Statement on Teaching and Mentoring

I have been teaching Computer Science (CS) in some capacity since high school. I love imparting knowledge and kindling enthusiasm amongst students. Since joining Northeastern, I have taught 22 classes, corresponding to seven distinct courses. My average instructor effectiveness score post-tenure is 4.88/5.0 in TRACE surveys (versus 4.37 for the College overall). In 2015, I received the CCIS Best Teacher Award.

My teaching philosophy is centered around two pillars: (1) engaging lectures that contextualize concepts and explore the inherent trade-offs in real-world sociotechnical systems, and (2) substantial projects that reinforce fundamental concepts and challenge students to tackle difficult challenges. I have developed brand new lecture materials for five of the courses that I have taught and at least a dozen new course projects during my time at Northeastern. I try to include extensive test suites with all my projects, which helps make the requirements and grading of the assignments transparent, as well as forcing students to think through tricky corner-cases. Another technique that I leverage is "gamification", e.g., by adding scavenger hunt elements or competitive leaderboards. All of my materials and projects are open-source, and they are widely used by professors at Northeastern, as well as faculty at U. Mass. Amherst, Duke, and UCSB.

A representative student comment (from Spring 2023) nicely sums up what I try to achieve in my teaching:

> Cristo [sic] is one of the best teachers I have had at Northeastern. His class is incredibly engaging and his enthusiasm is infectious. Despite the fact that I am not particularly interested in a career related to networks, this was my favorite class this semester. The material is definitely difficult, but Cristo [sic] does an excellent job teaching you everything you need to know, and expertly fields questions that arise during lecture.

Another key facet of my teaching philosophy is integrating social awareness and ethics into CS education. I do this in my own classes by engaging with the broader impacts of CS, e.g., by discussing network neutrality and white hat hacking. With the support of a grant from the Mozilla Foundation, Ron Sandler and I developed a series of Value Sensitive Design modules that we integrated into six Khoury undergraduate courses. As of 2023 this module program is still going strong under the leadership of Matt Kopec, Vance Ricks, and Meica Magnani, and we are planning to expand into more courses in the coming semesters.

Courses Taught

Below, I highlight two courses I have taught and the new material I developed for them.

CS 3700 Networks and Distributed Systems. For this class, I produced all-new slide decks for the distributed systems portion of the course on topics like consensus, fault-tolerance, and cryptocurrency. Pre-tenure, I designed two new projects for this course: a BGP simulator where students implement their own internet routers, and a distributed, fault-tolerant key/value database using the Raft quorum protocol. Post-tenure, I designed another new project that asks students to develop an FTP client. This project reinforces their socket programming skills and comes with an extensive test suite.

CY 2550 Foundations of Cybersecurity. I designed this class from scratch as the onramp for undergraduates in the cybersecurity BS program. Its enrollment has skyrocketed to 200+ students a semester now that all Khoury undergrads must fulfill a cybersecurity course requirement. This course covers a wide range of introductory concepts, such as threat modeling, cryptography, authentication, social engineering, and simple exploitation

techniques. Students gain hands-on experience through projects, including developing a secure passphrase generator, password cracking, and exploiting websites and SQL databases.

Mentoring

Since joining Northeastern, I have mentored Ph.D., Masters, and undergraduate researchers. I owe a great deal of my success to their hard work and dedication. As an advisor, I try to instill a sense of curiosity and skepticism in my students. Much of my research touches on sensitive topics, thus I teach my students to carefully consider the ethics of their work and to have a sense of civic responsibility.

I schedule weekly, and sometimes bi-weekly, meetings with all my students, in addition to maintaining an "open door" policy. Additionally, my students and I participate in weekly group meetings with other faculty, where we read papers, host talks from visitors, and do practice talks before conferences. I see this last activity as particularly crucial, as it gives my students an opportunity to perfect their communication and question answering skills.

Finally, I encourage all my students to go on summer internships. They have gone to places like MPI, Twitter, Facebook Security, and Bell Labs. I feel strongly that Ph.D. students learn a great deal from collaborations with outside researchers, and that increasing their visibility in the community is important for their future job prospects.

Ph.D. Students. During my time at Northeastern I have advised ten PhD students:

- Le Chen's thesis, "Measuring Algorithms in Online Marketplaces", focuses on understanding how automation and machine-learning can create problems in online marketplaces, such as broken economic incentives and discrimination. Currently at Meta.
- Muhammad Ahmad Bashir's thesis, "On the Privacy Implications of Real Time Bidding", uses sophisticated crawling techniques to assess the flows of personal information between trackers on the web. Currently at Google.
- Shan Jiang's thesis, "Measuring the Misinformation Ecosystem: Audiences, Platforms, and Storytellers", examines the problem of misinformation from the perspective of multiple stakeholders using NLP techniques. Currently at Meta.
- Ronald Robertson's thesis, "An Interdisciplinary Examination of Partisanship in Web Search", presents techniques for auditing political information on web search engines. Currently a postdoc at Stanford.
- Desheng Hu (co-advised with Aniko Hannak from University of Zurich) is studying partisanship and information quality on search engines. Desheng began his PhD at Northeastern but was forced to transfer to University of Zurich.
- Avijit Ghosh's work focuses on the performance and normative implications of fair machine learning algorithms in real-world settings. Scheduled to defend in June 2023.
- Johanna Gunawan (co-advised with David Choffnes and Woodrow Hartzog from Boston University) is examining manipulate and deceptive user interfaces.
- Muhammad Abu Bakar Aziz is studying online tracking, with a focus on assessing trackers' compliance with emerging legal standards like CCPA in California.
- Jeffrey Gleason is studying the confluence of online platforms, algorithmic systems, and power, with implications for technology policy and internet regulation.
- Jessica Teurn's work is focused on online scams, perpetrated against but also conducted by major platforms.

Undergraduate Students. I feel strongly about involving undergraduates in research. To date, I have funded six undergraduate RAs on NSF REU grants, seven of my undergraduate RAs published papers while working with me, and three (James Larisch, Gary Soeller, and Maggie Van Nortwick) earned research awards from Northeastern.