Michal Golovanevsky
Computer Science

Graduate School Statement of Purpose (student accepted to multiple top schools)

Bioacoustics, roadside safety, and human trafficking prevention are all domains I never thought I could have a significant impact on. What started as a pursuit of a concentration to accompany my applied mathematics degree turned into discovering my passion and my future research focus - data science. During my undergraduate journey, I learned just how far reaching and influential this field could be, broadening my knowledge and technical skills to help find solutions to real-world challenges. I draw inspiration from my experiences and wish to further deepen my expertise through a Ph.D. in computer science.

Junior year, I took the first step in realizing my long-term educational goal of pursuing a doctorate degree and applied for a summer research project. Despite having no prior background in bioacoustics, I was able to dive into the field through independent research. I was awarded a significant grant to build a bioacoustics app, using the programming language R on the Shiny-App platform, supervised by a data science and statistics scholar. The goal of the project was to create a free, interactive web-application for bioacoustics students that would help visualize sound through graphs. The application includes a segmentation algorithm that distinguishes between animal sounds and background noise, highlighting patterns in the species' calls. For the first time, I realized how versatile and limitless data science can be. Future students using this application will no longer need to pay money for an expensive software to learn bioacoustics. The application has become an official part of the Cal Poly curriculum for bioacoustics courses and I am currently preparing a paper summarizing my experience with audio data for the Natural Science Education Journal.

Knowing that my work will benefit students inspired me to explore the power of software and sharpen my knowledge of machine learning. This led me to discover a cause I never knew developers like me were needed for - preventing automobile accidents. Advised by an applied mathematics scholar, and in collaboration with Amazon Web Services (AWS) and the World Bank, I designed the infrastructure to reduce the cost and time of road assessments through the use of street view images. The World Bank provided me with 20,000 such images and AWS trained me to use their cloud instances, allowing me to develop an image classification algorithm that automatically identifies key road features (pedestrian facilities, lanes, traffic signals, etc.). After optimizing the architecture of a convolutional neural network, the final model performed with 95.6% validation accuracy, providing the World Bank with accurate safety assessments so that at-risk intersections can be properly evaluated and restructured. My department thesis, "Roadside Safety: Feature Detection and Convolutional Neural Networks," was submitted to AWS and approved for deployment. While developing a high-performing algorithm comes with its own set of challenges, I learned how to overcome obstacles that come with working on Big Data projects and how to maintain a focused goal while collaborating with large organizations. I

was then able to carry the knowledge I gained from this experience to another large-scale undertaking.

My data science capstone project, advised by a data science and computer science scholar, was in partnership with an organization that seeks to end human trafficking in the U.S. through the use of data analytics, enabled me to brainstorm with other students and create meaningful results as a team. Our task was to develop a model assessing the likelihood of massage parlors in California to be engaged in illicit services. Using flagged vocabulary, we performed textual analysis (creating features from bigrams and trigrams) on reviews from Yelp, Google and a website called RubMaps which purports to rate workers at illicit massage businesses. Using KMeans clustering as our unsupervised algorithm, we validated our model on a similar dataset created in Florida with ground truth data, and finally compiled a list of businesses with a probability greater than 85% to engage in such activities. We sent a detailed report to the local District Attorney to emphasize the severity of the issue and to demand action. Seeing firsthand the adversities that vulnerable people in our community face, fueled my passion for using cutting-edge technology to help others, and made me want to work even harder to achieve my goals.

Guided by my project coordinator, I submitted and won an NSF summer research grant to expand our work and took over as the lead data scientist. Automating the data gathering process, optimizing our model to fit new data, and co-authoring a report that was submitted to authorities in additional states helped push more local governments to take action against human trafficking.

Though not always smooth-sailing and never without hard work, these projects taught me the importance of choosing a discipline that makes significant contributions to society and leaves room for curiosity, personal growth and fulfillment. I will continue to seek projects of such nature through my doctorate degree. I aspire to fulfill this interdisciplinary task through the application of machine learning to diverse fields ranging from medicine to privacy.

After earning a Ph.D., I hope to embark on a career in academia, pioneering research and teaching others how to apply mathematics and computer science to challenging problems. Working with top professors on projects that use cutting edge NLP techniques to uncover gender and race biases and other fundamental problems in educational research, or those leading research into the application of Deep Learning to Natural Language Processing, or on creating computational methods to advance drug discovery, would truly allow me to combine theory and application to life-changing solutions and learn from world renowned faculty. With my extensive mathematical and programming background, my tenacity in conducting research, combined with your exceptional Ph.D. program, I am confident that I will flourish and achieve my academic and career aspirations.

In a continuously technologically advancing and interconnected world, it is paramount that researchers put forth the utmost effort into fine tuning and advancing a more equitable experience for every global citizen. With my Ph.D, I hope to be on the front lines of these

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advancements in problem solving to fully and completely achieve these goals of efficiency, equity, and inclusivity.