MIT EECS

Electrical Engineering | Computer Science | Artificial Intelligence + Decision-making
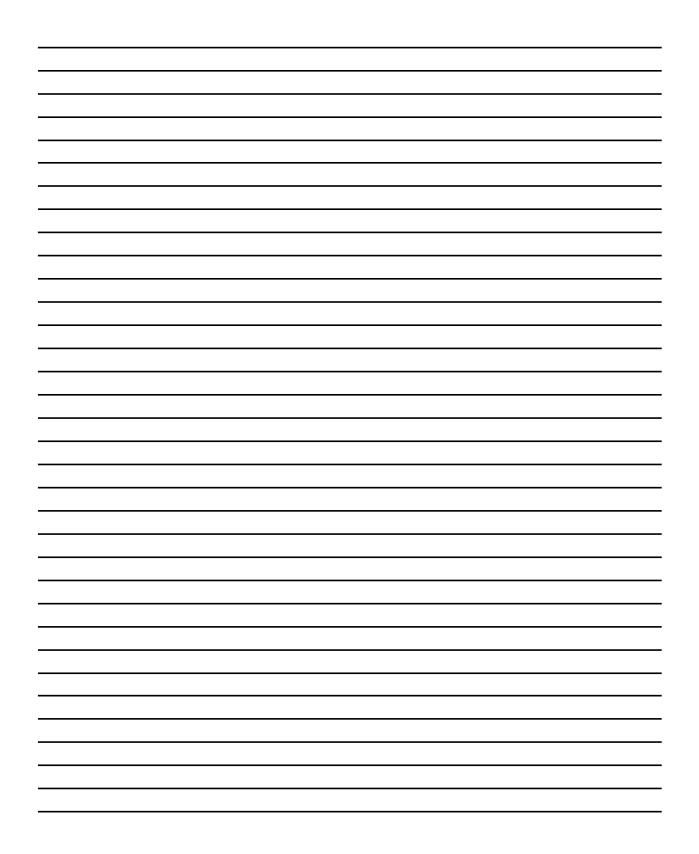
Guide to Research Interests of
Faculty and Research Staff Thesis Supervisors

2023-2024

NOTES

This guide is intended to help students who are seeking a thesis topic and an appropriate thesis supervisor. Most theses will be supervised by a member of the Electrical Engineering and Computer Science (EECS) faculty who are listed in the following guide. Faculty and research staff in other departments may also supervise graduate theses.

Each doctoral thesis committee must include at least two Electrical Engineering and Computer Science faculty members. Special approval of the Committee on Graduate Students is required for doctoral thesis supervision by a non-faculty member except for those individuals noted in the non-faculty listing. Requests for such approval should be made to the Graduate Officer before beginning thesis research. This approval is also needed for the supervision of the Master of Science thesis.

AREA KEY

EE - Electrical Engineering	CS - Computer Science	AI+D - Artificial Intelligence and Decision-Making
Artificial Intelligence and Machine Learning	AI for Healthcare and Life Sciences	AI and Society
Biological and Medical Devices and Systems	Artificial Intelligence and Machine Learning	AI for Healthcare and Life Sciences
Communications Systems	Communications Systems	Artificial Intelligence and Machine Learning
Computer Architecture	Computational Fabrication and Manufacturing	Communications Systems
Computational Fabrication and Manufacturing	Computer Architecture	Graphics and Vision
Educational Technology	Educational Technology	Music Technology and Creativity
Electronic, Magnetic, Optical and Quantum Materials and Devices	Graphics and Vision	Natural Language and Speech Processing
Energy	Human-Computer Interaction	Optimization and Game Theory
Integrated Circuits and Systems	Programming Languages and Software Engineering	Robotics
Nanoscale Materials, Devices, and Systems	Quantum Computing, Communication, and Sensing	Security and Machine Learning
Robotics	Robotics	Signal Processing
Signal Processing	Security and Cryptography	Systems Theory, Control, and Autonomy
Systems and Networking	Systems and Networking	Statistics and Inference
Systems Theory, Control, and Autonomy	Theory of Computation	

Faculty Member	Area(s)	Special Interest for Research
Abelson, H.	CS AI+D	Artificial intelligence, educational computing, machine learning and education, Internet policy.
Adalsteinsson, E.	EE AI+D	Medical imaging with MRI. Computation in imaging for data acquisition, image reconstruction and image analysis for quantification of markers of health and disease. Methods for existing MRI platforms and for novel hardware. Applications in neuroimaging and imaging in pregnancy. Collaborations with Massachusetts General Hospital Martinos Center and Boston Children's Hospital.
Adib, F.	CS EE AI+D	Wireless, sensing, Internet-of-Things (IoT), communications, computer networks, software-hardware systems, mobile computing, signal processing, low-power & battery-free computing, RF, acoustics, robotics, augmented reality, oceans, edge AI/ML, climate, underwater imaging.
Agarwal, A.	AI+D CS	Computer architecture and software systems, multicore architecture, multicore operating systems, self-aware computing, VLSI processors, compilations and runtime technologies for parallel computing.
Agrawal, P.	AI+D CS	Learning for Decision Making from raw sensory observations such as vision, haptics and audio (i.e., sensorimotor learning); special impetus on robot learning; deep reinforcement learning; deep learning; object manipulation; robotic locomotion; navigation; model-based control; imitation learning; inverse reinforcement learning; design of robotic hands; soft robotics; integrating common sense knowledge into machine learning systems using natural language; self-supervised learning; computer vision; multimodal representation learning from vision, touch and audio; understanding human activities; human-robot interaction; applications of machine learning in healthcare; human cognition; computational neuroscience. The overall research goal is to build mechanisms that allow agents/robots to continuously keep learning about their world by exploring and conducting experiments. One application area is robots in households, but not limited to it.
Akinwande, A. I.	EE	Display devices, vacuum microelectronics, devices based on nano-scale charged particle beams. Applications to nano-fabrication, imaging, sensors & actuators, and harsh environments.
Alizadeh, M.	CS AI+D	Computer networks and systems, programmable networks, learning-based networked systems, datacenter networks, cloud computing, modeling and analysis of computer systems.
Amarasinghe, S. P.	CS	Domain specific languages, program analysis and optimizing compilers. Performance engineering and high-performance computing. Machine learning for compilers and compilers for machine learning. Computer architecture.
Andreas, J.	AI+D	Natural language processing: computational models of syntax, semantics and pragmatics; compositionality in natural languages and learned representations; explainable machine learning.

