PROFESSIONAL EDUCATION

GRAPH ALGORITHMS AND MACHINE LEARNING

July 31–Aug 3, 2023 | professional.mit.edu/gaml | Instructor: Julian Shun

Note: All times are US Eastern Daylight Time. Schedule is subject to change.

	TOPICS *Include lectures, hands-on work, laboratory work and social events as applicable.*	DESCRIPTION
MONDAY, JULY 31		
10–11:00 AM	**Introduction to Graph Theory and Applications of Graphs:** Definitions of graph structures; Introduction to graph problems; Real life examples of graphs	We will start the course with definitions of graphs and discuss how they can be used to model data in real life.
11–11:15 AM	**BREAK**	
11:15 AM–12 PM	**Structure of Real-World Graphs:** Structure of the Web; Power laws	We will discuss properties that are common in many real-world graphs.
12–1:00 PM	**LUNCH**	
1–2:00 PM	**Structure of Real-World Graphs:** Small world phenomenon; Decentralized search; Synthetic graph generation	We will discuss how many real-world graphs are formed and present algorithms for simulating this graph formation process.
2–2:30 PM	**Q&A**	
TUESDAY, AUGUST 1		
10–11:00 AM	**Graph Algorithms:** Link analysis and Web search	We will discuss the famous PageRank algorithm for Web search.
11–11:15 AM	**BREAK**	
11:15 AM–12 PM	**Graph Algorithms:** Graph representations; Graph traversal	We will introduce computer representations of graphs as well as basic graph traversal algorithms.
12–1:00 PM	**LUNCH**	
1–2:00 PM	**Graph Algorithms:** Topological sort; Strong connectivity; Shortest paths	We will continue with discussing other fundamental graph algorithms.
2–2:30 PM	**Q&A**	

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WEDNESDAY, AUGUST 2		
10–11:00 AM	**Demo and Exercises with Graph Processing Software (NetworkX):** Creating graphs; Running graph algorithms; Graph visualization	We will do a live demo of the NetworkX graph processing package.
11–11:15 AM	**BREAK**	
11:15 AM–12 PM	**Large-Scale Graph Processing Frameworks:** Parallel computing; Programming abstractions; Performance analysis	We will introduce parallel computing, which can be used to speed up graph processing. We will present different classes of graph processing frameworks.
12–1:00 PM	**LUNCH**	
1–2:00 PM	**Large-Scale Graph Processing Frameworks:** Parallel computing; Programming abstractions; Performance analysis	We will study the pros and cons of different graph processing approaches.
2–2:30 PM	**Q&A**	
THURSDAY, AUGUST 3		
10–11:30 AM	**Machine Learning on Graphs:** Graph representational learning; Graph neural networks	We will introduce machine learning algorithms for various graph analysis tasks, with a focus on graph representational learning and graph neural networks.
11:30 AM–12:30 PM	**LUNCH**	
12:30–2:00 PM	**Problem Clinic:** Small-group discussion of graph problems submitted by participants; Presentations of each group to the whole class	We will have small-group discussions of real-world graph problems submitted by class participants, followed by presentations to the whole class.
2–2:30 PM	**Q&A**	