

# CS8803-O23 Modern Internet Research Methods

## Course Syllabus for Spring 2025

**Delivery:** 100% Web-Based, Asynchronous

### Instructor Information

Course instructor: Dr. Maria Konte, [mkonte@gatech.edu](mailto:mkonte@gatech.edu)

Head TA: Cody Tessler, [ctessler3@gatech.edu](mailto:ctessler3@gatech.edu)

### About This Course

Welcome! This is a research-oriented course that covers new developments in Internet measurement techniques, with an emphasis on topics related to reliability, freedom and security of modern Internet platforms.

The goals of this course are to:

- a. Explore new research topics in the modern Internet interdisciplinary research areas.
- b. Familiarize and experiment with techniques, tools, platforms and datasets.
- c. Develop new research ideas and deliver an academic research paper. Use the course material as a starting point to brainstorm on new research ideas, and select a topic of interest. Perform the entire cycle from selecting a research topic, focusing to a specific research question, following through (e.g. data collection and analysis, system design and evaluation, etc.) and finally delivering the results through an academic paper.

The topics the course discusses span across three areas:

1. **Internet and Cybersecurity Analytics:** Techniques to map and study the Internet host population along with the services it offers. Internet infrastructure resilience. Cybersecurity analytics.
2. **Censorship:** Techniques currently used to block access to specific content enforcing censorship, censorship observatories, techniques that are used to overtake the control of the Internet infrastructure, security of voting systems.
3. **Social platforms:** Identify abusive entities on social platforms and map out the current landscape of abuse (misinformation, tracking narratives, etc.). Techniques that leverage social platforms for early warning such as identifying emerging threats as soon as possible.

Finally, the course covers topics related to ethics guidelines when performing large scale Internet measurements. Last, the course discusses elements of sustainable research such as transparency and reproducibility.

### Lectures Format

The instructor presents weekly prerecorded lectures, each lecture covering a topic along with associated techniques, platforms or datasets (see course calendar below). The

lectures are delivered across 16 modules. Through each module the instructor presents 2-4 research papers delivered over 2-4 mini videos. In parallel, the students are assigned milestones that guide them towards the completion of their research project and paper (see assignments section below).

### Course Learning Objectives

The learning objectives of this course are to:

1. Describe the current state of research in the intersection of Internet measurements and cybersecurity. Specifically, you will learn about modern topics of broad and current interest related to the risks that the Internet infrastructure faces (e.g. Internet infrastructure hijacking), Internet censorship, abuse and entities on social platforms, web trust management, the ecosystem of false information on the web. Finally, you will learn about how to perform Internet measurements using ethical guidelines, and principles of sustainable research (e.g. replicability).
2. Describe a plethora of passive and active measurement techniques, data collection and analysis approaches for each of the above topics.
3. Demonstrate the ability to apply the learned techniques to different or new research questions.
4. Demonstrate the ability to put together a research project; from identifying a broad idea, to specifying a well-defined research question, outlining and executing a research approach to address it.
5. Demonstrate the ability to transfer a research project into an academic paper, and deliver a presentation of the paper.

### Course Materials

There are no required books for this course. The lectures are based on academic papers.

### Office Hours

Weekly on Wednesdays at 11am EST, through Zoom.

### Course Assignments and Grading

As a research-oriented course, the main component and focus of the course is a semester long research project. Each student, either by themselves or in a group, will work on a research project that will run through the entire semester. More specifically the assignments, along with their weight on the final grade, are the following:

Please note that **all submissions are individual submissions**.

- **Research interests questionnaire [1%]**. Due at 1<sup>st</sup> week (Friday).
- **Select a timeslot for the weekly meetings [no points]**. Due at the end of the 1<sup>st</sup> week.
- **Acknowledge the course policies [no points]**. Due at the end of the 2<sup>nd</sup> week. Please reach out to the instructor if you have questions for the class policies.

- **Brainstorming assignments (I and II) [6%].** Due at the end of 1<sup>st</sup> and 2<sup>nd</sup> week. Each group starts by working with a brainstorming assignment, that later becomes the project proposal, and then eventually it becomes the final project. Towards this goal and as intermediate steps, each group will submit two mini brainstorming assignments that summarize the groups progress towards the proposal. The mini brainstorming assignments (5% each) reflect the progress as the group refines the project idea and getting ready for the proposal.
- **Research Problem and Related Work [5%].** Due at the end of 3<sup>rd</sup> week. Each group starts a running draft of the paper, and describes the main research problem they will work on, and the paper's main contributions (typically a list of three main contributions), as well as the related work section.
- **GT GitHub repository and Overleaf Project [1%].** Due at the end of the 3<sup>rd</sup> week. Each group starts a GT GitHub repository and a GT Overleaf Project and shares the link with the instructional team.
- **Project Proposal [5%].** Due at the end of the 4<sup>th</sup> week. Each group expands their running draft to include all sections of the paper in a skeleton format. The project proposal will explain the problem in detail, and the approach. Also the proposal will include a schedule that outlines how the group will distribute the work through the semester, and among the team members. Therefore each team member has their own tasks they are working on. Each group will split their work into 3 main milestones (example milestones can include: data collection, data analysis, or system design, system implementation, system evaluation).

