BOSTON UNIVERSITY

MS Project / Thesis Topics for Summer/Fall 2025

4.23.2025

Faculty: Professor Irving Bigio (bigio@bu.edu)

Project Title: Deep learning or other machine learning methods for 3D reconstruction of myelin fibers in brain tissue
Project Description: The student will collaborate with a group of PhD students to develop algorithms for 3D reconstruction of myelin fibers using microscopy images acquired from our birefringence microscope.
Semester: Summer or Fall
Number of students: 1-2 students
Expected period: 1-2 semesters
Desired Background: CE, EE. Coding: Matlab, Python, some experience with machine learning preferable
Scope of work: Image / data analysis
Application requirements: A CV to be submitted and applicants will be interviewed

Faculty: Professor Michelle Sander (msander@bu.edu)

Project Title: AI tools for neuroscience imaging
Project Description: The student will explore how to integrate state-of-the art AI tools to enhance data analysis and identification of features in label-free photothermal microscopy images.
Semester: Summer, Fall
Number of students: 1-2 students
Expected period: 1-2 semesters or longer
Desired Background: Matlab, programming experience
Possibility of extending a project to a thesis: Yes
Application Requirements: please provide a CV

Faculty: Professor Michelle Sander (msander@bu.edu)

Project Title: How to generate ultrashort pulsed lasers?
Project Description: The student will explore pulse propagation in various laser cavities to optimize the optical output and overall performance for femtosecond and ultrashort pulses operating in the 2um regime.
Semester: Summer, Fall
Number of students: 1-2 students
Expected period: 1-2 semesters or longer
Desired Background: Matlab, programming experience
Possibility of extending a project to a thesis: Yes
Application Requirements: please provide a CV

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Faculty: Vladimir Kleptsyn (vklep@bu.edu) & Professor Enrico Bellotti (bellotti@bu.edu)

Project Title: Design and fabrication the capacitive type of the Dew point sensor for home and medical applications

Project Description: The project comprises design and fabrication of a sensor itself as well as electronic portion of the device. Both design and fabrication are assumed to be completed in two form-factors: macro-sensor on a PCB for home use and a fast-responsive silicon micro-sensor.

Semester: Summer and potentially Fall

Number of students: 1-2 students

Application Requirements: A CV must be submitted and applicants will be interviewed

Faculty: Min-Chang Lee (mclee@bu.edu) & Vladimir Kleptsyn (vklep@bu.edu)

Project Title: Megasonic transmitter power driver for holographic bio-printing

Project Description: Acoustic 3d holography has potential applications in bioprinting for tissue engineering / regeneration. Biomaterial microparticle manipulation via sound relies on proper amplification of the signal sent to the ultrasonic transducers (piezo transmitters) used in the setup. This project comprises design, simulation, and building a powerful MHz range amplifier with a matching circuit for driving a piezo transmitter at its resonance frequency. To estimate an efficiency/power of the transmission a sound pressure measurement circuit needs to be designed as well.

Semester: Summer

Number of students: 1-2 students

Application Requirements: A CV must be submitted and applicants will be interviewed

Faculty: Min-Chang Lee (mclee@bu.edu) & Vladimir Kleptsyn (vklep@bu.edu)

Project Title: Solar powered transmitting systems and environmental impacts

Project Description: The recent advancement in power electronics and microelectronics led to the further development of large-scale solar and fusion powered systems for green energy applications. However, we need to evaluate the potential environmental impacts, caused by the transmitted electromagnetic (EM) wave-plasma interactions in the upper atmosphere.
This project involves the design and testing of transmitting and receiving system components, and the analysis of EM wave interactions with magnetized plasmas.

Semester: Fall

Number of students: 1-2 students

Desired Background: Power electronics and Plasma Engineering

Application Requirements: A CV must be submitted and applicants will be interviewed

Faculty: Professor James Galagan (jgalag@bu.edu)

Title: Neural Network Framework for Analyzing Genomic Data
Project Description: The student will gain valuable first-hand experience with both the practical coding and theoretical aspects of machine learning and neural networks. The project also has a very high potential for one or more independent publications.
Semester: Summer, Fall
Number of students: 1 - 2
Desired Background: The work requires strong Python coding skills, and experience with tensor-flow is highly desirable. Also desired, but not required, are experience working in a shared code environment and basic familiarity with SQL.
Application requirements: CV and an Academic Transcript

Faculty: Professor Eshed Ohn-Bar (eohnbar@bu.edu)

Title: Adapting Large Vision and Language Models for Real-World Systems
Project Description: The goal of this project is to explore the usability of multimodal large language models for robotics and intelligent systems, such as autonomous vehicles and assistive technologies. Students will work with a PhD student.
Semester: Summer, Fall
Desired Background: Programming (Python, PyTorch), machine learning, graphics
Expected Time: 1-2 semesters
Application requirements: CV and an Academic Transcript

Faculty: Professor Eshed Ohn-Bar (eohnbar@bu.edu)

