

## TEACHING STATEMENT

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One of the primary reasons of my interest in academia is the opportunity to teach students and to produce new leaders in computing. I believe that teaching not only helps students to learn new concepts but also enriches the teacher to have a more coherent understanding of the topics. Teaching also inspires to build a vibrant research environment by passing on ideas and passion of inquiry to students. As a teacher, I truly believe:

*The art of teaching is the art of assisting discovery.* (Mark Van Doren)

### Teaching

Since becoming an Assistant Professor at UVA, I have designed and taught three graduate courses on Software Engineering. These courses teach how to analyze large scale software automatically. The graduate course CS 6240 covers different static and dynamic *Program Analysis* techniques with a focus on automatic bug detection. This is an introductory class to Software Engineering designed to be taken by graduate and advanced undergraduate students. I have also taught two special topic courses that discusses how advanced statistical and machine learning techniques can be applied to analyze software and what kind of tools can be built using them. The goal here is to show the students how Machine Learning techniques can be applied to Software Engineering domains to automate many traditional Software Engineering processes.

As most of my research as well as teaching experience is in the experimental aspects of computer science, I have found a hands-on approach is the most effective in preparing a student towards a successful engineering career. My teaching philosophy consists of three key factors:

**1. Employ a hands-on approach:** I think learning is most effective, when one applies the learned concept in real life. Hence, I strongly encourage implementation in order to grasp new concepts. I prefer to incite and distill the solutions from the students' thoughts over telling them the solutions straightaway. In this process, students not only get to know the solution, but also can identify alternative approaches to solve the problems by themselves. For example, while teaching the concept of unit testing in a class, I first showed the students a buggy program and asked them to generate inputs that will trigger the bug. While coming up with the solution, they have already written their first unit test case. In fact, I have noticed that such an approach helps the students to think independently and thus motivate them in active research.

**2. Show the bigger perspective:** While teaching, I make sure to present a bigger perspective of the problem before introducing a particular solution. For example, before teaching the concept of differential testing, I explained why such testing is necessary; A set of test specifications or oracles is necessary to test a Software. However, retrieving such specifications is non-trivial and expensive. A possible solution is to run the test cases across other similar software or program variants and cross-check their outcomes. Once students understand the background, particular solutions are easier to explain. I believe this helped students to understand the relationship between an abstraction and its implementation.

**3. Encourage active participation:** Finally, I strongly encourage students to actively communicate in my classes. Instead of long lectures about a topic, I prefer to make the discussion interactive by involving the students. This not only helps the students feel

more confident by answering simpler questions, but also allows advanced students to ask about related topics of their interest and enriches the overall learning. To encourage students in active class-participation, I asked them to send two questions before each class about the topic we will discuss in that day's class. Then we discuss those questions in the class. I have learned that this practice increases the class participation significantly and students also feel responsible to be prepared for the class.

Given my background in systems and software engineering, I can teach undergraduate classes in *software engineering* and *program analysis*. In particular, I will be able to teach "Advanced Software Engineering" (COMS W 4156) and "Programming Languages and Translators" (COMS W 4115). In future I would like to develop a graduate course on testing and debugging ML-based software.

## Mentoring

Mentoring is challenging, especially because students are very different from one another in terms of research taste, work patterns, and background knowledge. As an adviser, it is my responsibility to be inclusive of such diversity and help my students to fulfill their potential.

I am fortunate to advise four PhD students, two masters students, and five undergraduate students. In the process, I realized that students at different stages in their career need guidance in different ways. For example, the beginning PhD students need closer attention. I help such students in choosing interesting research problems as well as assist them with low-level technical issues. For example, I extensively helped Yuchi Tian, a beginning graduate student, to conduct a study on error handling bugs in C. From asking the relevant research questions, developing code analysis algorithm, to writing a research paper, Yuchi worked under my close supervision. The corresponding paper got *best paper award* in FSE 2017, a premiere Software Engineering conference. In contrast, my student Chong Tang (co-advised with Prof. Kevin Sullivan), being a senior Ph.D. student, needs guidance at a higher level. Thus, I helped him in shaping the ideas and writing papers. Chong successfully defended his thesis proposal, and the work was selected in FSE doctoral symposium. We also submitted a paper at a top tier conference venue.

I had the opportunity to mentor two female undergraduate students in research. For example, I mentored Yixun Nie to implement a code search engine for GitHub. She did her capstone project on that topic. She is currently working for Facebook as her first job. Further, I am advising Jed Barson, an undergraduate student funded by USOAR (Undergraduate Student Opportunities in Academic Research) initiative. We are having a successful ongoing collaboration on code search project along with my graduate student Md Masudur Rahman. We are planning to submit a paper soon. This project also gives Masudur an opportunity to learn active mentoring.

As an adviser, I will encourage my students to conduct independent research while guiding them to produce quality work. I will try to hone their faculty by organizing reading groups, encouraging collaborative research, and challenging them to their best. Last but not least, I want my students to be excited about their research, and I try to harbor a friendly erudite environment to achieve the same.