

Engineering Concentration in Machine Learning (ML)

Requirements and Instructions

bu.edu/eng/programs/machine-learning/

25 March 2022

Goals

Equip students with skills in:

1. ML algorithms:

- select
- adapt or optimize
- design
- assess performance
- explore various application contexts

2. ML software or hardware tools: utilize, gain experience

3. Data: curate, visualize, or analyze data of various types

4. Communication: read and explain methods from ML literature

Overview

- **Concentration Declaration**
- **Coursework** (elective courses on website + slides 11, 12)
 - **1 Required overview course** (2 choices):
 - **ENG EC 414:** Introduction to Machine Learning
 - **ENG EC 503:** Learning from Data
 - **2 Elective depth courses** (20+ choices across 3 pillars):
 - **Pillar I:** Models, Learning, and Inference (4 choices)
 - **Pillar II:** Optimization, Algorithms, and Programming (6 choices)
 - **Pillar III:** Applications (12 choices)
- **Experiential component**
 - **Proposal + Report + Self-Recorded Presentation**
 - **Options:** laboratory research, directed study, internships, senior design project, experiential course project, and others.

Concentration Declaration

- **Check:** You must have a **declared major** on record
- **Declare concentration** as early as possible, but not later than **May 1 of junior year**
- **Download and complete** ML concentration declaration form from website
- **Propose 3 courses:**
 - 1 required
 - 2 electives
 - **no proposed course must be required for the major**
 - If a course project is proposed to satisfy the experiential component, then it must be from a course that is different from the above 3 proposed courses
- **Sign, date and submit** ML concentration declaration form to:
engrec@bu.edu

Experiential Component

- **Options:** laboratory research, directed study, internships, senior design project, experiential course project, and others.
- If a course project is proposed for the experiential component, then it must be from a course that is different from the 3 courses used to satisfy the course-requirements of the concentration.
- **Required course:** must be completed **before** experience
- **Supervisor:** needed, e.g., faculty member at a university or a researcher in industry
- **Group projects:** individuals must contribute **substantial effort** in **lead roles** for **ML tasks**

Experiential Component: Proposal

- Must be submitted and approved **prior** to experience (form on website)
- Not later than last day of **fall semester** classes, **senior year**
- Required course must be completed **before** experience
- Must include name and contact information of **experience supervisor**
- If a course project is proposed, then it cannot be from the 3 courses used to satisfy the course-requirements of the concentration
- Proposed experience must:
 - Be **relevant** to ML: must connect to some **goals of concentration** (slide 2)
 - Have **substantial** ML content
- Group projects:
 - **substantial individual contribution to ML tasks** required
 - **individual proposal** required
 - discussion of **ML tasks and individual roles (lead vs support)** required
- Submit proposal-form (completed, signed & dated) + PDF document of proposal (see slide 7) to engrec@bu.edu

Experiential Component: Proposal

- **PDF document** (up to 2 pages) describing proposed experience in **sufficient detail**. Include the following information:
 1. **Heading:** “Machine Learning Concentration Experiential Component Proposal” + Title + Your name & major + Name(s), affiliation(s) and email(s) of supervisor(s) + Name(s), major(s) and email(s) of team member(s) (for a group project) + Date
 2. **What & Why:** context + motivation + goals
 3. **How & When:** methods + proposed work + plan (timeline)
 4. **Relevance to ML:** (connect to some **goals of ML concentration** on slide 2)
 - Data
 - ML algorithms or models
 - ML software or hardware tools
 5. **Evaluation** basis for proposed work
 6. Suitable figures, tables, and references
 7. **Group projects:** discuss ML tasks and individual roles (lead vs support)

Experiential Component: Report & Presentation

- Must be submitted and approved **after** completion of experience (form on website)
- Not later than **April 22 of senior year**
- Must include **supervisor's approval** via signature on report
- Submit the following to engrec@bu.edu
 - Copy of Experiential Component Proposal
 - Summary Approval Form (completed, signed & dated)
 - PDF document of report with supervisor's signature (see slide 9)
 - PDF document of presentation slides (see slide 10)
 - Link to a self-recorded video of your presentation placed on your BU Google Drive (include link in PDF document of presentation slides)

Experiential Component: Report

- **PDF document** (up to 4 pages) summarizing experience in **sufficient detail**. Include the following information:
 1. **Heading:** “Machine Learning Concentration Experiential Component Report” + Title + Your name & major + Name(s), affiliation(s) and email(s) of supervisor(s) + Name(s), major(s) and email(s) of team member(s) (for a group project) + Date
 2. **Overview:** context + motivation + goals
 3. **Contributions:** work accomplished + comparison with goals & plan in proposal
 4. **Methods of study relevant to ML:** (connect to some **goals of ML concentration** on slide 2)
 - Data
 - ML algorithms or models
 - ML software or hardware tools
 5. **Evaluation** of contributions
 6. Suitable figures, tables, and references
 7. **Group projects:** discuss individual contributions (identify lead and supporting roles) related to ML tasks

Experiential Component: Presentation

■ Slides:

- **Create** slides (limit 10) summarizing your experience
- **Structure** the slides similarly to the report
- **Submit** a PDF version of your slides together with your report

■ Video recording:

- Create a video recording of your slide presentation by yourself
- The video must not be more than 5 minutes in duration
- You must be clearly visible at the beginning of the video
- Place the video file in **your** BU Google Drive and include a **link** to it in the PDF document of your presentation slides (on slide 1)

Elective Courses

■ Pillar I: Models, Learning, and Inference

- ENG EC 500 (Orabona) Online Learning
- [ENG EC 505 – Stochastic Processes and Inference](#)
- [ENG EC 517 – Introduction to Information Theory](#)
- [ENG EC 523 / CAS CS 523 – Deep Learning](#)

■ Pillar II: Optimization, Algorithms, and Programming

- ENG EC 500/525 – (Cutkosky) Optimization for Machine Learning
- [ENG EC 504 – Advanced Data Structures and Algorithms](#)
- [ENG EC 524 – Optimization Theory and Methods](#)
- [ENG EC 526 – Parallel Algorithms for High Performance Computing](#)
- [ENG EC 527 – High Performance Programming with Multicore and GPUs](#)
- [ENG EC 528 – Cloud Computing](#)

Elective Courses

■ Pillar III: Applications

- [ENG BE 403 – Biomedical Signals and Controls](#)
- ENG BE 500 – AI and Systems Biology
- ENG BE/EC 519 Speech Processing by Humans and Machines
- [ENG BE 562 – Computational Biology: Genomes, Networks, Evolution](#)
- [ENG BE 570 – Introduction to Computational Vision](#)
- [ENG ME 416 – Introduction to Robotics](#)
- [ENG ME 570 – Robot Motion Planning](#)
- [ENG EC 401 – Signals and Systems](#)
- [ENG EC 415 – Software Radios](#)
- ENG EC 500 – (Ohn-Bar) Robotic Learning and Vision for Navigation
- [ENG EC 516 – Digital Signal Processing](#)
- [ENG EC 520 – Digital Image Processing and Communication](#)

Questions?

- Administrative:
Undergraduate Programs & Records Office
engrec@bu.edu
- Other:
ML Concentration Coordinator
Prof. Prakash Ishwar pi@bu.edu