I am a computational cognitive neuroscientist with 10+ years of programming experience. For the past decade, I have been conducting research on human learning, and in the past 4 years, I have focused on how machines learn. In the next chapter of my career, I want to leverage that experience to create technology that will help educate students as efficiently as possible.

As a PhD student at New York University and in research positions prior, I explored how the brain supports learning, and what factors predict long-lasting memories. My dissertation research focused on how rhythmic patterns of brain activity relate to learning, and part of this work was recently published in Nature Neuroscience.

As a Postdoctoral Fellow at Dartmouth College, my time is split between building adaptive learning algorithms to educate students more efficiently, and creating software to analyze and visualize data. The plot to the right is was created with HyperTools, a Python toolbox for gaining geometric insights into high dimensional data (Fig. 1). I was the lead developer of this package, which was recently accepted in the Journal of Machine Learning Research (preprint). The plot depicts a low-dimensional embedding of topic models fit to the audio transcripts from 4000 educational videos on Khan Academy, where each video is a point colored by the field of study. The videos cluster together by field of study, suggesting that topic models capture meaningful variance in the content across videos.

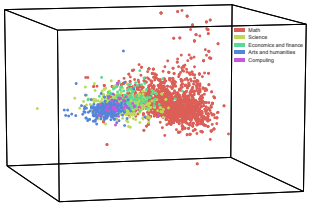

Figure 1: **Topic vectors for 4000 Khan Academy videos.** Average topic vectors for each course are projected onto a common 3D space and colored according to their human-curated subject area.

We are also exploring the 'flow' of topics in educational videos (Fig. 2). In this new project, I developed a Bayesian model that estimates what a student has learned from a video by linking a moment-by-moment model of the video to a student's performance on a post-video quiz. We hope to use this approach to get a more fine-grained estimate of what topics a student is familiar with, and ultimately use it to help students learn faster. We are exploring how deep learning methods may help to improve the accuracy of this model.

In addition to these research projects, I am leading the development of a number of other open-source software projects, including HyperTools (described above), Quail, a toolbox for analyzing data from (human) learning experiments, and SuperEEG, a Gaussian process model for inferring whole brain activity from a small sample of intracranial electrodes. The projects listed above are written in Python, but I also have several Javascript projects as well (bayesian knowledge tracing, an academic article tracker and stimulus presentation software). In addition to my academic and software development experience, I have industry experience working with OpenBCI, a start-up focused on the design and production of open-source EEG hardware and software. When I'm not coding, you can find me backpacking or playing music.

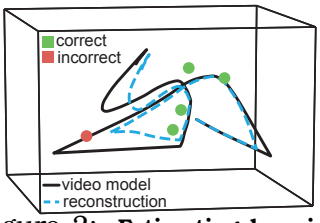

Figure 2: **Estimating learning trajectories.** Moment-by-moment topic weights extracted from a Khan Academy video about photosynthesis. The black line shows a visualization of the moment-by-moment topics, projected onto a 3D space (i.e. a *content trajectory*). The questions are shown as dots (green: correct; red: incorrect). The dotted blue line displays a reconstruction of the knowledge gained from each moment of video (the *learning trajectory*).

Technology has revolutionized education in many ways. The advent of MOOCs offered the possibility of a high-quality, affordable education to anyone with a web browser. I think that the next "big thing" in education will be to capitalize on the global online education infrastructure by creating technologies to personalize training programs, and help to make online learning maximally efficient and rewarding. By harnessing the power of deep learning (and other modern computational) methods, I would like to create technologies that personalize the trajectory of an educational journey to the individual learner.

Andy Heusser