Faculty Member	Area(s)	Special Interest for Research
Arvind	CS	Architecture synthesis and verification, digital design, term rewriting systems and lambda calculus. Parallel architectures and programming languages.
Balakrishnan, H.	CS AI+D	Networked systems: mobile and sensor computing, network architecture and protocols, scalable distributed systems, data management.
Baldo, M. A.	EE	Molecular electronics and spintronics.
Barzilay, R.	AI+D	ML for drug discovery and clinical AI.
Bates, S. D.	AI+D	Statistical inference, uncertainty quantification for AI systems, inference and decision-making with strategic agents, distribution shift, and applications in life science and sustainability.
Beery, S.	AI+D	Computer Vision for the Environment, Biodiversity, Conservation, and Sustainability. Methods for heterogeneously sampled spatiotemporal and multimodal environmental monitoring (visual, acoustic, sonar, lidar, hyperspectral, time-series, text, museum collections, community science, environmental covariates). Deployable, reliable computer vision under domain shift, including verification and participatory systems for efficient use of human expertise out of distribution. Distributed sensing with limited bandwidth including efficient and edge-based computer vision. Incorporating structure and knowledge from scientific domains into computer vision and machine learning methods. Collaborative development of equitable tools that empower NGOs, governmental agencies, and local communities to make data-centric, informed decisions on conservation policy. International fieldwork to test our methods on the ground in diverse ecosystems.
Belay, A.	CS	Operating systems, networking, computer architecture, and datacenter performance.
Berggren, K. K.	EE	Methods and materials for nanofabrication. Superconductive electronics and detectors. Optics, nano-optics, and electron optics. Quantum-information-based systems.
Bertsekas, D.	EE	Analytical and computational methods of deterministic and stochastic optimization, large scale systems, data networks. (Post-Tenure)
Berwick, R. C.	AI+D CS	Natural language processing: computer models of language acquisition and parsing. Computational biology and evolutionary theory including evolution of language. Artificial intelligence: formal models of learning, including inductive inference and computational complexity analysis of language. Cognitive science: word learning, semantics of natural languages.

Faculty Member	Area(s)	Special Interest for Research
Bhatia, S.	EE AI+D	Applications of miniaturization technologies in medicine. Specific interests include using microfabrication, synthetic biology; 3D printing and nanotechnology to regenerate human livers and diagnose and treat cancer.
Bodner, A.	EE	Analytical and computational methods for climate model development. Numerical simulations of ocean and climate. Machine learning applied to geophysical fluid dynamics and turbulence.
Boning, D.	EE AI+D	Semiconductor and photonics manufacturing. Modeling, optimization, and control of IC, photonic, and MEMS processes, devices and circuits using statistical and machine learning methods. Computer aided design (CAD) tools and systems. Design for manufacturability (DFM).
Bresler, G.	AI+D	Statistics and computation, theoretical machine learning and applied probability. Algorithms and performance limits for statistical inference and decision-making in large-scale systems.
Broderick, T.	AI+D	Statistics and machine learning; uncertainty and robustness quantification; Bayesian methods; nonparametric, unsupervised, scalable learning; approximation methods including variational inference and Markov chain Monte Carlo; exchangeability; approximations to cross validation, the bootstrap, and other reweighting schemes.
Bulovic, V.	EE	Physical properties of nano-structured thin films, structures, and devices as applied to the development of optoelectronic, electronic, photonic, and mechanical active surfaces of nano-scale thickness, including LEDs, lasers, solar cells, photodetectors, transistors, actuators, sensors, and encompassing flexible, lightweight, and transparent formats for imperceptibly integrated technologies.
Carbin, M.	CS AI+D	Design and implementation of programming systems, including languages, program logics, program analysis/verification systems, and runtime systems. Particular interest in programming systems for emerging probabilistic and approximate computing fabrics.
Chan, V.	AI+D EE	Optical, wireless and space communications and networks. Architecture, technology, system designs, and testbed implementations. New communication and network technologies, architectures and applications.
Chandrakasan, A. P.	EE CS	Design of energy-efficient integrated circuits and systems. Energy efficient implementation of signal processing, communication, security, machine learning, and medical electronics. Circuit design with emerging technologies.

