

ELEC 7970 – Special Topics: Information Freshness
TR 8:00 am BROUN 107 (On Zoom until Jan. 24)

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Bulletin Data: **ELEC 7970. INFORMATION FRESHNESS. LEC. 3. Fundamentals and Practical Applications of Information Freshness.**

Textbook:

No required textbook.

References:

1. Roy D. Yates, Yin Sun, D. Richard Brown III, Sanjit K. Kaul, Eytan Modiano, and Sennur Ulukus, “Age of Information: An Introduction and Survey,” arXiv preprint arXiv: 2007.08564 (2020).
2. Yin Sun, Igor Kadota, Rajat Talak, and Eytan Modiano, *Age of Information: A New Metric for Information Freshness*, Morgan & Claypool Publishers, 2019.
3. Antzela Kosta, Nikolaos Pappas, and Vangelis Angelakis, *Age of Information: A New Concept, Metric, and Tool*, Foundations and Trends in Networking, 2017.

Instructor:

Yin Sun, Assistant Professor.

Overview:

The concept of information freshness is of fundamental importance in networked monitoring and cyber-physical systems such as sensor networks, caching, airplane/vehicular control, robotic networks, and the Internet of Things, as well as in information-update and data analytics applications such as crowdsourcing, financial trading, social networks, and machine learning. It has become known as the Age of Information (AoI), which has developed over the last few years into an active and rapidly growing area of research. Recent research advances on AoI suggest that many well-known design principles (e.g., for providing high throughput and low delay) of traditional data networks need to be re-examined for enhancing information freshness in emerging real-time applications. This course will explain the fundamental concept of information freshness, introduce cutting-edge research topics in the AoI area, and illustrate the applications of information freshness in robotic control and machine learning. The students will have opportunities to learn and explore new research ideas based on the concept of information freshness.

Topics & Class Schedule (75 minute classes):

The following schedule is likely to be adjusted during the semester.

1. Overview (1 class)
2. Graphical Decomposition Analysis and AoI in Elementary Queues (5 classes)
3. Stochastic Hybrid Systems based AoI Analysis (3 classes)
4. Non-linear AoI Metrics and Sample-path Scheduling Method (3 classes)
5. AoI for Energy Harvesting Sources (3 classes)
6. Real-time Sampling, Estimation, and Control Systems (4 classes)
7. AoI based Scheduling in Wireless Networks (4 classes)
8. Machine Learning and Reinforcement Learning for AoI Optimization (3 classes)
9. Application Examples: AoI in Robots and Machine Learning (2 classes)

Lectures: For the first two weeks (until Jan. 24), lectures will be delivered online using Zoom. Please use the following link <https://auburn.zoom.us/j/85327536811> or navigate to “Canvas => Zoom”.

Questions are more than welcome during the lectures! Note: Please do tell me when I am teaching too fast!

Lecture slides will be uploaded to “Canvas => Files.” Lecture recordings will be uploaded to “Canvas => Panopto Recordings” after the lecture.

Attendance: Attendance is required, because it is crucial for the effectiveness of your learning! Please **turn on the camera** in the Zoom sessions.

Grading policy:

No test or exam.

Homework, paper reading, simulation projects, presentations. Details TBD during the semester.

Excused Absence:

Engineering Student Services provides excused absence memos to students who present verifiable documentation related to university excused absences. The steps for obtaining an excused absence memo are as follows:

1) The student submits the request form using this link: <https://aub.ie/EngAbsence>

- Students submit documentation of the reason for the absence
- Students must read and acknowledge the excused absence policy

2) The ESS office staff processes the requests and verifies authenticity of documentation provided by student, as well as the dates of the absence (s).

3) Assistant Dean determines if the documentation meets the standard for a university excused absence or if the documentation warrants consideration by the professor

4) An official memo is sent directly to professors via email regarding the student's absence

NOTE: *The ESS office does not process excused absences for red screens from the GuideSafe app. Students receive a notification email related to the "greater risk" red screen instructing them not to come to campus. Students can provide this email as documentation for Covid-related absences.*

COVID-19 related Absence:

- If you test positive for COVID-19, or if you need to quarantine due to an exposure to someone with COVID-19, you should complete a Self-Report Form on the COVID-19 Resource Center website.
- Once completed, you will receive an email with a return to campus date included.
- An email will also be sent to your instructors letting them know that you will not be in class and stating the date when you will be able to return to campus.
- The email sent to professors will not state the exact reason for your absence (positive versus exposure), it will simply state that you will not be able to return to campus until a specific date.