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Faculty Project Supervisors 2023-24

	Professor	*Home department*	*Area / Projects*
1	Aluru, Narayana	Mechanical Engineering	Research in the Multiscale Nanotechnology Group focuses on the development of multiscale methods combining quantum, atomistic, mesoscale and continuum scales, and application of multiscale methods to study physics of nanofluidics, bionanotechnology, nanomaterials/nanoelectromechanical systems, and soft matter. Some of the applications currently pursued in the group include water desalination, nanopower generation, DNA sequencing, protein recognition, 2D materials-based chemical and biological sensing, CO2 reduction, energy storage, etc. Website: https://sites.utexas.edu/aluru/
2	Bajaj, Chandrajit	Computer Science	1) Deep Structured Inference Agents: Counterfactual Inference for Improved Outcomes from Multi-modal Patient Clinical and Imaging Observations (e.g. Combatting Parkinson's disease)
			2) Principled Learning to Model Stochastic Dynamical Environments (eg. POMDPs, PDEs, HJB, PMP)
			3) Dynamic Belief Games (e.g. New Materials Discovery, Network Topology Optimization)
3	Baker, Aaron	Biomedical Engineering	We are creating computational models of the cell and the glycocalyx under mechanical forces. In particular, we are interested in modeling how mechanical forces are transmitted through cells and can cause changes in the chromatin or cell signaling. These studies aim to improve our understanding of cellular mechanism of mechanotransduction and gene regulation.
4	Bakolas, Efstathios	Aerospace Engineering & Engineering Mechanics	Interested students will have an informal interview to ensure background, experience, and interests match the project's expectations/requirements.
			1) Data-driven modeling for control of fluid flows (requirement: good familiarity with control theory for linear systems and computational fluid dynamics)
			2) Local motion planning (collision avoidance) and path planning for autonomous robots in dynamic and uncertain environments (requirement: good familiarity with path / motion planning methods)
5	Baldea, Michael	Chemical Engineering	1) Mathematical modeling, optimization and control of process and energy systems.
			2) Data visualization and analysis for manufacturing systems.
6	Becker, Thorsten	Geological Sciences	1) Earthquake dynamics
			2) Thermo-chemical mantle convection models
			3) Planetary evolution modeling
7	Biros, George	Mechanical Engineering	Parallel Algorithms for Data Analysis and Simulation Group. We are working on numerical methods for fundamental problems in computational physics & machine learning. Target applications include machine learning for medical imaging, computational fluid mechanics for blood flow & porous media flows, inverse problems, & uncertainty quantification. Website: https://padas.oden.utexas.edu/

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8	Bollapragada, Raghu	Mechanical Engineering	*Area:* Optimization for Machine Learning *Description:* We are developing nonlinear stochastic optimization algorithms for solving problems in training large-scale machine models with applications in science and engineering. Projects involve designing, analyzing, implementing, and testing optimization algorithms.
9	Bui, Tan	Aerospace Engineering & Engineering Mechanics	1) Inverse problems 2) Uncertainty quantification 3) Numerical analysis 4) Numerical optimization 5) Reduced-order modeling (model order reduction) 6) Scientific computing 7) Parallel computing 8) Scientific machine learning
10	Castillo, Edward	Biomedical Engineering	The Dynamic Medical Image and Computing Lab develops medical image processing & analysis methods for clinical applications. This work is highly interdisciplinary, drawing on expertise in imaging, applied mathematics, medical physics, biomechanics, and medicine. Our current projects involve inferring patient-specific biomechanical properties from dynamic imaging for applications in radiation oncology, radiology, and pulmonology. Project: Standard image-guided radiotherapy (RT) planning for lung cancer delivers a prescribed dose to the tumor while satisfying safety constraints for critical organs. Current RT planning makes the simplifying assumption that lung function is spatially homogeneous. However, we recently showed that incorporating heterogenous function into RT planning reduces both the incidence of lung toxicity and the magnitude of post-RT pulmonary function loss. Using physical modeling and deep learning methods, we wish to develop an optimization framework for maximizing patient lung function post-RT.
11	Chang, Joshua *(cont'd next pg)*	Neurology	1) Developing a better understanding of how electrical stimulation therapy modulates neuronal behavior. We've developed techniques to find optimal stimulus waveforms for controlling neuronal systems, but more insight is needed to understand the mechanisms underlying such changes. This project will involve modeling more complicated neuronal systems, and then exploring the relationships between the optimal stimulus shape and the responses along different ionic channels. 2) Optimizing and understanding the use of complex stimulus waveforms to construct spatially targeted stimulation in biological tissue. This project will involve complex spatial computational modeling of electric field propagation in tissue (e.g., brain) as well as experimental studies conducted on the effects of electrical stimulation of brain tissue.

