

SE 5702 Data Science for Materials and Manufacturing

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Course format: online course, recorded lectures and live discussions

Course learning objectives:

1. Identify opportunities of applying data mining (DM) and machine learning (ML) to solve material/manufacturing-relevant problems
2. Generate data of material/manufacturing systems
3. Select proper DM and ML methods for material/manufacturing-relevant problems
4. Implement DM and ML algorithms in software
5. Perform data analysis to predict the responses
6. Conduct design optimization based on the knowledge learned from data
7. Apply the DM and ML methods to solve a real world engineering problem

Course contents:

1. Introduction: Integrated Computational Materials Engineering (ICME)
2. Data generation by simulation process integration
3. Material image data analysis and learning
4. Data collection and labeling by Design of Experiments (DOE)
5. Surrogate modeling
6. Comprehensive study with matminer
7. Optimization and model parameter calibration
8. Multi-fidelity modeling
9. Final project: progress update and final presentation
10. Literature study: computational material design and design for additive manufacturing

What's exciting about this course:

The students will learn data mining and machine learning methods for materials and manufacturing-related applications. This course provides you a project-based learning experience. The students will apply data mining and machine learning techniques to tackle challenges in their research or projects.

Supplemental materials: handouts, recorded lectures, journal papers, and demo codes.

Prerequisite: basic knowledge in statistics, knowledge in differential equations, and programming skills (MATLAB and Python).

Homework: Homework include reading tasks and algorithm implementation.

- Reading tasks: the students need to read the provided papers and answer the questions.
- Algorithm implementation: the student need to read and run the provided demo codes, and then adapt the codes to solve the homework questions.

Homework should be done individually. Homework can be discussed in groups, but each individual must create their own answers.

Literature study: the students will do a literature study on (i) a topic given by the instructor, or (ii) a topic that they are interested in. For the latter case, the students need to set up a meeting with the instructor to discuss the topic of literature study.

The student will present the literature study to the class in the mid of the semester.

Final project:

Students will work individually or in a group of two persons. The students need to set up a meeting with the instructor to propose the topic of the final project in the first three weeks. The report of the final project includes a mid-term progress update presentation, a final presentation, and a final report.

Note: All reports must be done on a word processing system and presentation in Power Point or equivalent.