Faculty Member	Area(s)	Special Interest for Research
Cheema, S.	EE	Electronic materials and devices for microelectronics to address energy consumption, storage, and generation challenges. Atomic engineering of electronic phenomena (e.g. ferroelectricity, negative capacitance) for energy-efficient computing (logic transistors, nonvolatile memory, AI hardware, superconducting electronics) and energy technologies (energy storage and power delivery, energy harvesting and thermal management).
Chen, Y.	EE AI+D	Microscale robotics, aerial robotics, bio-mimetic and bio-inspired design, and dynamics and control; soft robotics and soft actuation resembling artificial muscles; intermediate Reynolds number aerodynamics, fluid structure interaction, and interfacial effects.
Chlipala, A.	CS	Programming languages and tools. Formal methods. Security and privacy. Design and implementation of abstractions for software and hardware systems.
Chuang, I.	AI+D EE CS	Quantum information science, quantum physics, computation and physics.
Coday, S.	EE	Power electronics and energy conversion; circuit design, control and optimization; device characterization and modeling; applications to future electric aircraft, space exploration and renewable energy systems.
Coley, C. W.	AI+D	Molecular design, chemistry-informed neural networks, drug discovery, Bayesian optimization, experimental design, and laboratory automation. (Has shared appointment in Chemical Engineering.)
Corrigan-Gibbs, H.	CS	Computer security, cryptography, computer systems, privacy.
Dahleh, M. A.	AI+D EE	Networked systems with applications to social and economic networks, transportation networks, financial networks and the power grid. Specific focus on the development of foundational theory necessary to understand, monitor, and control systemic risk in interconnected systems. Statistical learning of controlled systems and its relations to model reduction of stochastic systems. The economics of data and the design of real-time markets for data and digital goods. The interface between system theory and neuroscience with application to motor control.
Daniel, L.	EE AI+D	We develop numerical techniques related to uncertainty quantification, inverse problems, assessment and improvement of robustness. Currently we are applying those techniques to: nano-devices, magnetic resonance imaging scanners, electrical energy networks, virtual spaces and enhanced environments, lack of robustness in deep neural networks.

Faculty Member	Area(s)	Special Interest for Research
Daskalakis, C.	AI+D CS	Theory of computation. The interdisciplinary fields of algorithmic game theory, computational biology, social networks and applied probability.
Davis, R.	AI+D	Artificial intelligence; intelligent multimodal interfaces; novel interfaces for evaluating cognition; AI and ethics; intellectual property issues in software.
del Alamo, J. A.	EE	Nanometer-scale III-V compound semiconductor transistors for future digital, power, RF, microwave and millimeter wave applications. Reliability of compound semiconductor transistors. Diamond transistors. Ionic and ferroelectric non-volatile programmable AI synapses.
Delmitrou, C.	CS	Computer architecture, cloud computing, machine learning for systems. Hardware acceleration for cloud systems, cluster management and scheduling, cloud programming frameworks, cloud-edge environments, cloud security.
Demaine, E.	CS	Algorithms and data structures. Discrete and computational geometry, particularly folding. Graph algorithms and graph minors. Combinatorial games, puzzles, and magic. Art.
Dennis, J. B.	CS	Parallel computer system design to support functional languages and advanced environments for modular programming. Study of architecture, performance and reliability issues. (Emeritus)
Devadas, S.	CS	Computer-aided design. Computer security and applied cryptography. Computer architecture.
DeWitt, D.	CS	Database systems, parallel query processing and optimization; scalable data warehouse, big data. (Adjunct)
Donti, P. L.	EE AI+D	Machine learning methods (robust, physics-informed, and/or engineering-constrained), optimization, control, power and energy systems, climate change mitigation and adaptation.
Durand, F.	AI+D CS	Computer graphics; computational photography; structural analysis of masonry, content creation for online education. Lighting simulation, Fourier analysis, light fields. Computational optics, blur removal, revealing the invisible, video magnification. Systems for computational imaging, compilers. Video lecture authoring and editing.
Emer, J. S.	CS	Architectures for machine learning, spatial computing architectures, performance/energy modeling, parallel and multi-threaded processor architecture, cache and memory hierarchy design, processor reliability analysis.

Faculty Member	Area(s)	Special Interest for Research
Englund, D.	EE AI+D	Understand and bridge gaps between today's technology and the theoretical limits given by quantum mechanics and information theory. Key focus on theory and proof-of-principle demonstrations working at the discreteness ("graininess") of quantum mechanics and information theory: [Quantum Computing] - Development of large, programmable quantum systems combining individual-qubit control and large numbers of qubits to solve bottlenecks in large-scale quantum control (see DARPA ONISQ, DOE QSA, MITRE MOONSHOT, etc.). [Quantum Networks] - Constructing the "quantum information" layer on the internet by new quantum control and noise mitigation methods for large-scale utility (viz. NSF Center for Quantum Networks). [Machine Learning] - Explore the "complexity frontier" of ML by new algorithms, architectures, and coherent physical systems including photonic, quantum, and mixed-signal CMOS systems with world-leading foundries.
Farina, G.	AI+D	Optimization and computational game theory, multi-agent systems and reinforcement learning, decision-making under uncertainty, machine learning, online allocation.
Freeman, D. M.	EE AI+D	Theoretical and experimental studies of hearing. Development of optical methods to measure nanometer motions of biological structures at audio frequencies. Measurement of sound-induced motions of inner ear structures.
Freeman, W. T.	AI+D	Machine learning applied to computer vision and computer graphics. Computational photography. Bayesian models of visual perception.
Fujimoto, J. G.	EE	Biomedical optical imaging, new imaging technology and methods, clinical applications. Optical coherence tomography (OCT) and nonlinear microscopy. Advanced photonics. Medical imaging devices. Image analysis. Applications in ophthalmology, endoscopy, pathology and cancer surgery. Technology development and clinical studies for age related macular degeneration and diabetic retinopathy, leading causes of blindness. Imaging technologies for gastrointestinal cancer detection. Advanced microscopy for real-time pathology and intraoperative assessment. Surgical guidance in breast cancer lumpectomy to reduce repeat surgeries and radical prostatectomy to reduce incontinence and impotence. Collaborations with teaching hospitals.
Ghaffari, M.	CS	Algorithms, theory of computing, distributed & parallel algorithms, randomized algorithms, graph algorithms.
Ghassemi, M.	CS AI+D	Machine learning for healthcare, ethical machine learning, robustness, fairness, privacy, policies for technology in human/health deployments.
Ghobadi, M.	CS EE AI+D	Systems for machine learning, high-performance cloud infrastructure, hardware-software co-design, data center networks, network optimization, and optical networks.

