Syllabus

Stony Brook University

ESE 592

Distributed Computation, Control and Learning over Networks

1. Course Staff and Office Hours

Instructor: Ji Liu
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211 Light Engineering

Office Hours: by appointment

Office hours and locations may change. Please check Blackboard for most up-to-date information.

2. Course Description

Network science is an emerging interdisciplinary research area, which typically deals with large-scale complex networks. The need for distributed information and data processing has arisen naturally in such networks because autonomous agents, mobile sensors, or machines are physically separated from each other and communication constraints limit the ow of information and data across a network and consequently preclude centralized processing. Over the past decade, there has been considerable interest in distributed computation and decision-making problems of all types. Notable among these include consensus and flocking problems, multi-agent coverage problems, the rendezvous problem, localization of sensors in a multi-sensor network, and the distributed management of multi-agent formations. These problems have found applications in a wide range of _fields including sensor networks, robotic teams, social networks, and electric power grids. Compared with traditional centralized processing, distributed processing is believed to be more promising for those emerging large-scale complex networks, including social, epidemic, power, and economic networks, because of its fault tolerance and cost saving features, and its ability to accommodate various physical constraints such as limitations on sensing, computation, and communication. This course will cover fundamental problems in distributed computation and control, including consensus and distributed averaging, distributed optimization, discuss the rendezvous problem and formation control, and explore recent development in distributed machine learning over networks.

Pre- or Corequisite: Linear Algebra, Applied Calculus

Credits: 3

3. Textbook

Slides are provided on Blackboard.

4. Student Learning Outcomes

Introduce fundamental distributed problems and algorithms in control, computation, optimization and learning. Students will be able to:

- Have a basic understanding of distributed settings over large-scale networks;
- Understand discrete-time linear consensus processes and their analyses;
- Know three types of distributed averaging algorithms and their application scenarios;
- Understand distributed convex optimization problems and basic algorithms;
- Understand basic distributed learning problems and their solutions.

5. Schedule

Week 1	Introduction to Distributed Systems
Week 2	Consensus I
Week 3	Consensus II
Week 4	Distributed Averaging I
Week 5	Distributed Averaging II
Week 6	Opinion Dynamics I
Week 7	Student Presentations
Week 8	Opinion Dynamics II
Week 9	Distributed Optimization I
Week 10	Distributed Optimization II
Week 11	Distributed Control Problems
Week 12	Distributed Learning I
Week 13	Distributed Learning II
Week 14	Student Presentations

6. Assignments

6.1. Homework Assignments

• Problem sets will be assigned on an approximately every-week basis, and will include MATLAB-based exercises.

• Homework will not be graded.

6.2. Collaboration Policy

Homework assignments are to be completed individually. You may *discuss* them with your classmates. (In fact, you are encouraged to do so.) However, you must write up your own solution individually without any help from any other person.

For example, it is fine if you and a friend discuss a problem together, and then separately work out the details and write your own separate solutions. On the other hand, it is not acceptable to share written solutions with another person or to create the written solutions together. In other words, the work you turn in must entirely be your own personal effort.

If you discuss homework problems with another person in the class, you must write "I discussed this assignment with…" and include the name(s) at the top of the assignment.

7. Grading

Your grade will be based on homework, presentations and report.

Homework Assignments	20%
Presentations	40%
Final Report	40%

8. Academic Honesty

Any academic dishonesty on a written homework or lab will result in a zero grade for the assignment for all parties involved.

All exam work must be entirely your own with no collaboration or outside materials/information. Any academic dishonesty on the midterm exams or the final exam will result in failing the course. The case will be submitted to the College of Engineering's Committee on Academic Standing and Appeals.

9. Electronic Communication Statement

Email and especially email sent via Blackboard (http://blackboard.stonybrook.edu) is one of the ways the faculty officially communicates with you for this course. It is your responsibility to make sure that you read your email in your official University email account. For most students that is Google Apps for Education (http://www.stonybrook.edu/mycloud), but you may verify your official Electronic Post Office (EPO) address at http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo.

If you choose to forward your official University email to another off-campus account, faculty are not responsible for any undeliverable messages to your alternative personal accounts. You can

set up Google Mail forwarding using these DoIT-provided instructions found at http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail.

If you need technical assistance, please contact Client Support at (631) 632-9800 or supportteam@stonybrook.edu.

10. Student Accessibility Support Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or at sasc@Stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation are confidential.

11. Academic Integrity Statement

Each student must pursue their academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

12. Critical Incident Management Statement

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Until/unless the latest COVID guidance is explicitly amended by SBU, during Spring 2022 "disruptive behavior" will include refusal to wear a mask during classes. For the latest COVID guidance, please refer to: https://www.stonybrook.edu/commcms/strongertogether/latest.php