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11	Chang, Joshua *(cont'd from prev pg)*	Neurology	3) Analyzing physiological signals from the NICU in order to identify time-series driven signatures of critical adverse events in prematurely born infants (e.g., bradycardia, apneas and desaturations). Determining how these signatures may relate to longer term patient-specific outcomes (e.g., rehospitalization, neurological and cognitive performance metrics).
			4) Developing a computational model for emergency transport services (Austin EMS) specifically examining stroke outcomes, using real clinical and geographical data to provide public health insights into the utility of mobile CT units, elevation of hospital stroke certifications, etc.
12	Chelikowsky, James	Physics / Chemistry / Chemical Engineering	Center for Computational Materials
			Student should have some modern physics
13	Chen, Jingyi Ann	Aerospace Engineering & Engineering Mechanics	1) Interferometric Synthetic Aperture Radar (InSAR) image analysis
			2) InSAR-based earth observation applications
14	Clarno, Kevin	Mechanical Engineering	Nuclear and Radiation Engineering Program. The Computational Nuclear Energy Group uses advanced computing algorithms to model the multiphysics behavior of commercial and advanced nuclear reactors for the generation of clean energy.
15	Cullinan, Michael	Mechanical Engineering	1) Computer Vision Processing of In-Line Photoelastic Image Capture for the Improvement of Roll-to-Roll Manufacturing Web Control Description: This project will be operating in tandem with a photoelastic imaging tool used in roll-to-roll (R2R) micro/nano fabrication to build a computer vision tool and reference library for analyzing images taken by the tool as they are taken during the manufacturing process. By processing these images, it will be possible to provide real-time tension information to the R2R system and provide recommendations for improving web control and layer alignment to produce more high quality components at a high throughput.
			2) Image reconstruction using machine learning from sparce data Description: Image reconstruction using machine learning is a widely applicable topic of research, and in the area of nanomanufacturing it presents a unique opportunity to optimize the feedback control process. Large area nanometrology is typically very slow because it requires physical interaction with the sample to take scans at such a small scale. Image reconstruction makes it possible to generate high quality metrology images using faster scan speeds and low density sampling, reducing overall tool time. This project is working to utilize machine learning to accomplish image error correction and reconstruction for nanometrology by adapting established reconstruction algorithms such as Noise2Noise and Intermediate Layer Optimization and applying them to atomic force microscopy data.

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16	Delshad, Mojdeh	Petroleum & Geosystems Engineering	1) Modeling Bench- and Field-Scale Hydrogen Storage in Geological Porous Media 2) Pilot- and Field-Scale Simulation and Optimization of Carbon Storage (CCS) and Co-optimization of CO2 Storage and Enhanced Oil Recovery Method (CCUS) 3) Modeling Enhanced Oil and Gas Recovery Methods
17	Demkowicz, Leszek	Aerospace Engineering & Engineering Mechanics	1) Study on Galerkin and Petrov Galerkin methods for 1D model problems 2) Numerical study on DPG and DPG* methods using 1D model problems 3) Study on minimum residual methods in Banach spaces
18	Elber, Ron	Chemistry & Biochemistry	Modeling Biological Molecules by Computer Simulations
19	Engquist, Bjorn	Mathematics	Numerical analysis of differential equations, optimization, multiscale modeling and seismic imaging.
20	Ezekoye, Ofodike	Mechanical Engineering	UT Fire Research Group seeks to understand and characterize high temperature reacting systems with a focus on fire safety science. 1) Modeling and simulation of thermal runaway propagation, fire, and explosion dynamics for lithium-ion cells and battery arrays 2) Modeling and simulation of fire and smoke transport in rooms and buildings
21	Fomel, Sergey	Geological Sciences	Computational geophysics, including seismic imaging, wave propagation, inverse problems, and geophysical data analysis using machine learning
22	Foster, John	Petroleum & Geosystems Engr / Aerospace Engr & Engr Mechanics	Contact for project areas
23	Fridovich-Keil, David	Aerospace Engineering & Engineering Mechanics	Research is at the boundary of autonomous and multi-agent decision-making, machine learning, and control theory, and focuses on algorithmic development with validation on physical systems.
24	Ganesan, Venkat	Chemical Engineering	Research in our group uses computer simulations (primarily classical molecular dynamics) to address the structure and properties of a variety of soft matter systems such as polymers, colloids, biological membranes etc. Current interests relate to the design of polymer electrolytes for batteries, optimization of water purification and ion separation membranes, and the use of machine learning tools to address tradeoffs resulting in such systems.

