Teaching Statement

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Engineering and research are complex and evolving disciplines, and professionals in these disciplines have to keep learning new things in their fields or keep applying their background knowledge to problems that differ from what they have learned in school. Electrical engineering and computer science being heavily technical fields that strongly builds upon mathematics, the technical and analytical skills are in the essence of undergraduate teaching. However, given the diverse nature of topics and the positions the graduates take on, a very important aspect of a successful professional is the ability to learn new things quickly and effectively. I make it a priority when teaching that the students, in addition to learning the course content, learn how to build upon their existing knowledge, in other words, *learn how to learn*.

Teaching students the thinking patterns that lead to a deeper understanding of a concept that is new to them is a difficult task. Effective ways of achieving this also come in different forms depending on the level of the students and the type of the class. During my Master's, I taught the sophomore circuits laboratory classes, where I observed that the students tend to see the experiments in a more task-oriented manner, typically missing the lessons behind the experimental designs. The classes were structured as the analysis of a set of circuits that reflect the topics covered in theoretical lectures prior to the session, and implementing the circuits in hardware and confirming their calculations experimentally. With 4 hours of interaction with the students every week, I realized that even the students who were successfully completing the experiments were not able to pin down the significance of a particular experiment or the sessions in general. In order to push them towards abstract thinking, to teach them how to see the bigger picture behind the experiments, I discussed what was *interesting* about each circuit they set up that week with the students at the end of a session. In the following weeks, I encouraged them to write extensive conclusion sections in their lab reports, which was not the norm in the class. They clearly demonstrated improvement in the rest of the experiments as they started finding interesting points about the experiments, sometimes going beyond what I have listed in my own analysis.

In more advanced courses targeted at senior undergraduate or graduate students, I take multiple approaches to stimulate students to think on a higher level. In order to give the students a wider perspective on how the concepts in the lecture can be generalized, I frequently go beyond the course content and give them real-world examples how the topics build into complex systems. An effective way to evaluate their progress in this way of understanding is project-based assignments, where the students are given a seemingly wider problem and expected to find a solution from the lecture content. From my experience as a student, and as a teacher in elementary courses as well as more research-based graduate courses, producing a complete system with building blocks coming from the course content and their basic knowledge from other courses helps them in developing higher-level skills that are crucial for a professional.

When there is an important concept or theory that other lectures will build upon, I try to give the students insights from different angles. For instance, while I was giving guest lectures for the Visual Computing class at ETH Zürich, I covered filtering, convolution and Fourier transform, which relate to each other on very fundamental levels. In order to emphasize their importance and their relationship with each other, after introducing the Fourier theory through slides, I held an extra lecture explaining the subject and its relation to filtering and convolution on the blackboard step by step, while taking comments and questions from the students throughout the lecture. The real-time interaction through questions helped me assess which aspects were unclear to the students in the beginning. The students were more confident before diving into the mathematical formulations of these concepts afterward.

I adopt a conversational tone during the lectures to provide students with a more casual learning environment. This includes inserting small jokes where appropriate, or jokingly introducing a concept to be *weird*, or hard to follow, and asking them to *hang in there with me* until everything comes together and becomes clearer. I observed that this inclusive tone creates an environment where students feel less pressure about the lecture, especially the ones who are shyer in asking questions or participating in the discussions in general. My approach was noticed and praised by the students in the surveys I conducted for my guest lectures for visual computing.

At ETH Zürich, Ph.D. students have the chance to define and directly supervise Bachelor's and Master's theses, and I also had the chance to supervise several interns during my time at the Computer Vision and Geometry Lab. Supervising research is a very different challenge than teaching courses, and it requires a more personalized attention to students with different backgrounds, research interests, and skill sets. Especially in the beginning and throughout my supervision, I share my insights and enthusiasm about research and academia in general in order to keep them motivated during the challenges that arise in their project. I often go into details about theoretical concepts and programming and design tools that they may not be familiar with. I have worked with students who propose their own topic and carry the research independently, which is a pleasure from the supervisor's perspective. After revising the project goals and definition and guiding them towards the right solution and methodology, I try to give them new perspectives on how to extend their project's impact. For students who require more close guidance, I encourage them to think independently by themselves to find a solution and take control of the project as much as they can. During weekly meetings, I ask the students to plan the next week and define specific goals that can be achieved in the time span in order to teach them about properly managing a research project. When the student and I are to co-author a manuscript or a technical report, I ask them to write the first version after a thorough planning of the talking points and experiments. I start revising or rewriting the manuscript after the initial version and keep them involved throughout the writing process in order for them to learn how to write a well-crafted research paper. Perhaps the most meaningful teacher-student relationships are formed through thesis supervision, and seeing the personal development of my students throughout our collaborations is a powerful motivator for me in pursuing a faculty position.

If I have the chance, I would like to develop a visual computing class for senior-level undergraduates or graduate students that focuses on developing a solid understanding of image processing that underly many approaches in computer vision and computer graphics. The core of this class would be each student building their own image processing library, implementing fundamental methods from scratch as new topics are covered in the lecture each week. The final assignment would be a 2 week- or a month-long project, where the students implement a system for a high-level task in computer vision or graphics, using their own library. I have seen first hand how implementing core methods one-self teaches the advantages and challenges of the methods we usually take for granted in visual computing research, and how it may lead to a wider perspective on how to solve problems that arise when engineering a visual computing system. Giving the students this understanding in a lecture would support them in their future careers in visual computing, may it be engineering a large system or in research.

I can contribute to undergraduate teaching on the general subjects of linear algebra, signal processing, probability theory and image processing, and graduate classes that fall under the visual computing umbrella.

I have been teaching since my early undergraduate years with private classes for high-school students and as a trainer for the university debating team, and I see teaching as one of the reasons I pursue an academic career. With each new assignment as a teacher, I saw my approaches diversifying and my perspective widening, and I see an evolving teaching philosophy as an important part of career development. I will bring my enthusiasm about teaching to contribute to the teaching efforts both in fundamental and advanced levels of electrical engineering and computer science curriculum in your department.