Faculty Member	Area(s)	Special Interest for Research
Gifford, D. K.	AI+D CS	Machine learning methods and algorithms for therapeutic design, genomics, genetics, and experimental design. Machine learning. Systems biology.
Goldwasser, S.	CS	Cryptography, complexity theory, computational number theory, randomized algorithms.
Gordon, M.	CS	Human-computer interaction, human-AI interaction, social computing, design and creativity tools, machine learning evaluation and interpretability, large language models
Golland, P.	AI+D	Image analysis and understanding. Statistical inference and machine learning for medical image computing.
Gray, M. L.	EE	Biomedical imaging. Needs-driven biomedical technology innovation. Wearable and point-of-care devices. Imaging biomarkers.
Guttag, J. V.	CS AI+D	Application of machine learning and data mining techniques to large data sets, especially medical data sets. Application of computer vision to medicine. Sports analytics.
Hadfield-Menell, D.	AI+D	Human-robot interaction, inverse reinforcement learning, multi-agent and multi-stakeholder systems, AI policy + regulation, preference elicitation, AI safety, sequential decision making, robotics, recommender systems.
Hagelstein, P.	EE	Theoretical studies of anomalies in metal deuterides, excitation transfer, and anomalous energy exchange between disparate quantum systems, and thermal to electric conversion.
Han, J.	EE	Micro-nanofluidic systems, biological MEMS. nanofluidics, electrokinetics, biosample preparation, bioprocessing engineering, stem cell engineering, water purification, desalination, electrochemical devices.
Han, R.	EE	Design of high-speed (millimeter-wave and terahertz) integrated circuits using CMOS and emerging technologies. Microsystems for high-precision spectroscopy, time-keeping, imaging and communications.
Han, S.	EE CS AI+D	Efficient AI on edge devices, tinyML and intelligent internet of things, model compression, pruning, quantization, neural architecture search, efficient training and inference, hardware accelerator for neural networks.
He, K.	AI+D	Computer vision, visual perception, machine learning, deep learning, with emphasis on representation learning from visual and/or scientific data.

Faculty Member	Area(s)	Special Interest for Research
Heldt, T.	EE AI+D	Signal processing, modeling, estimation and identification of physiological systems; computational physiology; computational medicine; clinical inference. Application of machine learning and data mining to medicine.
Hopkins, S.	CS AI+D	Algorithms, high-dimensional statistics. theoretical machine learning, convex programming, information-computation tradeoffs, sum of squares method
Horn, B. K. P.	AI+D CS	Computational imaging, machine vision. Representation of objects and space. X-ray phase imaging. Traffic flow instability suppression. Indoor navigation.
Hu, Q.	EE	Terahertz and infrared quantum cascade lasers, frequency combs and amplifiers; and imaging and sensing applications using those devices.
Huang, A.	CS AI+D	Generative AI for Human-AI Collaboration: (1) Generative modeling, learning from human feedback, preference elicitation and learning, creative practice, participatory design, tools for artists. (2) Music theories and music cognition of neural networks (NNs) and for NNs, music cognition and perception, interpretability, explainability, interactive systems and visualizations. (3) Multi-agent reinforcement learning and efficient AI for interactive and real-time jamming, improvisation, composition, performance, music education, and game design.
Huttenlocher, D.	CS AI+D	Computer vision, social and information systems and networks, social responsibilities of computing.
Ilic, M.	EE	Large-scale systems modeling and simulation; power systems control and pricing algorithms; critical infrastructures and interdependencies; smart grids; micro-grids; computing for energy systems.
Indyk, P.	CS AI+D	Computational geometry, especially in high-dimensional spaces; databases and information retrieval; streaming and sketching algorithms; sparse recovery and sparse Fourier transform; learning-augmented algorithms.
Isola, P.	AI+D	Computer vision and graphics, machine learning, artificial intelligence, robotics and embodied cognition, models of human and biological perception, learning and evolution.
Jaakkola, T. S.	AI+D	Statistical inference and machine learning. Applications to molecular design, therapeutics, and computational chemistry. Artificial Intelligence.

Faculty Member	Area(s)	Special Interest for Research
Jackson, D. N.	CS	Software design for usability, security and dependability; critical systems; design languages, methods and tools; new programming paradigms.
Jaillet, P.	AI+D	Online optimization and learning; machine learning; decision-making under uncertainty.
Jegelka, S.	AI+D	Machine learning; optimization; discrete and combinatorial optimization; submodular functions; discrete probability; applications in materials science, computational biology and other areas.
Jossou, E.	AI+D	Rational materials design for energy applications using advanced characterization tools coupled with multiscale simulations and physics-based machine learning models.
Kaashoek, M. F.	CS	Computer systems: operating systems, networking, programming languages, compilers, and computer architecture for distributed systems, mobile systems and parallel systems.
Kaelbling, L. P.	AI+D	Planning and learning with applications to robotics, with special interest in: decision-theoretic planning, integrating geometry and probability, integrating logic and probability, and learning relational models.
Kalai, Y.	CS	Cryptography, complexity theory, interactive coding, computer security, and distributed algorithms. (Adjunct)
Karger, D.	CS	Systems that help people (mainly non-programmers) manage information more effectively. User interfaces for databases that regular people can use. Frameworks to let non-programmers create interactive web applications. Personal information management. Improving online discussion and collaboration tools such as wikis and social media.
Katabi, D.	AI+D CS	Digital health, machine learning and computer vision models for medicine and healthcare, and mobile computing and Internet of Things (IoT).