updated 08/15/23

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25	Gerstlauer, Andreas	Electrical & Computer Engineering	Related research areas in the System-Level Architecture and Modeling (SLAM) Group (http://slam.ece.utexas.edu) 1) Accelerator-rich, heterogeneous high-performance computer architectures 2) Algorithm/architecture co-design for scientific and ML workloads 3) GPU, FPGA and custom hardware acceleration of scientific and ML kernels 4) Neuromorphic and near-/in-memory computing
26	Gilpin, William	Physics	Our group is interested in developing new computational tools for the analysis of nonlinear dynamical systems. 1) Automated discovery of rare dynamics in dynamical systems 2) Time series featurization with topological data analysis
27	Giustino, Feliciano	Physics	Research Area: Computational Materials Science Mentors: Feliciano Giustino / Viet-Anh Ha Project: Computational screening of putative perovskites for photovoltaics and solid-state lighting. In this project the student will use quantum mechanics, density-functional theory, and high-performance computers to predict the electronic and optical properties of hypothetical new materials identified by our group. The goal of this activity is to identify new materials for applications in solar cells and light-emitting devices. This project requires prior knowledge of quantum mechanics (at the level of one undergraduate-level course) and familiarity with python workflows.
28	Heimbach, Patrick	Geological Sciences	Computational ocean and ice forward & inverse modeling: As part of several NASA, NSF, & ONR-funded projects we are conducting forward & inverse modeling studies of the global and regional-scale ocean circulation. The projects seek to improve our understanding of climate dynamics and variability, improve ice-ocean interaction simulations at high latitudes, represent small-scale processes such as the internal wave field in the ocean, develop methods for uncertainty quantification, conduct formal observing system design studies, and improve the efficiency of adjoint-based optimization for coupled ocean-ice state and parameter estimation. Interested students would be involved in one of these subjects through model and algorithm development, conducting simulations, or developing quantitative analysis tools. The student should be familiar with Fortran, Linux, Matlab, Python, or Julia.

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29	Henkelman, Graeme	Chemistry	The primary focus of the Henkelman group is the development of algorithms and simulation methodology to study kinetic processes at the atomic scale. We are interested in surface chemistry for catalysis and diffusion in solids with application to battery materials. Electronic structure methods are used to model the atomic interactions. Although accurate, these calculations are expensive, so that computational efficiency is very important and the development of machine learning and surrogate models will be valuable. Using our computational methods, we strive to understand the dynamics of chemical systems over experimental time scales, and use this understanding to design new materials for energy applications.
30	Hesse, Marc	Geological Sciences	General Area: Geological Fluid Dynamics
			1) Cryo-volcanism on icy dwarf planets
			2) Mars global hydrology
			3) Ice shell dynamics of tidally heated moons
31	Huang, Rui	Aerospace Engineering & Engineering Mechanics	1) Multiscale modeling of two-dimensional nanomaterials and mechanical interactions
			2) Mechanics of bio-inspired soft active materials by molecular and continuum modeling
32	Jah, Moriba *(cont'd next pg)*	Aerospace Engineering & Engineering Mechanics	General Area: Non-Gravitational Astrodynamics, Space Surveillance, Space Situational Awareness, Space Traffic Management, Spacecraft Navigation, Orbit Determination and Prediction, Multi-Source Information Fusion
			1) Space Environment Effects and Impacts on Anthropogenic Space Objects and Events: A) Application of physics-based algorithms & models leveraging high performance computing to quantify space object material aging/degradation, charging effects, & non-gravitational forces & torques for various classes of anthropogenic space objects (rocket bodies to multi-layer insulation). Realistic trajectory prediction of these objects is of interest. B) Modeling & prediction of anthropogenic space object break-up events due to material fatigue, cracking, stress, etc. C) Modeling & prediction of anthropogenic space object re-entries ad determining landing/survivability footprints & possible expected casualty calculations. This is highly computational & physics-based.
			2) Development of a Multi-factor Anthropogenic Space Object Recognition, Charcterization, and Assessment (MASORCA) method
			3) Anthropogenic Space Object Classification Leveraging Knowledge Graphs and Ontologies: Investigate the utility of representing multi-source information in a Knowledge Graph and demonstrate the ability to use the Ontologies as a method to classify (taxonomy) of anthropogenic space objects. This would potentially have to be done for tens of thousands of anthropogenic space objects in the analyses. Also investigate the use of artificial intelligence and machine learning to apply to this classification problem.

