning Theory for Stochastic Control. Reinforcement learning theory allows for arriving at near optimal solutions for problems whose dynamics are unknown or which are too challenging to analytically solve. Empirical learning and Bayesian learning may lead to policies which are near optimal in the presence of data under technical conditions. Many fundamental open problems remain for systems with general state and action spaces and information structures.

Problem 3 Interaction between Control and Information. There is an intrinsic relation between information and control, and related areas such as game theory. One has to optimally utilize partial information to generate decisions, sometimes via non-linear filtering. The transmission of information over measurement channels may be part of a problem, leading to an information theoretic angle. For some problems, value of additional information is always positive; but for some (in game theory) this may not be the case. Our group works on this relation in a variety of contexts.