

# Teaching Statement

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Teaching and advising students is an integral part of academic life. Teaching fundamental concepts of a topic in an accessible and simple way can spark students' interest. This can motivate them to gain a deeper understanding and work towards pushing the limits of that field through research. Furthermore, in order to teach the fundamentals of a research area, the instructor needs to approach the topic from different angles to find the most appropriate for teaching. This can lead to a broader, spherical view of the topic, which can result in high quality research. In addition to teaching, advising students is the quintessential research catalyst, where exchange of ideas and introduction of new perspectives by students often shapes the research agenda in wonderful and surprising ways. During my graduate studies at Carnegie Mellon University (CMU), I have had numerous teaching opportunities, ranging from delivering lectures, to being a teaching assistant, and from mentoring students to delivering tutorials in top-tier conferences.

## Teaching Experience

### Lectures

One of the most challenging, as well as fulfilling teaching tasks was delivering guest lectures. During Spring 2013 I delivered a guest lecture on *Scalable Tensor Methods*<sup>1</sup> for the graduate-level class *10-605 Machine Learning with Large Datasets* taught by Prof. William Cohen. The topic is perfectly aligned with a significant part of my research. Making the lecture slides, choosing the right motivating examples, selecting the most relevant state of the art techniques, and distilling their essence into a self contained one-hour lecture at an introductory level was extremely valuable; it made me take a step back and study the material objectively, eliminating potential "expert bias" which inevitably exists. Similarly, I delivered an introductory lecture on *Introduction to Tensor Decompositions* for the graduate-level course *15-826 Multimedia Databases and Data Mining* during fall 2014, taught by my advisor, Prof. Christos Faloutsos. The lecture was an introduction to the subject, and as such, the prior knowledge that I could assume the students had was limited to a few basic algebraic concepts. To that end, I created additional material (exercises and examples) specifically designed to boost understanding of fundamental concepts and caveats of tensor decompositions. In both cases, delivering a guest lecture entails an additional challenge, that of gaining the trust and attention of the audience, which I believe I successfully accomplished, judging by the degree of participation and the questions that students asked me during and after the lectures.

### Teaching Assistantships

I have served as a Teaching Assistant (TA) for the graduate-level course *15-826 Multimedia Databases and Data Mining* during Fall 2013 (taught by Prof. Christos Faloutsos) and the undergraduate-level course *15-415/615 Database Applications* during Spring 2014 (taught by Profs. Christos Faloutsos and Andy Pavlo). For *15-826* I was responsible for 1) designing homework assignments that captured the fundamental concepts and included hands-on experience, 2) holding office hours where I answered questions by the students, 3) designing a self-contained project for students who chose a non-research oriented project, and 4) designing research oriented projects for advanced students, and supervising them ensuring the smooth completion of the project. For *15-415* I was responsible for 1) designing homework assignments, tailored to offer hands-on experience with real database systems, 2) designing, in collaboration with the instructors and my co-TAs, a project that asked the students for creating a simple version of Twitter, where they could use a database system in real and fun application 3) holding recitations which aimed to clarify challenging parts of the project and the lectures, and 4) holding office hours. In addition to assisting in official CMU courses, I was a TA and web-master for a *Graph Analytics Workshop* sponsored by the NSA and organized by Prof. Christos Faloutsos during September 10-13, 2012. The purpose of the workshop was to give a comprehensive and rapid overview of the most recent advances in Graph Mining, targeted to national security and defense professionals. I designed hands-on exercises (both on paper as well as using popular graph visualization and analysis tools) in order to provide the attendees with a basic set of tools that they could subsequently use in their work. I was also responsible for creating and maintaining the workshop web-site<sup>2</sup>.

I found all three TA experiences extremely rewarding and instructive. Interacting closely with students, understanding the difficulties they were facing and helping them throughout the course of the semester to master the material provided a great sense of fulfilment and satisfaction. Finally, creating exercises and projects for varying backgrounds and levels of expertise has provided me with the necessary tools for designing and structuring materials for introductory, mid-level, as well as advanced and specialized courses.

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<sup>1</sup>[http://curtis.ml.cmu.edu/w/courses/index.php/Syllabus\\_for\\_Machine\\_Learning\\_with\\_Large\\_Datasets\\_10-605\\_in\\_Spring\\_2013](http://curtis.ml.cmu.edu/w/courses/index.php/Syllabus_for_Machine_Learning_with_Large_Datasets_10-605_in_Spring_2013)