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32	Jah, Moriba *(cont'd from prev pg)*	Aerospace Engineering & Engineering Mechanics	4) Hard/Soft Information Fusion: Develop a method to combine and fuse both physics-based information (e.g. radar and telescopes) with human-based information(e.g. texts interrogated by Natural Language Processing). Investigate methods of Uncertainty Quantification and Representation for this problem and demonstrate realistic utility for several use-cases. How can one handle both probabilistic (aleatory) and opinion based (epistemic) inputs in a common framework? 5) Use of clustering models for Uncertain orbital Dynamical Systems: A) It is possible to represent uncertain orbital dynamical systems in a clustering framework? B) Is it possible for improved Anthropogenic Space Object identification, classification, and behavioral prediction to be achieved by extending the parameter space in the clustering model to include physical and functional anthropogenic space object features, beyond solely kinematics states (i.e. position and velocity)? Much like the molecular structure readily captured by Voronoi theory, we proposed to define an equivalent "Space Object Molecule" whose parameter space includes orbital states but also space object characteristics such as mass, size, material properties, and perhaps even functional capabilities. C) This will involve intense math and investigation into topologies leveraging g computational frameworks.
33	Jones, Brandon	Aerospace Engineering & Engineering Mechanics	Our research focuses on the intersection of orbit propagation and advanced estimation to solve problems in astronautics. Applications of this work include space domain awareness, satellite navigation, and spacecraft systems. Specific projects vary with the semester and are designed to overlap with active research conducted by graduate students.
34	Kallivokas, Loukas	Civil, Architectural, & Environmental Engineering	We are working on wave propagation and wave-driven inverse problems. Applications include subsurface imaging, condition assessment, and metamaterials.
35	Kileel, Joseph	Mathematics	1) Reconstruction problems in imaging and computer vision 2) Higher-order tensor decompositions 3) Non-convex optimization landscapes

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36	Kumar, Krishna	Civil, Architectural, & Environmental Engineering	1) <u>Accelerating Simulations using Graph Neural Networks</u>: The Graph Network Simulator (GNS) https://github.com/geoelements/gns project provides a unique opportunity to gain hands-on experience in advanced machine learning techniques, specifically focusing on surrogate modeling. In this project, students will leverage the power of GNS for creating surrogate models that efficiently mimic complex physical phenomena. These models can significantly speed up computer simulations by bypassing the need to calculate detailed physics at every step. Furthermore, the project will delve into accelerating the GNS itself on multi-node architecture, enhancing its performance and efficiency for large-scale problems. The experience culminates with the implementation of a mesh network accelerating complex CFD and Finite Element solvers.
			2) <u>Building next-generation simulators with Differentiable Programming</u>: The Differentiable Simulations project is a cutting-edge research program focused on the integration of Automatic Differentiation (AD) and Gradient-based optimization, offering an innovative class of simulation tools that promises to transform the landscape of optimization, design, control and inverse problems. Leveraging AD, these tools provide a way to compute the derivatives of a function that can be represented as a computational graph, thereby enabling the efficient calculation of gradients necessary for optimization algorithms. This technology holds enormous potential for application, from optimizing complex systems and machine learning models, to advancing the field of robotics through more intelligent design and control mechanisms.
37	Laguna, Pablo	Physics	Numerical Relativity and Computational Astrophysics:
			1) Binary black holes and black hole – neutron star binaries
			2) Scalar-tensor alternative theories of gravity
			3) Physics Informed neural networks applied to gravitational physics
38	Landis, Chad	Aerospace Engineering & Engineering Mechanics	Computational Mechanics Group
39	Lavier, Luc	Institute for Geophysics	Computational Solid Earth Geophysics to simulate flow and deformation of Earth materials (rocks, Ice) across multiple time scales (millions of years to seconds)
			1) Earthquakes and slip transients in fault zones
			2) Deformation processes on Earth (tectonic evolution of Earth)
			3) Deformation processes on other planets (Mars, Venus) and icy Moons (Europa)
			4) Thermomechanical evolution of continental margins