After the project proposal deadline, each group is set in terms of team members, specific research problem, and approach. No further changes are allowed after this point.

- **Identify the target conference [1%].** Due at the end of 5<sup>th</sup> week. Submit the url of the conference where you plan to submit, along with information on deadlines and formatting or type of submission.
- **Research milestone I [12%].** Due at the end of the 7<sup>th</sup> week. Each group is expected to expand their running draft to includes the results of research milestone I.
- **Research milestone II [12%].** Due at the end of the 10<sup>th</sup> week. Each group is expected to expand their running draft to includes the results of research milestone II.
- **Research milestone III [12%].** Due at the end of the 14<sup>th</sup> week. Each group is expected to expand their running draft to includes the results of research milestone III.
- **Weekly check-in meetings with instructional team [1% x 14].** Running from Week 2 until Week 15th. Each group will be asked to keep in touch and check-in with the TA team, on a weekly basis through the end of the semester. The

goal of these check-ins is to brainstorm, problem solve, discuss any challenges the group might be facing at any stage of their project.

- **Weekly quizzes [5%].** Weekly mini quiz on the material presented over the videos. The quizzes are “open book” and open resources. Due at the end of each week.
- **Final Project code [4%].** Due at the end of 16<sup>th</sup> week. Each group submits the code of the project. Each group is required to be using Georgia Tech’s GitHub repository to host the project code throughout the course.
- **Final Paper presentation [6%].** Due at the end of 16<sup>th</sup> week. Each group will prepare and record a 15-20 minute presentation on their project.
- **Final Paper [6%].** Due at the end of 16<sup>th</sup> week. Each group will write a 10-12 page final report written in academic style-format. Each group is required to use Georgia Tech’s Overleaf to host the paper throughout the course.
- **Class roundtable discussions [10%].** In the first 2 weeks of the course, our roundtable discussions will be to share our research interests on the course's Ed Discussion forum. Please see the Ed Discussion thread and write a comment there to describe to your classmates your research interests. From week 3 and forward (until week 15), every week one (or two) students will be assigned to give a 5-10 minutes mini presentation about the problem they are working on (e.g. the specific problem, a paper they recently read etc). The rest of the students, who are not assigned to present, they comment on the presentation in a constructive manner, with follow up questions. Each student is assigned to give a mini presentation once throughout the semester. The instructor will coordinate with each student about which week to do their mini presentation.
- **Extra credit I: Results dissemination [extra credit 10%]:** Each group is encouraged to disseminate their project either with a general high-level description or a more detailed description of the results. Examples can include: **1)** Setting-up a webpage on sites.gatech.edu, (setting up the website takes only a few minutes!) and include your title and abstract, **2)** Submit the link to your presentation to the OMSCS conference and showcase, **3)** Create a public GitHub repository hosting your code and instructions how to run your scripts, **4)** Reach out to the instructors if you have other ideas, e.g. an interactive environment where others can run your scripts.
- **Extra credit II: Course surveys [extra credit 3%]:** Through the semester the instructional team will send out three surveys for providing course feedback.

## Forming a Team, Team Size and Proposed work

**Why working within a group?** As highly likely you will confirm for yourself, writing an academic paper is different than putting together an end of semester class report, and it greatly benefits from team work. **The goal of this course is exactly to guide you**

## **how to write an academic paper on a topic that you are passionate about, and to get it published.**

If we take a look at google scholar to identify our favorite papers we will notice that in practice **rarely any academic paper is written by a single author!** And there are several good reasons for that including: 1) Performing the entire research cycle from conceiving an idea to narrowing down to a specific topic, and delivering the results through an academic paper is a very rewarding and time consuming process. 2) Brainstorming, interacting with others, problem solving and pushing through can make your paper so much better and increase the chances that your paper will be accepted in top academic conferences.

