Teaching Statement

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I view teaching and advising as both the most challenging and rewarding endeavor. The opportunity to be constantly surrounded by students, collaborate with them on novel ideas, and help them channel their energy and enthusiasm into becoming independent researchers is one of the key reasons I look forward to an academic career. My teaching (and mentoring) philosophy is based on two simple principles. First, it is the intuition behind an idea that is of utmost importance. It is relatively easier to explain just the intuition (i.e., takes less time), and even fun if a teacher could engage the class in developing the intuition. The students could build on the intuition to develop (or even refine) the idea. Second, it is a healthy (and, sometimes, a fun) exercise to trace an idea to its origins. It is crucial to learn that because an idea failed to gain traction in the past does not necessarily mean it was wrong; the circumstances, perhaps, were not quite right (e.g., the idea of virtualization). It is worth highlighting that some of the successful ideas of today are built on the "mistakes" of the past. While I have had some success in using these principles for both teaching and mentoring, I understand that there is no "one-size-fits-all" solution. I am always on the lookout for refining my teaching style by incorporating feedback from students and colleagues.

Teaching Experience

I have always been passionate about teaching. Naturally, during my PhD study at Duke University, I requested to serve as a teaching assistant (TA) as often as possible and beyond the department's stipulated teaching requirements. As such, I was the TA for three undergraduate-level (which were also entry-level computer science) courses and gave guest lectures a few times on the map-reduce programming paradigm in graduate-level courses. The time I served as the TA for a programming languages course offered by Prof. Susan Rodger, in particular, was extremely useful in refining my teaching skills: as a professor of practice, Susan's teaching styles, meticulously prepared lectures and teaching aids broadened my knowledge in teaching methods and helped me develop a deeper appreciation for teaching. It also helped me gain a first-hand knowledge of how to structure a course and design the curriculum for a freshman in computer science.

I co-taught an entry-level networking course for graduate students at the Universität des Saarlandes along with Prof. Anja Feldmann, and we will be teaching an improved version of this course again this summer. In addition to using illustrative examples with animations in slides to explain the key protocols (e.g., TCP), Anja and I also devised interactive games to demonstrate some of the protocol functionality. In the informal feedback we received, students indicated that they found the teaching style both enjoyable and helpful to quickly learn the concepts. Teaching networking, in particular, is fun because of the rich history associated with most ideas. Rather than explain the technical details of an idea, for instance, I find it quite useful to share some of the historical details; the simple structure during the Internet's infancy and the simpler assumptions we made about it (e.g., the implicit notion of trust) helps students to appreciate some of the networking challenges we face today. Lastly, I enjoy the ability in networking courses to familiarize the students with few simple command-line tools, and later use these tools (a) to show some of the sub-optimal (and sometimes bizarre) behavior (e.g., circuitous paths in the Internet) and (b) to debug such behavior and reason about performance. I regularly meet with students after lectures to get feedback on how I could have made the lectures more engaging, and also continuously exchange my observations and ideas with Anja to improve my teaching.

Mentoring Experience

I'm currently co-advising two PhD students—Mirko R. Palmer and Emilia N. Weyulu—at the Max-Planck-Institut für Informatik. Mirko works on the topic of designing an optimal transport, based on Google's QUIC protocol, for video

streaming in the Internet. Despite Mirko not having much experience with designing transport protocols for streaming, over the course of roughly one year of my advising, he has made significant progress in designing and developing an ideal transport. We also recently published a few pieces related to the solution design to the ACM CoNEXT 2018 Workshop on the Evolution, Performance, and Interoperability of QUIC (EPIQ). We are currently in the process of preparing our video transport solution for submission to a highly competitive venue. Emilia's research focusses on congestion control algorithms, and on designing novel congestion control schemes by exploiting support from the underlying network. We recently published a proposal on network-assisted congestion feedback at the Stanford Workshop on Buffer Sizing, and we are currently working on evaluating the proposal under diverse workloads and network conditions. I also recently graduated a Master's student, Malte Apfel, whose research focussed on identifying what part of a video stream requires reliable delivery and how to exploit the parts that do not for optimizing the overall end-user's quality of experience. Malte will be joining the Internet Initiative Japan (IIJ) in Tokyo, Japan as a researcher.

In the past, at Duke University, I co-advised Kyle V. Moses, a graduate student, in his Master's thesis on *Improving IP-based geo-location through Internet Topology and Geospatial Datasets* under the supervision of Prof. Bruce M. Maggs in March 2013. I mentored Kyle on the project of simplifying (i.e., lowering the vertex count) high-resolution shape files of locations (e.g., cities, and countries) for use in an IP geolocation system, and evaluating heuristics for using topology-based non-measurement data in IP geolocation. To introduce Kyle to the problems, I demonstrated how the system works, and where and why it needs improvements. I showed him how to implement a few simple solutions and helped him evaluate the efficacy of the implementations. Having explained the problem clearly, and demonstrated how to evaluate the solutions, Kyle was able to explore different algorithms, with minimal help, and implement the algorithms to improve the system's accuracy. Kyle is currently an instructor at the US Military Academy at West Point, New York.

I also mentored Mingru Bai on several tasks related to an IP geolocation project during his senior year of undergraduate studies at Duke University. His work was on gathering ground truth for evaluating geolocation systems and integrating the use of actual city/state/country shapes (instead of approximating them by a circle, as was done earlier) to improve the accuracy of the geolocation system. After spending the first few meetings in providing a high-level overview, I quickly isolated parts of the code relevant to Mingru's work and helped him making a small but significant change to the code. That he was able to contribute quickly built his confidence, and it reflected in his enthusiasm for making much larger contributions. Although Mingru started with not much experience in software development with Java, over the course of a few months he was confidently changing parts of a map-reduce applications spanning several thousand lines of code. Mingru went on to pursue graduate studies at Princeton University, New Jersey. The geolocation system along with Kyle's and Mingru's contributions is currently in limited use at Akamai Technologies.

Teaching plans

My background and training in computer science along with my modest experience in teaching should allow me to teach courses in the areas of networking, operating systems, and programming, at both undergraduate and graduate levels. Recently, I co-taught a graduate-level introductory course on networking at the Universität des Saarlandes with Prof. Anja Feldmann, and we will be offering the course again this summer. In the past, during my graduate school days, I served as a teaching assistant in a few key, introductory, undergraduate-level computer science courses, e.g., discrete mathematics and programming. I immensely enjoy teaching the entry-level computer science courses, and, in particular, welcome the challenges in making the topics fun and accessible to a diverse student pool. I look forward to more such opportunities in the future.