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40	Makarov, Dmitrii	Chemistry & Biochemistry	1) Biophysical Dynamics. We apply computer simulations and polymer theory to learn how biomolecules fold into biologically functional shapes and how they search for their targets. 2) Chemical rate theory with applications to mechanochemical phenomena. We develop theoretical models and computational algorithms to describe how mechanical forces affect the dynamics and pathways of chemical reactions. 3) Theory and interpretation of single-molecule experiments. We develop physical models and numerical tools to explain single-molecule observations.
41	Manuel, Lance	Civil, Architectural and Environmental Engineering	1) Uncovering patterns, anomalies, motifs and discords in time series databases. 2) Stochastic weather window analysis in planning of ocean-related operations and maintenance activities in support of a “blue economy”. 3) Uncertainty quantification in long-term ocean climate trends and prediction of extreme waves.
42	Marcotte, Edward	Molecular Biosciences	Computational, systems, and synthetic biology. The Marcotte group studies the large-scale organization of proteins, reconstructing 'wiring diagrams' of cells by learning how the proteins encoded by a genome are associated into functional pathways, systems, and networks. Such models help determine the functions of genes and link genes to traits and diseases. Computational projects include 3D structural modeling of proteins and assemblies, graphical modeling of biological systems, and analysis of high-throughput functional genomics and proteomics approaches for studying thousands of genes/proteins in parallel.
43	Matzner, Richard	Physics	1) Experimental/observational program which will do tests of General Relativity (GR) based on laser-ranged satellite measurements. It will eventually provide very accurate orbital information about a new satellite (LARES-2) which, once sufficient observations are achieved can play a dominant role in measuring the "frame dragging" of that satellite due to the rotating Earth. 2) Research group looking at other satellite tests of gravity to see how accurately we can confirm GR. This has a part in deciding whether/which extensions to GR are consistent with what we already know.
44	Meyers, Lauren	Integrative Biology	Developing mathematical models of infectious disease dynamics to investigate outbreaks, forecast their spread, and design effective intervention strategies.
45	Morrison, Philip	Physics	Computation of low degree-of-freedom Hamiltonian/symplectic dynamical systems with applications in fluid mechanics, astrophysics, and plasma physics. Development of structure preserving algorithms for PDEs of kinetic theory and fluid mechanics.

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46	Niyogi, Dev	Geological Sciences / Civil, Architechtural, and Environmental Engineering	If you have an interest to conduct cutting-edge research in environmental sustainability, climate, weather extremes, and satellite datasets our group will be the right fit. Examples of possible studies include working with (i) using AI/ML approaches for developing climate/weather digital twins especially for the Gulf Coast region, (ii) satellite data assimilation techniques, (iii) data+model fusion to create synthetic datasets for applications ranging from urban fires, heat stress mapping, air quality, (iv) statistical downscaling climate information from global to local scales, (v) urban, coastal boundary layer and severe weather simulations using advanced weather research and forecasting models, and (vi) developing user interfaces and data portals for climate and environmental datasets using GIS. The work will be with the University of Texas Extreme Weather, Climate and Urban Sustainability (TExUS) Lab, which has number of active and evolving projects. Email happy1@utexas.edu, dev.niyogi@jsg.utexas.edu
47	Offner, Stella	Astronomy	Applying and improving neural networks to predict gas chemistry/abundances. This is a hybrid astronomy-chemistry project.
48	Ostling, Annette	Integrative Biology	1) Development and application of clustering and network analyses methods to detecting structure in ecological data related to mechanisms of niche differentiation/biodiversity maintenance 2) Development and application of numerical methods for partial differential equations to numerical analysis of models of competition between populations structured by size and patch aging (which describe competition between tree species, but also other ecological systems) 3) Stochastic community assembly simulations to study competitive coexistence and its influence on community structure
49	Pyrcz, Michael	Petroleum & Geosystems Engineering	Spatial and subsurface data analytics, geostatistics and machine learning
50	Rausch, Manuel	Aerospace Engineering & Engineering Mechanics / Biomedical Engineering	1) Mechanics of soft tissues using the finite relent method 2) Inverse material parameter identification 3) Automatic image segmentation 4) Automatic filtering, smoothing, and analysis of surgical data
51	Rylander, Marissa	Mechanical Engineering	Project will develop a computational model to accurately predict the evolving and complex nature of tumor growth and the response of tumors to candidate therapeutic regimens for treatment optimization. This model will be formulated, calibrated, and validated using a series of physiologically representative in vitro tumor platforms of varying complexity developed by our lab which have been shown to recapitulate the intricacies of the cancer microenvironment.