**How do we go about forming groups and what about team size?** Students will work in groups of 2-4 students. Each student will be assigned to a group based on the research interests questionnaire that they are filling out in the first week of classes. If you are interested in working with specific students, please let the instructor know. The teams are formed based on the research interests, diverse backgrounds, expertise and skillset. Therefore, the overall work of each group will benefit and each student will be provided the opportunity to bring in their unique skills and perspective to their team.

**Note:** Please reach out to the instructors if you have concerns about group formation, and working within a group in general.

**Grading Scale.** The final grade will be assigned as a letter grade according to the following scale:

- A 90-100%
- B 80-89%
- C 70-79%
- D 60-69%
- F 0-59%

### **Course Prerequisites**

The course is geared towards students who are interested in pursuing a research project and writing an academic paper.

This is a research-oriented course that intersects topics in Internet protocols, computer networks, cybersecurity and data analysis. Having taken courses in topics related to systems, ML/AI, data visualizations, data structures, algorithms, computer architecture is a plus, since the student will be able to leverage their background in these areas to pursue a research project and write an academic paper. The course will not cover undergraduate material typically covered in undergraduate networking, cybersecurity or data analysis courses. The students are expected to code in Python (or a language of their choice) at an intermediate level (e.g. comfortably using object-oriented programming, data structures, control structures, etc. as well as testing and debugging tools/strategies).

In lieu of a readiness questionnaire, prospective students are expected to be comfortable with and/or passionate about:

- Reading and understanding the paper “*An Open Platform to Teach How the Internet Practically Works*”.
- Defining their own research questions/ideas, and therefore working with open ended projects rather than predefined assignments.
- Student-led projects that require more autonomy and taking ownership of the work and the progress/pace.
- Working with projects that require coding skills, as well as technical writing and presentation skills.
- Receiving peer-to-peer feedback.
- Working in a group of students with multidisciplinary backgrounds.

## Course Calendar

| Week                                                                          | Lecture Topics & Tasks                                        | Deliverables & Due Dates                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b><br><b>Jan6-Jan12</b><br><b>First Day of</b><br><b>Classes Jan 6.</b> | Lecture: Course Intro & Crash Review “How the Internet Works” | <u>Due Friday Jan10:</u> <ul style="list-style-type: none"> <li>○ Research interests questionnaire</li> <li>○ Select a timeslot for weekly meetings</li> </ul><br><u>Due Sunday Jan12:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Class roundtable discussion</li> <li>○ Brainstorming assignment I</li> </ul> |
| <b>2</b><br><b>Jan13-Jan19</b>                                                | Lecture: Surveying the Internet Address Space (I)             | <u>Due Sunday Jan19:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Acknowledge the course policies</li> <li>○ Brainstorming assignment II</li> </ul>                                                                                  |
| <b>3</b><br><b>Jan20-Jan26</b>                                                | Lecture: Surveying the Internet Address Space (II)            | <u>Due Sunday Jan26:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Research problem and related work</li> <li>○ GT GitHub repository and Overleaf Project</li> </ul>                                                                  |

| Week                            | Lecture Topics & Tasks                                          | Deliverables & Due Dates                                                                                                                                                                                                                                 |
|---------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>4</b><br><b>Jan27-Feb2</b>   | Lecture: Overtaking the Internet Infrastructure Control         | <u>Due Sunday Feb2:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Project Proposal</li> </ul>                                                         |
| <b>5</b><br><b>Feb3-Feb9</b>    | Lecture: Internet Censorship (I)                                | <u>Due Sunday Feb9:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Identify your target conference</li> <li>○ Extra credit: Course survey I</li> </ul> |
| <b>6</b><br><b>Feb10-Feb16</b>  | Lecture: Internet Censorship (II)                               | <u>Due Sunday Feb16:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> </ul>                                                                                    |
| <b>7</b><br><b>Feb17-Feb23</b>  | Lecture: Web and Trust Management                               | <u>Due Sunday Feb23:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Research milestone I</li> </ul>                                                    |
| <b>8</b><br><b>Feb24-Mar2</b>   | Lecture: Measuring the Security of Voting Systems               | <u>Due Sunday Mar2:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> </ul>                                                                                     |
| <b>9</b><br><b>Mar3-Mar9</b>    | Lecture: The Landscape of Abuse and Threats on Social Platforms | <u>Due Sunday Mar9:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> </ul>                                                                                     |
| <b>10</b><br><b>Mar10-Mar16</b> | Lecture: Entities on Social Platforms                           | <u>Due Sunday Mar16:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> </ul>                                                                                                                                                                |



