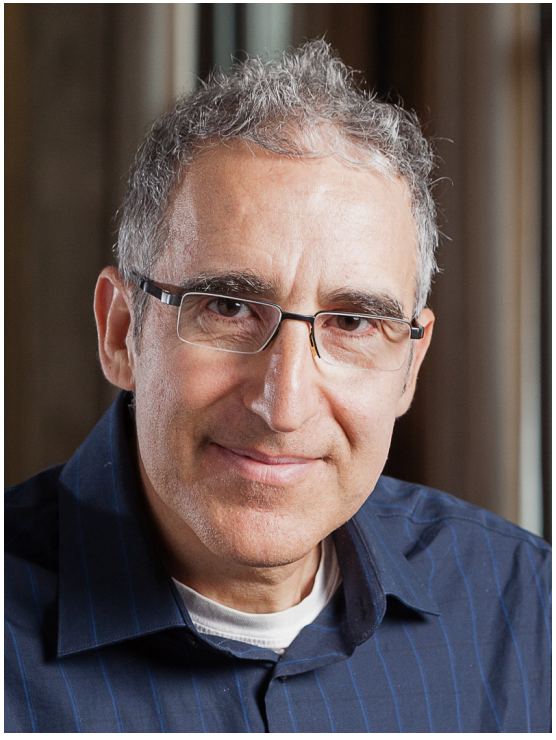

My name is Fady Alajaji and I am a Professor in the Department of Mathematics and Statistics at Queen's University.

My research focuses on fundamental problems in:

(1) information theory and communications;

(2) stochastic reinforcement and contagion processes in complex networks;

(3) information-theoretic machine learning: data privacy, artificial intelligence (AI) fairness and deep learning generative adversarial networks.

A brief description of these research areas follows.

Information Theory and Communications: The coding of information bearing signals for transmission over noisy communication channels is studied. One objective is to establish fundamental Shannon-theoretic limits (via coding theorems) on how efficiently one can encode information and still be able to recover it with negligible loss. Another objective is to develop effective coding techniques and algorithms for achieving reliable data communication over wireless networks.

Reinforcement and Contagion in Networks: Reinforcement processes and contagion phenomena are ubiquitous in real life. Examples include error bursts in communication channels, disease propagation, computer malware spread, cascading failures in finance and rumor dissemination in social networks. Stochastic reinforcement models and contagion mitigation strategies for epidemics and opinion dynamics in networks based on generalized Polya urns are investigated.

Information-Theoretic Machine Learning: As AI technology gets widely deployed in society, it is of critical importance to ensure that machine learning algorithms are both fair (by not discriminating based on users' sensitive attributes) and private (by not disclosing users' personal information) while remaining robust and accurate. Information-theoretic tools such as the information bottleneck method, the privacy funnel and the rate-privacy function are employed to develop and analyze data privacy and AI fairness mechanisms in representation learning algorithms that protect against the leakage of private data and guarantee unbiased outcomes. Generalized loss functions via the judicious use of information-theoretic measures are also examined for improving the performance and stability of deep learning generative adversarial networks.

If you find any of these topics interesting or would like to hear more about my research, do not hesitate to contact me at fa@queensu.ca