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52	Sacks, Michael	Biomedical Engineering	1) Machine Learning methods in finite element modelling of the cardiovascular system 2) Diffeomorphic geometric modelling of cardiac structures
53	Sen, Mrinal	Institute for Geophysics	1) Seismic wave propagation simulation in 3D elastic, anisotropic media. 2) Inverse Problems in Seismology and Seismic Exploration.
54	Sha, Zhenghui	Mechanical Engineering	Multidimensional Network Modeling and Analysis of Complex Sociotechnical Systems *Description:* Complex sociotechnical systems are constituted of multiple types of stakeholders from different levels who exhibit complex relations and make multiple types of decisions that are dependent on each other. Moreover, there might be a large number of stakeholders, each of which has different decision-making preferences, i.e., heterogeneity. These unique features call for modern computational methods and a systematic modeling framework for complex systems engineering. In this project, we leverage the advancement in network theory and design science to develop a multidimensional network-based approach to model, analyze and predict individual entities' decisions in supporting the study of emergent behaviors in complex systems and the design of complex sociotechnical systems.
55	Shoemaker, Deirdre	Physics	1) Gravitational Wave Data Analysis in Python: work with gravitational wave data and numerical relativity waveforms to detect and interpret gravitational waves, could involve machine learning. 2) Numerical relativity: work to improve the efficiency of the code that solves Einstein's partial differential equations for black holes merging. Involves MPI, C, and could involve machine learning/AI
56	Siegel, Donald	Mechanical Engineering	1) Atomic scale simulation of materials for energy storage 2) High-throughput computational screening for new materials 3) Applications of machine learning to improve understanding and accelerate discovery of functional materials
57	Subramanian, Venkat	Mechanical Engineering; Texas Materials Institute	1) Real-time simulation and optimization of nonlinear differential-algebraic equations to enable fast charging of batteries in electric vehicles and cell phones 2) Model and data-driven estimation of capacity fade 3) Collocation methods - strong and weak forms for current and next-generation battery materials
58	Tamir, Jon	Electical & Computer Engineering	Computational Sensing and Imaging Lab 1) Medical image modeling through deep learning 2) Large-scale distributed optimization for MRI reconstruction 3) Joint system and reconstruction design for MRI

