LABORATORY FOR INFORMATION AND DECISION SYSTEMS

The Laboratory for Information and Decision Systems (LIDS) (*http://lids.mit.edu*) at MIT is an interdepartmental laboratory devoted to research and education in systems, networks, and control, staffed by faculty, research scientists, and graduate students from many departments and centers across MIT. Its mission is to develop and apply rigorous approaches and tools for system modeling, analysis, design, and optimization. It encompasses the development of novel analytical methodologies, as well as the adaptation and application of advanced methods to specific contexts and application domains. LIDS research addresses physical and man-made systems, their dynamics, and the associated information processing. Some of the lab's core research areas are as follows:

Statistical Inference and Machine Learning: This area deals with complex systems, phenomena, and data that are subject to uncertainty and statistical variability. It also includes the development of large-scale data processing software systems. Research ranges from development of basic theory, methodologies, algorithms, and computational infrastructures to adaptations of this work for challenging applications in a broad array of fields. Typical applications involve causal inference in experimental design, social data processing and e-commerce, as well as image processing, computer vision, and automation of data engineering. Other current topics include reinforcement learning and online optimization, recommendation systems, graphical models, large scale software systems for data engineering, medical image processing, causal inference in genetics, and high-dimensional statistics.

Optimization: This area aims to develop analytical and computational methods for solving optimization problems in engineering, data science, and operations research, with applications in communication networks, control theory, power systems, machine learning, and computer-aided manufacturing. In addition to linear, nonlinear, dynamic, convex, and network programming, methods that exploit the algebraic structure of large-scale problems as well as simulation-based methods are also studied.

Systems Theory, Control, and Autonomy: This area deals with all aspects of system identification, inference, estimation, control, and learning for feedback systems. Theoretical research includes quantification of fundamental capabilities and limitations of feedback systems, development of practical methods and algorithms for decision making under uncertainty, robot sensing and perception, inference and control over networks, as well as architecting and coordinating autonomy-enabled infrastructures for transportation, energy, and beyond.

Networks: This area includes communications, information theory, and networking, with applications ranging from wireless systems to data centers and the Internet of Things, with an emphasis on fundamental limits on communications systems, optimal resource allocation schemes, and the design of optimal architectures and control algorithms for data centers and cloud networks. It also includes the analysis of social networks and of agent interactions in networked systems, with applications ranging from the analysis of large-scale social network data to the study of dynamics and risk in large interconnected financial, transportation, and power systems.

LIDS graduate students are typically enrolled in the Department of Electrical Engineering and Computer Science, the Department of Aeronautics and Astronautics, the Institute for Data, Systems, and Society, the Operations Research Center, the Mathematics Department, the Department of Mechanical Engineering, the Department of Civil and Environmental Engineering, the Center for Computational Science and Engineering, and the Department of Biological Engineering. For further information, including about postdoctoral opportunities, contact LIDS Headquarters (*lids-info@mit.edu*).