Faculty Member	Area(s)	Special Interest for Research
Kellis, M.	AI+D CS	Computational biology and machine learning for genomics, therapeutics, and personalized medicine. (1) Understanding genomes, their programming language, their circuitry, epigenomics, dynamics, single-cell multi-omics. (2) Disease mechanism, genetic variation, patient subtyping, personalized medicine, electronic health records. (3) Neuroscience, Alzheimer's, schizophrenia, cardiovascular disease, obesity, cancer, evolution. (4) Therapeutic design, drug repurposing, high-throughput experiments, drug screening, genome circuitry manipulation, disease reversal. (5) Statistical genetics, causal inference, geometric deep learning, joint embeddings, contrastive learning, computational chemistry, therapeutic design. (6) Embedding space idea representations, visualization, and navigation for learning, discovery, invention, and collaboration.
Kim, Y.	AI+D CS	Natural language processing; machine learning; deep learning; approximate inference.
Kong, J.	EE AI+D	Synthesis, characterization and applications of nanomaterials, including graphene and other two-dimensional materials, nanotubes, and inorganic nanowires.
Kraska, T.	CS AI+D	Systems for machine learning/machine learning for systems, interactive data science tools, systems for visual data exploration, risk-aware data analysis, database systems, transactions processing, and adaptive system design.
Lampson, B. W.	CS	Computer science. Hardware design and machine architecture through distributed systems and programming languages to user interfaces and office automation. (Adjunct)
Lang, J. H.	EE	Analysis, design and control of electromechanical and energy conversion systems. Emphasis on: traditional rotating- and linear-machine drives, micro/nano sensors and actuators, energy harvesters, and flexible systems.
Lee, H. S.	EE	Analog and mixed signal integrated circuits with the emphasis on low power consumption. Applications include communication, hardware security, signal processing, automotive, and medical electronic devices.
Leeb, S. B.	EE CS	Energy conversion systems, circuit design, power electronics, and embedded control. Applications to power systems, power system monitoring, energy scorekeeping, and fault detection and diagnostics for critical systems. Construction of combined electrical and mechanical systems with applications to wireless power transfer, solar power, electric utility, electric drives for propulsion systems, power supplies and dc-dc converter systems, and electromagnetic power harvesting.

Faculty Member	Area(s)	Special Interest for Research
Leiserson, C. E.	CS	Algorithms, caching, cloud computing, computer architecture, concurrency, fast AI, fast code, multicore systems, multithreading, parallel computing, performance engineering, theory.
Lewis, L. D.	EE AI+D	Human brain imaging technologies (MRI, PET, EEG); biomedical image and signal processing; computational neuroscience; machine learning for neural data; imaging and modeling physiological fluid dynamics; applications to neurological and psychiatric disorders and the neuroscience of sleep.
Lim, J. S.	EE AI+D	Signal processing, image/video processing, speech processing.
Liskov, B. H.	CS	Parallel and distributed systems including blockchains, programming languages, programming methodology.
Liu, L.	EE	Spintronics; spin-based non-volatile logic and memory devices; magnetic material for information storage and microwave applications; generation and manipulation of spin in systems such as low dimensional material, high spin orbit coupling metals and semiconductors; novel spin-related phenomena in superconductors; sensing and imaging techniques for magnetic materials.
Lozano-Perez, T.	AI+D	Robotics and artificial intelligence. Emphasis on developing planning and learning methods for robots operating in complex and uncertain environments.
Lu, T. K.	EE	Construction of synthetic organisms and fundamental gene circuits using engineering principles and quantitative designs; development of new clinical therapeutics for cancers and protein-misfolding disorders; using synthetic biology to produce renewable energy; study of the human microbiome.
Lukovic, M.	AI+D	Computer graphics, computational fabrication, 3D geometry processing and machine learning, including architectural geometry and design of smart materials.
Lynch, N. A.	CS	Theory of distributed computing: models, algorithms, proofs, analysis, and lower bounds. Algorithms for fixed and mobile networks for problems of communication, building network structures, data management. Hybrid (continuous/discrete) distributed systems. Biological distributed algorithms, including insect colony algorithms and brain network algorithms. (Post-Tenure)
Madden, S.	CS AI+D	Databases and computer systems; query processing, distributed systems, analytics and applied machine learning over massive scale data.
Madry, A.	AI+D CS	Deployable machine learning. Algorithms and optimization.

Faculty Member	Area(s)	Special Interest for Research
Mark, R. G.	EE	Improve health care through the generation of new knowledge, monitoring technology and clinical decision support through the application of physiological signal processing, data science and machine learning technology to large collections of critical care data.
Matusik, W.	CS AI+D	Computer graphics. Additive manufacturing (3D printing). Computer-aided design. Compilers. Robotics. Computational imaging. Optics. Display devices.
Medard, M.	CS AI+D EE	Communications and networking. Low latency, security and reliability. Network coding. Universal decoding. Computation in networks.
Megretski, A.	EE AI+D	Theory and algorithms of analysis and design of hybrid systems, nonlinear and robust control, non-convex and convex optimization, formalization of knowledge in education, functional analysis and operator theory.
Micali, S.	CS	Cryptography, secure protocols, pseudo-random generation, proof systems, zero knowledge, mechanical design.
Miller, R.	CS	Human-computer interaction, online education, crowd computing, social computing, programming systems, software engineering.
Morris, R. T.	CS	The design of an easy-to-control data networking infrastructure designed to bring about a new level of flexibility to network configuration. The Resilient Overlay Networks Project. Grid routing protocols.
Mueller, S.	CS EE	Human-computer interaction, 3D printing, computer aided design, creativity tools, prototyping, robotics, computer graphics, materials.
Natarajan, A.	CS	Quantum information theory, focusing on quantum complexity theory. Also interested in quantum cryptography, quantum algorithms, and connections with classical CS theory, and to physics.
Niroui, F.	EE	Active engineering of light-matter interactions, electronic transport and exciton dynamics at extreme nanoscale dimensions. Design and development of nanoscale devices and systems for applications including plasmonics, molecular electronics and quantum technologies.
Notaros, J.	EE	Integrated photonics platforms, devices, and systems for applications including augmented-reality displays, LiDAR sensing for autonomous vehicles, free-space optical communications, quantum engineering, and biophotonics.