Title: Expressive 3D Perception and Reinforcement Learning for Self-Driving
Project Description: Students will work with a PhD student on state-of-the-art models for navigation. The goal of this project is to add new modules for a high-fidelity simulation related to 3D computer vision, and use the improved 3D reasoning to develop effective models for navigational decision-making.
Semester: Summer, Fall
Desired Background: Programming (Python, PyTorch), machine learning, graphics
Expected Time: 1-2 semesters
Application requirements: CV and an Academic Transcript

Faculty: Professor Eshed Ohn-Bar (eohnbar@bu.edu)

Title: Low-cost and Resource-constrained Assistive Systems
Project Description: Students will develop novel low-cost design and models for efficient assistive and robotic systems, the project is a collaboration with Red Hat Research.
Semester: Summer, Fall
Desired Background: Programming (Python, PyTorch), machine learning, graphics
Expected Time: 1-2 semesters
Application requirements: CV and an Academic Transcript

Faculty: Professor Luca Dal Negro (dalnegro@bu.edu)

Title: Quantum correlation measurements of nonlinear optical nanostructures
Semester: Summer, Fall
Background: Materials Science, EE, Physics
Expected period: 6 months to 1 year total with possible extension
Brief work description: This experimental project involves testing and measuring the single-photon coincidence statistics and intensity correlation function of nonlinear nanostructures and interferometers for novel applications to quantum sensing and computing.
Application requirements: Candidates must send a CV

Faculty: Professor Luca Dal Negro (dalnegro@bu.edu)

Title: Quantum deep learning for electromagnetic inverse problems
Semester: Summer, Fall
Background: EE, CE, Physics, Materials Science
Expected period: 6 months to 1 year total with possible extension
Brief work description: Based on recent advances quantum deep learning, we plan to develop and test a general quantum neural network (QNN) framework for the solution of electromagnetic inverse scattering problems using variational quantum circuits. The recent field of quantum machine learning explores how to devise and implement quantum software that could enable the solution of complex inverse problems exponentially faster compared to classical computers.
Application requirements: Candidates must send a CV

Faculty: Professor Luca Dal Negro (dalnegro@bu.edu)

Title: Physics-driven deep learning methods for inverse design of optical nanomaterials
Semester: Summer, Fall
Background: CE, EE, Physics
Expected period: 6 months to 1 year total with possible extension
Brief work description: Using advanced deep learning approaches. We plan to design miniaturized optical devices and diffractive optical elements based on random scattering media for large-scale reservoir optical computing (RC) applications.
Application requirements: Candidates must send a CV

Faculty: Professor Luca Dal Negro (dalnegro@bu.edu)

Title: Nonlinear optical nanoantennas in the quantum regime
Semester: Summer, Fall
Background: EE, Physics, Materials Science
Expected period: 6 months to 1 year total with possible extension
Brief work description: We plan to design, fabricate, and test novel types of highly nonlinear optical nano-antennas in the quantum regime and investigate their potential to achieve quantum computing functionalities at the nanoscale.
Application requirements: Candidates must send a CV

Faculty: Professor Luca Dal Negro (dalnegro@bu.edu)

Title: White-light low-coherence interferometric study of anomalous photon transport in complex media
Semester: Summer, Fall
Background: EE, Physics, Materials Science
Expected period: 6 months to 1 year total with possible extension
Brief work description: We plan to test a state-of-the-art a white-light low-coherence interferometric setup and characterize the nature of photon transport in complex scattering media with femtosecond-scale time resolution. Applications to lasing and optical sensing boosted by photon localization phenomena are anticipated as well as discovery of novel optical phenomena in the anomalous transport regime of photons.
Application requirements: Candidates must send a CV

Faculty: Professor Lei Tian (leitian@bu.edu)

Title: Deep learning for microscopy image analysis
Number of students: 1-2 students
Semester: Summer, Fall
Expected period of the project: 1 – 2 semesters
Project Description: The student will work a group of PhD students to develop deep learning algorithms for quantitative microscopy image analysis
Scope of work: Deep learning algorithm development**;** Image / data analysis
Required Background: Coding: Python, Tensorflow or PyTorch
Application requirements: A CV must be submitted and applicants will be interviewed

Faculty: Professor Lei Tian (leitian@bu.edu)

Title: Deep learning for image reconstruction
Number of students: 1-2 students
Semester: Summer, Fall
Expected period of the project: 1 – 2 semesters
Project Description: The student will work a group of PhD students to develop deep learning algorithms for image reconstruction techniques for computational microscopy
Scope of work: Deep learning algorithm development**;** Image / data analysis
Required Background: Coding: Python, Tensorflow or PyTorch
Application requirements: A CV must be submitted and applicants will be interviewed

Faculty: Professor Tianyu Wang

Project Title: Integration of the API of open-source imaging acquisition software with language models.

Project Description: The student will work directly with the faculty member. The aim of the project is to integrate the image acquisition API of ScanImage with LLLm-powered nodal graph pipelines to automate the control of optical microscopy.

Semester: Summer and Fall

Number of students: 1-2 students

Expected period: Summer with the possibility of extension

Extendable to a thesis: Yes

Desired Background: Being a natural programmer and computer enthusiast; good at Python and Pytorch; having an exploratory mindset, willing to try new tools and find creative ways to use them; curious about the application of large language models.

Application requirements: CV, academic transcript, and meeting with the faculty advisor