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Personal Statement

G.H. Hardy once said: “I have added something to knowledge, and helped others to add more; and … these somethings have a value.” This sentiment profoundly resonates with my academic journey, which began in a high school renowned for nurturing gifted minds in mathematics. It's here that I first discovered my passion for mathematics, a journey that has led me to the pursuit of a PhD in Computer Science at Columbia University, driven by a desire to contribute to the field of computational innovation.

My passion for mathematics, particularly geometry, was evident from my early years. It was this fascination with spatial thinking and problem-solving that fueled my success in mathematical competitions and later crystallized my interest in computer science during my undergraduate years at Nazarbayev University, the foremost higher educational institution in Kazakhstan. Here, I discovered the symbiotic relationship between mathematics and computer science, which was further exemplified in my project “Imaging in Seismic Explorations” under Professor Yogi Erlangga. This project entailed applying the method of difference potentials in 2D space on a circular domain, challenging me to translate mathematical theory into practical computational solutions. This early exposure to research was instrumental in shaping my approach to problem-solving and computational thinking.

My graduate studies at NYU's Courant Institute of Mathematical Sciences were pivotal in shaping my research trajectory, beginning with a transformative experience in the Computer Graphics course. Under Professor Daniele Panozzo, I discovered the fascinating interplay of geometry and computer science, reshaping my perspective on the practical applications of mathematical concepts I had engaged with since my school days. A significant milestone was my capstone project with Professor Ben Peherstorfer, focused on accelerating ray tracing algorithms using parallel computing. This work deepened my understanding of high-performance computing, which is crucial in complex computer science research.

These experiences at NYU Courant were complemented by my work in Professor Rob Fergus' Computer Vision class, where I delved into cutting-edge topics such as Diffusion Models, Transformers in Vision, Semantic Segmentation, GANs, Optical Flow, Stereo Reconstruction, and Text-to-Image models. The culmination of this class was the 'Emoji Diffusion' project, an exploration of denoising diffusion

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probabilistic models. It was a significant step in my journey towards understanding the transformative power of computer vision in interpreting and generating visual data.

Currently, I am engaged in a research project titled “Surgical Simulation for Manipulating the Omentum” with Professor Gizem Kayar. This research involves developing realistic physical representations of deformable objects using numerical integration methods like Euler’s and Verlet’s methods, an essential aspect of surgical simulations. This research has honed my technical skills and emphasized the real-world impact of computational research in healthcare.

My teaching assistantship roles, from being a recitation leader in Honors Linear Algebra to grading for Graduate Computer Graphics, were instrumental in refining my ability to simplify complex concepts. These experiences not only solidified my subject matter expertise but also enhanced my communication and leadership skills, crucial for a career in academia.

At Columbia, I am particularly enthused by the opportunity to work with faculty like Professor **Changxi Zheng**, whose work in physical simulation aligns with my interest in computational models. Professor **Carl Vondrick**’s research in computer vision offers a perfect platform for further exploration in this field, particularly in the areas of robust and versatile perception models. Additionally, the expertise of Professor **Shree Nayar** in computational imaging and vision systems aligns with my aspirations in physics-based models for vision and graphics.

In joining Columbia University’s PhD program, I aim to contribute to the field of computer science by developing innovative computational models and algorithms. I also look forward to sharing my experiences in programming and mathematics competitions, nurturing a culture of intellectual curiosity and problem-solving skills among students.

In conclusion, my journey has been a testament to my commitment to computational research and academic excellence. At Columbia, I am eager to continue this trajectory, evolving as a researcher and educator, and making impactful contributions to the scientific community and beyond, in line with the ethos of G.H. Hardy.