Faculty Member	Area(s)	Special Interest for Research
O'Brien, K.	EE CS	Quantum metamaterials, quantum optics, and experimental quantum computing with superconducting circuits and circuit quantum electrodynamics (cQED). Near quantum limited amplifiers and quantum measurement. Making noisy intermediate-scale quantum (NISQ) technology less noisy.
Oliver, W.	EE AI+D	Quantum computing with multi-qubit superconducting circuits and high-performance cryogenic classical computing. High-coherence materials, fabrication, and 3D integration; circuit design; quantum algorithms and benchmarking; noise spectroscopy and error mitigation; quantum-limited amplification and precision measurements; quantum optics with microwave photons.
Oppenheim, A. V.	EE CS	Signal processing theory, applications and algorithms.
Orlando, T. P.	EE	Quantum computing with superconducting devices. Superconducting devices.
Ozdaglar, A.	AI+D EE CS	Optimization theory and algorithms with focus on algorithms for machine learning and large-scale data processing and distributed and parallel computation. Game theory and mechanism design. Modeling, analysis and optimization of multi-agent networked systems, with applications in infrastructure systems (communication networks, traffic networks and power grid) and social, economic and financial systems.
Palacios, T.	EE	Novel electronic devices and systems in wide bandgap semiconductors and two-dimensional materials, such as graphene; polarization and bandgap engineering; transistors for sub-mm wave power and digital applications; new concepts for power conversion, generation and storage, interaction of biological systems with semiconductor materials and devices.
Parrilo, P.	AI+D	Control and identification of uncertain complex systems, robustness analysis and synthesis, and the development and application of computational tools based on convex optimization and algorithmic algebra to practically relevant problems in engineering, economics and physics.
Perreault, D. J.	EE	Power electronics and energy conversion; renewable energy systems; efficient generation and application of electrical energy; circuit design and control; applications to industrial, commercial, scientific, transportation and biomedical systems.
Polyanskiy, Y.	AI+D	Information theory, error-correcting codes, statistics, foundations of machine learning.
Ragan-Kelley, J.	CS AI+D	High-performance visual computing, computer graphics, domain-specific languages, programming languages, differentiable programming, compilers, GPUs, computer architecture.

Faculty Member	Area(s)	Special Interest for Research
Raghavan, M.	CS	Algorithmic fairness, machine learning, behavioral economics, technology policy, algorithmic game theory, mechanism design, algorithmic hiring, applied modeling, technology and society, theory.
Ram, R. J.	EE AI+D	Applied physics with an emphasis on photonics and analysis for applications ranging from advanced computing, medicine to environmental science.
Reiskarimian, N.	EE	Radio-frequency and millimeter-wave integrated circuits and systems design inspired by applied electromagnetics and photonics. Analysis, design, and implementation of integrated microsystems and metamaterials based on new physical phenomena. Applications span communication, Internet of Things (IoT), sensing, imaging, and optoelectronics.
Rinard, M. C.	CS AI+D	Computer systems, compilers, programming languages, software engineering, program analysis, program verification, real-time systems, embedded systems, distributed systems, parallel systems.
Rivest, R. L.	CS	Climate change. Election security. Exposure notification. Cryptography. Note: not currently looking for students.
Rubinfeld, R.	CS AI+D	Theory of computation: sublinear time algorithms, property testing, testing and learning discrete distributions over large domains, randomized algorithms.
Rus, D.	AI+D CS	Robotics, machine learning, AI.
Sanchez, D.	CS EE	Computer architecture. In particular, striving to improve the performance, efficiency and scalability of future parallel and heterogeneous systems, and to enable programmers to leverage their full capabilities easily. Current projects focus on scalable and efficient memory hierarchies, architectures with quality-of-service guarantees, scalable dynamic fine-grained runtimes and schedulers, and hardware support for scheduling.
Satyanarayan, A.	CS	Accessibility, Data visualization and analysis, human-computer interaction, design and creativity tools, end-user programming, machine learning interpretability.
Schindall, J.	EE	Automotive applications of electronics: energy storage using nanotube-enhanced ultra-capacitors, reliability enhancement of complex system architectures, industry-related research and product development, novel time-domain processing methods, satellite communication architectures. (Available for discussion, but no longer taking on students.)

Faculty Member	Area(s)	Special Interest for Research
Seethapathi, N.	AI+D	Computational modeling of biological motor control, nonlinear dynamics and control, embodied reinforcement learning, control and adaptation of wearable robots, computer vision for human pose estimation, computer-aided rehabilitation, machine learning for diagnostics
Shah, D.	AI+D	Graphical models, social data processing, time-series analysis, causal inference, reinforcement learning and stochastic networks.
Shavit, N.	CS	Computational connectomics: understanding how neural tissue computes through the mapping of brain connectivity and applying this knowledge to machine learning and the programming multiprocessor machines.
Shun, J.	CS	Parallel computing, algorithms, data structures, programming frameworks, concurrency, performance engineering, graph analytics, geometric data processing, text processing.
Sitzmann, V.	CS AI+D	Computational perception, computer vision, neural rendering, neural scene representation, neural fields, 3D computer vision, inverse graphics, neural scene representation applications in robotics, computer vision, computer graphics.
Smidt, T. E.	EE AI+D	Machine learning (ML) from first-principles for scientific data. Symmetry equivariant neural networks. Representation learning for 3D geometry. Computational science and ML surrogate models. Design and property prediction of atomic systems (e.g. molecules, materials, proteins, etc.).
Sodini, C. G.	EE	Design of technology-intensive microsystems, emphasizing integrated circuit and system design, for medical electronic devices. These devices include wearable and minimally invasive monitoring and imaging.
Solar-Lezama, A.	CS AI+D	Programming systems with a focus on software synthesis. Programming tools for parallel and high-performance computing.
Solomon, J.	AI+D CS	Geometry (shape analysis, correspondence, synthesis, meshing, machine learning), computer graphics, optimization/numerical methods, optimal transport, simulation, medical imaging, 3D vision, geometric approaches to machine learning.
Sontag, D.	AI+D	Machine learning and artificial intelligence; graphical models; unsupervised learning and topic modeling; variational inference and linear programming relaxations; causality and counterfactual inference; deep learning; natural language processing. Applications to health care: electronic phenotyping, precision medicine, disease progression modeling.