<sup>2</sup><http://www.cs.cmu.edu/~epapalex/gmc/>

## Tutorials

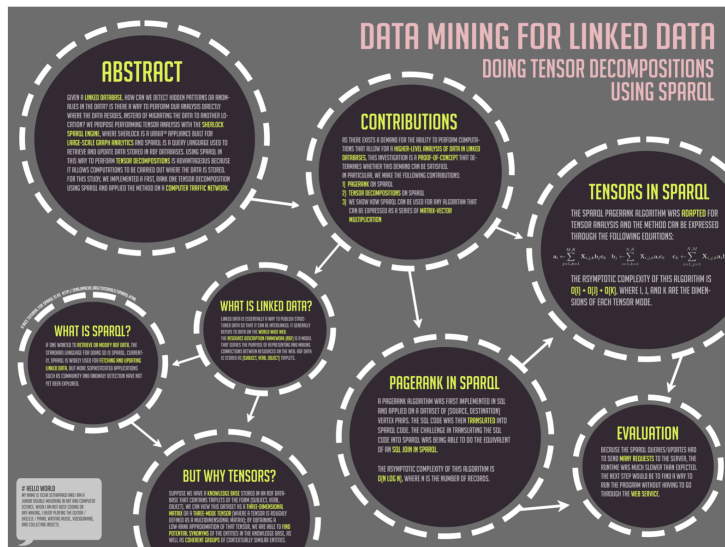
Teaching is ubiquitous and not necessarily restricted within the confines of a university. Examples of teaching outside of a university are conference tutorials, which are concise, comprehensive, and self-contained overviews of a research area wherein the tutors are experts, and cover basic concepts as well as state of the art advances. The target audience of a tutorial are researchers and practitioners who may have a working knowledge around the subject matter, however, the goal is to equip the audience with all the necessary tools for them to use in their own work, or get up to speed with the recent advances in the area. I have delivered two tutorials during my studies at CMU. The first one was a three hour tutorial on *Factoring Tensors in the Cloud: A Tutorial on Big Tensor Data Analytics* co-taught with Prof. Nikos Sidiropoulos (UMN) and delivered at IEEE ICASSP 2014, the flagship IEEE conference on Signal Processing. The tutorial covered basic concepts on tensor decompositions, as well as recent advances on scalable algorithms. It was well attended, with over 50 participants. Slides for the tutorial can be found here: <http://www.cs.cmu.edu/~epapalex/tutorials/icassp14.html>.

In addition to the ICASSP tutorial, I delivered a three-hour tutorial on *Big Data Analytics* at an invite-only meeting of 25-30 researchers in Chemometrics, organized by Prof. Rasmus Bro (University of Copenhagen) in Greenland in March 2014. The attendees were academic and industry experts in Chemometrics, and for the majority of them, this tutorial was their first encounter with Big Data tools. Designing the tutorial was a challenging experience: selecting the best motivating examples, striking and presenting the right balance between breadth and depth, and presenting the most appropriate and relevant tools for the particular audience. It turned out to be a very enjoyable two-way process, where both the audience and myself gained deeper insights in the respective fields (Big Data and Chemometrics), and engaged in very fruitful conversations.

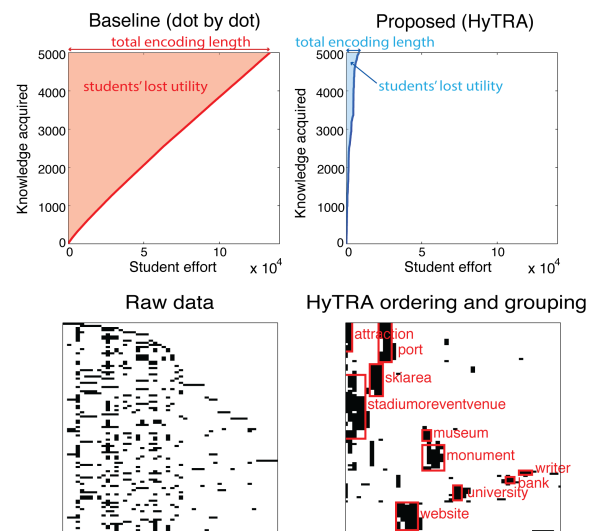
## Diversity of Student Backgrounds

I have worked with, taught, and mentored very diverse audiences: advanced graduate students, undergraduate students, experts in different fields (Signal Processing and Chemometrics), and experienced national security professionals. Each different type of audience requires a different approach and calibration of the material to their particular level of expertise. Often, there was high diversity within the same audience as well, which required a finer level of personalization, contingent to each particular student's needs. I found this diversity to be instrumental in my training towards becoming an effective and versatile teacher who can convey knowledge in a wide range of settings.

## Mentoring & Advising Experience



(a) Work by Ms. Ticha Sethapakdi (undergraduate student with double major in Arts and Computer Science): Tensor Decompositions for Linked Data using SPARQL. This project was featured at Pittsburgh Supercomputing Center (PSC) Data Exacell 18-month review to the NSF.



(b) Work by Ms. Hyuan Ah Song and Mr. Bryan Hooi (junior PhD students) on using Information Theory to find the best way to “teach” a matrix that describes facts (e.g., animals and their properties). This work has already appeared at ASSESS Workshop at ICDM 2015 and is under submission at a top-tier Data Mining conference.

**Figure 1:** Selected results of projects that I have mentored.

I have mentored and supervised five amazing students with quite diverse backgrounds, ranging from undergraduate students to masters students and junior PhD students. Every student is unique and depending on their background and character, I adapted my advising style to the right degree of my involvement to the project, the frequency of meetings, and the type of feedback, to each individual student's needs, strengths, and interests. I encourage student independence and enjoy brainstorming ideas with students, as I have noticed that this is a two-way learning experience. My advising experience at CMU has equipped me with the necessary

skills to nurture and guide graduate students in my group through their first steps in research, while at the same time having the opportunity to learn from them as well. Figure 1 shows two representative results of projects that I have mentored.

## **Future Teaching Plans**

To reiterate, I enjoy and value teaching both fundamental concepts as well as advanced topics and cutting edge research results. As such, I am willing and capable of teaching introductory computer science courses, and courses at any level related to data mining, data science, databases, and machine learning. In addition to introductory courses, I would be delighted to design and teach an advanced course related to my research, such as *Mining Large Multi-Aspect Data*, and *Signal Processing for Data Science*. I strongly believe that at any level, hands-on experience (manipulating and looking at real data, as well as writing clean and efficient code) is essential both for students interested in working in industry, as well as for students who are more inclined towards a research career, and I will strongly encourage and nurture it. In addition to within-university teaching, I will continue delivering tutorials at conferences, with specific emphasis on cross-disciplinarity, as I have done in the past (teaching at Signal Processing and Chemometrics venues). Finally, drawing from my own experiences, I would be happy to contribute on designing a cross-disciplinary data science curriculum within the school.