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59	Tanaka, Takashi	Aerospace Engineering & Engineering Mechanics	1) Path integral control of safety-critical robotic systems: We investigate a method to solve a stochastic optimal control problem by solving a high-dimensional partial differential equation by Monte-Carlo sampling. The project involves code development on GPUs and its lab implementation. 2) Encrypted control systems: We study how to integrate homomorphic encryption methods to enhance privacy in machine learning and control systems involving multiple parties. This project will test numerical implementations and perform feasibility studies.
60	Tompaidis, Efstathios	Information, Risk, and Operations Management	1) Energy reliability 2) Financial regulation
61	Topcu, Ufuk	Aerospace Engineering & Engineering Mechanics	Theoretical and algorithmic aspects of the design and verification of autonomous systems. Research is at the intersection of learning, controls, and formal methods with applications in robots and air and ground vehicles.
62	Torres-Verdin, Carlos	Petroleum & Geosystems Engineering	1) Large-scale inverse problems for subsurface geophysics 2) Machine-learning methods for expedient forward and inverse problems in subsurface geophysics 3) Machine-learning methods for the estimation of rock properties from multi-physics measurements 4) Estimation of uncertainty of results in inverse problems
63	Tsai, Yen-Hsi	Mathematics	1) Mathematical theory for deep learning 2) Machine learning approaches for games and navigation problems 3) Multiscale algorithms for wave propagation and highly oscillatory dynamical systems
64	Varghese, Philip	Aerospace Engineering & Engineering Mechanics	1) Kinetic Equations – Extending the quasi-particle simulation method for the Boltzmann equation to cylindrical and spherical coordinates in velocity space, Incorporating the Boltzmann equation into a multi-dimensional flow solver like Open Foam. 2) Solving the Fokker-Planck equation using a quasi-particle method.
65	Virostko, Jack	Diagnostic Medicine	We are using machine learning to perform classification and segmentation tasks on medical images. Specifically, we are analyzing abdominal MRI and identifying imaging features indicative of diabetes.
66	Wang, Atlas	Electrical & Computer Engineering	1) Learning optimization algorithms from data. You can read this as a primer: https://arxiv.org/abs/2103.12828 2) Exploiting sparsity in deep learning, with benefits including resource efficiency, data efficiency, and/or communication efficiency. Example: https://news.mit.edu/2020/neural-model-language-1201 3) Computer vision: image enhancement, image style transfer, creating visual arts from sketch. Sample: https://williamyang1991.github.io/projects/ECCV2020/

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67	Wheeler, Mary	Aerospace Engr & Engr Mechanics / Petroleum & Geosystems Engineering	Center for Subsurface Modeling
68	Yang, Zong-Liang	Biomedical Engineering	Research focuses on understanding and modeling of land-atmosphere exchanges of energy, mass and momentum, quantifying land-climate interaction & feedback strengths, and exploring important applications of societal relevance such as prediction of hydrological extremes (floods, droughts, heatwaves, wild fires, and severe storms). Approaches include theoretical work, data analysis and numerical modeling. Dr. Yang's terrestrial hydrological parameterizations and land surface models (CLM and Noah-MP) are used by the U.S. National Center for Atmospheric Research (in two of its premier models, the Community Earth System Model and the Weather Research Forecasting model), the U.S. National Centers for Environmental Prediction (the Climate Forecast System), the U.S. National Water Center (the National Water Model) and other major modeling centers worldwide. These predictive models have proven extremely critical and beneficial in climate applications and in accurately forecasting extreme weather and water events (including recent Hurricane Harvey) and associated impacts. He also develops innovative dynamic downscaling methods that generate high-resolution regional climate information for impact assessments and resource decision-making.
69	Yankeelov, Thomas	Biomedical Engineering	Dr. Yankeelov's team develops tumor forecasting methods by employing patient-specific, quantitative imaging data to initialize and constrain predictive, multi-scale biophysical models of tumor growth with the purpose of optimizing therapies for the individual cancer patient. This is accomplished by dividing his efforts into approximately equal parts mathematical modeling, pre-clinical development and validation, and implementation in human studies.
70	Yi, Stephen	Biomedical Engineering / Dell Medical School (Oncology)	1) Biomedical big data analysis and bioinformatics, involving disease mutations, single cell analysis and genotype-phenotype relationships. 2) Machine Learning/Deep Learning: leverage on large amount of biological/medical data to identify novel drug targets and drug combinations. 3) Network modeling for precision medicine, including early disease prevention and personalized therapeutics development. 4) Interdisciplinary science and engineering, involving mathematics, computer science and biology. 5) Computational simulation and modeling to study biological signaling transduction, dynamics and disease.
71	Zanetti, Renato	Aerospace Engineering & Engineering Mechanics	Modeling and simulating aerospace vehicles with an emphasis on stochastic methods.

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72	Zariphopoulou, Thaleia	Mathematics	1) Human-machine interaction systems and digital-twins 2) Inverse reinforcement learning, elicitation of risk preferences 3) Robo-advising and automated investment platforms 4) Information acquisition 5) Medical and health care, quantitative modeling and methods

List is not exhaustive. Students may select a project supervisor from any of the Oden Institute

GSC Faculty

or

Affiliated Faculty