Faculty Member	Area(s)	Special Interest for Research
Sra, S.	AI+D	Machine learning and artificial intelligence, especially from an optimization and mathematical perspective. Fundamental theoretical and algorithmic questions in these areas, as well as their application to data driven science (physics, chemistry, biology) and engineering. Optimization for machine learning, especially non-convex optimization, differential geometric optimization, theory of deep learning, discrete probability, optimal transport, convex geometry, polynomials, and more broadly, bridging different areas of math with optimization and machine learning.
Stonebraker, M.	CS	Database systems, query processing, data warehouses, federated databases, data visualization. (Adjunct)
Stultz, C.	AI+D EE	Machine Learning (ML) for healthcare, Explainable ML in cardiovascular disease, clinically useful AI tools
Sussman, G. J.	CS EE AI+D	Artificial intelligence: learning, problem solving and programming. Computational performance models for intelligent behavior, especially modeling the behavior of engineers. Numerical models of physical systems.
Sze, V.	EE CS AI+D	Design of signal processing algorithms, computer hardware architectures (e.g., domain-specific accelerators), and VLSI circuit design for energy-efficient systems. Applications include high-performance computing (e.g., deep neural networks, sparse tensor algebra), autonomous robot navigation (e.g., depth sensing and perception, motion planning, localization and mapping, exploration), video compression, image processing, computer vision, and digital health.
Szolovits, P.	AI+D CS	Application of artificial intelligence techniques to medical decision making, including machine learning approaches to natural language processing on clinical notes, predictive modeling based on clinical data including images, and discovery of relationships between disease phenotypes and genetics. Effective representation of knowledge, personal health information systems, medical confidentiality.
Tedrake, R. L.	AI+D	Robotics, nonlinear control, and machine learning. Robot manipulation with continued emphasis on rigorous optimization-based approaches to feedback control (which is so far largely absent in manipulation) and the connections between perception and control.
Tidor, B.	AI+D	Modeling of protein-protein interactions, focusing on electrostatic effects and structure-based drug design. Systems-level biology including biological network modeling and information theory applied to data analysis.

Faculty Member	Area(s)	Special Interest for Research
Torralba, A.	AI+D	Computer vision, machine learning and human perception; development of computer vision systems and solving real world recognition tasks; modeling human perceptual and cognitive capabilities; object recognition, classification of whole scenes; visual recognition and classification of places and objects.
Uhler, C.	AI+D	Machine learning and statistics (causal inference, graphical models, autoencoders, generative modeling, self-supervised learning, algebraic statistics, multivariate analysis); data science; mathematical and computational biology (genome packing models, inference of gene regulatory networks); convex optimization; applied algebraic geometry;
Vaikuntanathan, V.	CS AI+D	Cryptography, quantum cryptography, security and privacy in machine learning, computational complexity.
Verghese, G. C.	EE AI+D	Signal processing, estimation, identification, modeling, structured reduction and control for systems arising in biomedicine and other applications; computational physiology, bedside informatics and clinical inference.
Voldman, J.	EE	Biological applications of microtechnology, especially to cell biology; bio-MEMS; electrostatics at the microscale.
Wainwright, M.	AI+D	Statistical machine learning; High-dimensional statistics; Reinforcement learning and stochastic control; Graphical models; Causal inference; Semi-parametric statistics; Algorithms and optimization
Ward, S. A.	CS	Computer architecture and operating systems. (Emeritus)
Warde, C.	EE	Investigation of optoelectronic materials and devices for neuromorphic systems. Design, fabrication and testing of the Compact Optoelectronic Integrated Neural (COIN) co-processor system. Novel algorithms and approaches for training the COIN hardware.
White, J. K.	EE AI+D	Numerical simulation, optimization, and machine learning algorithms applied to medical imaging, nano-photonics, terahertz integrated circuits, and microfluidic devices. Design-based pedagogical strategies for teaching electromagnetics, feedback control, and machine learning.
Williams, R.	CS AI+D	Computational complexity, the design and analysis of algorithms, and their interactions: circuit complexity and circuit-analysis algorithms, graph algorithms, parameterized algorithms and complexity, fine-grained algorithms and complexity.
Williams, V.	CS AI+D	Algorithms and complexity: fine-grained complexity and algorithms, graph and matrix algorithms, dynamic algorithms and data structures, distance compression, computational social choice.