| Week                                                                           | Lecture Topics & Tasks                                                                         | Deliverables & Due Dates                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                |                                                                                                | <ul style="list-style-type: none"> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Research milestone II</li> </ul>                                                                                      |
| <b>11</b><br><b>Mar17-Mar23</b>                                                | Lecture: False Information on the Web and Social Platforms                                     | <u>Due Sunday Mar23:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Extra credit: Course survey II</li> </ul>                            |
| <b>12</b><br><b>Mar24-Mar30</b>                                                | Lecture: The False Information Ecosystem                                                       | <u>Due Sunday Mar30:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> </ul>                                                                      |
| <b>13</b><br><b>Mar31-Apr6</b>                                                 | Lecture: Online Social Platforms as a Vantage Point to Identify Emerging Threats               | <u>Due Sunday Apr6:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> </ul>                                                                       |
| <b>14</b><br><b>Apr7-Apr13</b>                                                 | Lecture: Ethics in Internet measurements                                                       | <u>Due Sunday Apr13:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Research milestone III</li> <li>○ Class roundtable discussion</li> </ul>                                    |
| <b>15</b><br><b>Apr14-Apr20</b>                                                | Lecture: Sustainable Research: The Importance of Transparency, Reproducibility & Replicability | <u>Due Sunday Apr20:</u> <ul style="list-style-type: none"> <li>○ Lecture quiz</li> <li>○ Check-in with the TA team</li> <li>○ Class roundtable discussion</li> <li>○ Extra credit: Course survey III</li> </ul>                           |
| <b>16</b><br><b>Apr21-Apr27</b><br>Final<br>Instructional<br>Days:<br>Apr21-23 | Lecture: Reading, Writing and Presenting Papers<br><br>Final grades due                        | <u>Due Sunday Apr27:</u> <ul style="list-style-type: none"> <li>○ Final project submission               <ul style="list-style-type: none"> <li>-Code</li> <li>-Presentation</li> <li>-Paper</li> </ul> </li> <li>○ CIOS survey</li> </ul> |



| Week | Lecture Topics & Tasks | Deliverables & Due Dates                                                                |
|------|------------------------|-----------------------------------------------------------------------------------------|
|      |                        | <ul style="list-style-type: none"> <li>○ Extra credit: Results dissemination</li> </ul> |

## Course Policies

**Late submissions & extensions.** The students are expected to complete the work on time by the due dates. In case of an emergency, please reach out to TA team through a private Ed Stem post, so we can come up with a plan to make up for the work or alternative solutions, depending on the type of the emergency and the impact it has.

**Plagiarism & academic integrity.** Students are expected to follow the Georgia Tech Honor Code (<https://policylibrary.gatech.edu/student-life/academic-honor-code>), including the Graduate Addendum. All incidents of suspected dishonesty will be reported to and handled by the Office of Student Integrity. If in doubt to whether an action is allowed in this course, please ask the Instructor/TAs.

In addition, the following specific policies apply to this course:

1. If your MIRM project is the same or similar to a project that you are working on in the current semester or you have worked on in previous semesters (e.g. other class projects, or 8903s, etc), you must communicate with the instructional team to carve out a piece that is appropriate and specific for the MIRM course for the current semester.
2. ACM guidelines on Authorship and Acknowledgements:  
<https://www.acm.org/publications/policies/new-acm-policy-on-authorship>
3. ACM guideline on the use of AI:  
<https://www.acm.org/publications/policies/frequently-asked-questions>
4. According to the ACM guidelines for Acknowledgements we ask that you Acknowledge the MIRM course for providing guidance for your paper. For example the following statement is sufficient to acknowledge our course's contribution in guidance.

"We would like to thank the Georgia Tech OMSCS-8803-O23 Modern Internet Research Methods course instructional team for supervising the first draft of this paper."

5. To help inform prospective students about the types of papers the MIRM instructional team work on with the students, we plan to include a high level description of each semester's projects on the course's website.

**Ed Discussion code of conduct.** The students are expected to be respectful with others when interacting on Ed Discussion. Please review the students' code of conduct. <https://policylibrary.gatech.edu/student-life/student-code-conduct>

**Georgia Tech student resources & student accommodation.** The Disability Services team collaborates with the students to find creative solutions and reasonable accommodation. Please contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodation letter. Please also send a private message to “Instructors” on Ed Stem as soon as possible. Please note that the TA team is not able to provide any accommodation or extensions without an accommodation letter, nor the accommodations can be provided retroactively.

### **Communication Policy**

Please use Ed Discussion (available via Canvas course site) for all communication with the instructional team.

### **Subject to Change Note**

Please note that the current syllabus is subject to change at any time.