Faculty Member	Area(s)	Special Interest for Research
Wilson, A.	AI+D	Development of fast optimization algorithms for machine learning, dynamical systems, robust statistics, fairness, inequality and healthcare.
Wornell, G. W.	AI+D	Signal processing, information theory, statistical inference, artificial intelligence, and information security. Applications including architectures for sensing, learning, computing, communication, and storage; systems for computational imaging, vision, and perception; aspects of computational biology and neuroscience; digitally-enhanced nanoscale systems and devices, and design of wireless networks.
Yan, M.	CS	Computer architecture and hardware security, with a focus on transient execution attacks and cache-based side-channel attacks and defenses.
Yang, G. R.	AI+D	Computational neuroscience, brain-inspired AI, cognition, deep learning, cognitive science.
You, S.	EE	Optics and algorithms to improve human health. Our current research focus includes nonlinear microscopy and spectroscopy (label-free imaging, multiphoton microscopy), light source engineering (fiber sources, wavefront shaping, spectral shaping), computational optics/imaging (3D holography, hyperspectral imaging, AI-assisted augmented microscopy).
Zeldovich, N.	CS	Building practical secure systems. Operating systems, hardware design, networking, and distributing systems. Programming languages and tools, security analysis and verification.
Zheng, L.	AI+D EE	Wireless communications, physical layer designs, wireless networks; space-time processing, digital communications, multi-user detection algorithms, information theory, stochastic signal processing, optical communications.
Zue, V.	CS AI+D	Development of human language technologies, especially the processing of unstructured content on the web, to enable easy access for novice users, for application such as education and healthcare.

Additional Supervisors

The following members of research staff and other departmental affiliates have been approved by the Committee on Graduate Students as both **PhD** and **Master's** thesis supervisors.

Supervisor	Area(s)	Special Interest for Research
Berger, B.	CS	Algorithms and software for computational biology: large-scale genomics; computational structural biology; network inference, population genetics, and medical genomics.
Clark, D. D.	CS	Computer networks: Internet engineering; hardware and protocols for high-speed large-scale network communications. Real-time services over networks. Policy and economic issues; pricing. Computer/communication security.
Cooke, C.	EE	Electron beams and irradiation. High voltage insulation and diagnostics. Wireless power and resonant power transfer and communications. Simulation and modeling of high frequency transformers.
Dalca, A.	AI+D	Machine learning and graphical models, especially applied to computer vision, biomedical image analysis, and healthcare.
Fisher, J. W.	CS	Information theory, nonparametric statistics and machine learning. Pattern recognition, distributed inference and learning in sensor networks, computer vision, multi-modal data fusion and functional imaging.
Fletcher, R. R.	EE CS AI+D	Biomedical devices; signal processing and machine learning for clinical diagnosis; wearable sensors; antenna design and electromagnetic propagation; wireless sensors and RFID; application to psychiatry (psychophysiology, mediation, mental health) and behavior medicine (drug addiction, substance abuse, depression).
Glass, J. R.	AI+D	Speech and natural language processing including robust speech recognition, multilingual speech processing, health-related biomarkers in speech, multimodal audio-visual processing, language understanding and generation, and conversational systems.
Harrell, D. F.	AI+D CS	Virtuality (VR, AR, MR, etc.), interactive narrative, cognitive science (cognitive semantics), artificial intelligence (AI) and the arts. Game studies and game engineering, serious impact games. (CSAIL/CMS/IDSS Faculty)
Kagal, L.	AI+D	ML systems; knowledge representation and reasoning; private, fair and trustworthy systems; policy frameworks.
Katz, B.	CS	Natural language understanding and generation, human computer interaction, artificial intelligence, and integration of language, vision and robotics.

Supervisor	Area(s)	Special Interest for Research
Keathley, P.	EE	Ultrafast optics, nanophotonics, nanoelectronics, nano-vacuum devices, nonlinear optics, light-matter interaction, quantum metrology, free-electron devices.
Oliva, A.	AI+D	Human perception and cognition; computer vision; human neuroscience; computational neuroscience; face, object, scene and place recognition by human and artificial systems; big data for visual recognition; modeling human perceptual, cognitive and memory capabilities.
O'Reilly, U-M.	CS AI+D	Artificial adversarial intelligence: data-driven ML, symbolic AI, and mod-sim approaches to intelligent behavior in adversarial domains, e.g., cyber security, disinformation.
Quatieri, T. F.	EE	Biologically-inspired signal processing; modeling speech production, auditory processing, and their coupling. Application to early detection of neurological, cognitive, and auditory disorders.
Rosenholtz, R.	CS	Computational modeling of human vision, attention, and capacity limits. Application of understanding of human vision to design of user interfaces and information visualizations. Perceptual and attentional aspects of distracted driving.
Rudolph, L.	CS	Pervasive computer, cell phone programming, optical communication, parallel computing/sensors/actuators, complex systems.
Seneff, S.	CS	Investigating the role of toxic chemicals and nutritional deficiencies in chronic disease through biomedical data mining.
Shrobe, H.	CS	Hardware and software architectures for secure computing, hardware and software architectures for secure and resilient computations, use of natural interfaces (speech, gestures) in the design and synthesis of software.
Sollins, K. R.	CS	Computer networks, internet protocols, network security and privacy, identity, denial of service, Internet of Things.
Veeramachaneni, K.	CS	Machine learning, data science, software and systems for data science, fairness and accountability in machine learning, AI for cybersecurity, artificial intelligence applications, automated machine learning, data science automation.
Velásquez-García, L. F.	EE AI+D	Micro- and nano-enabled, multiplexed, scaled-down systems that exploit high electric field phenomena (e.g., electrospray, electrospinning, field emission, field ionization, plasmas, x-rays) for space, energy, healthcare, manufacturing and analytical applications. Additively manufactured micro/nanoelectromechanical systems (MEMS/NEMS) with emphasis on microfluidics, sensors, and actuators. Artificial Intelligence (AI) applied to additively manufactured MEMS/NEMS.

Supervisor	Area(s)	Special Interest for Research
Weitzner, D.	CS	Network architecture and public policy; development of new web architectures to meet policy challenges such as privacy and intellectual property rights.

Some research staff members and other non-faculty associated with the department have been given departmental approval to supervise Master of Engineering (MEng) theses.

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