Adina Raluca Stoica
Statement of Purpose

Washington University in Saint Louis's computer science department is committed to being at the forefront of computer research and innovation, with experienced faculty that are leading researchers in their fields, and strong groups in many areas of computer research. This commitment to excellence, research and innovation is exactly what I am seeking in a university at this juncture. I wish to pursue a PhD in computer science, within Computer Graphics, but also hold an interest in Artificial Intelligence, Robotics, Computer Vision and Bioinformatics and in how they can be used together to solve contemporary, real-world problems.

Currently, I am a senior at Bard College, pursuing my bachelor degree in computer science on a Distinguished Scientist Scholarship. In my student career, I have taken several computer science classes, including Algorithms and Data Structures, Networks, Theory of Computation, Programming Languages, Artificial Intelligence, Distributed Systems and Computer Graphics. I have also made contributions to the activity of three research labs: the Laboratory for Algebraic and Symbolic Computation (ASC) at Bard College, the Computational Physiology Lab (CPL) at the University of Houston, and the Virtual Environments Group at Clemson University. Next semester, I will be taking a Probability and Statistics class, while continuing work on my Senior Project, which is a year-long research/programming project required of Bard seniors. In my Senior Project, I am investigating the usefulness of Voronoi diagrams based on Harris corner points as an invariant in image near-duplicate detection. My research experience has showed me how much I enjoy doing research, as it simulates my imagination and matches my inquisitive nature, my perseverance and my meticulousness, and convinced me that a research career is the right path for my future.

I started doing research my freshman year, by joining the ASC lab at Bard. The lab's ongoing research project is the classification of quandles, a collection of algebras that have arisen from the classification of 3-dimensional knots. My most recent work entailed designing an interface for visualizing operation tables, subquandles and the cycle structure of finite quandles. My team and I helped improve the Mathematica-based QuandleViewer for large quandles and implemented a subquandle viewer. Joining this lab served as my introduction to the research world, and opened my appetite for doing research.

The summer after my freshman year I participated in an REU at the University of Houston (UH). Working on the "Analysis of the Blood Perfusion and Perspiration Components of the Supraorbital Thermal Signature" project convinced me that that research is a good career choice for me. The research introduced me to a new technology (thermal cameras) and showed a novel approach towards its usage (stress detection). The project's premise was that, under stress, people experience the "fight or flight" syndrome, which produces facial perspiration. The goal was to develop an algorithm to extract the perspiration signals. Working on this project taught me how to approach a research problem, how to accept guidance as well as have initiative, and how rewarding a research career is. As a reflection of my work, my poster won the REU competition and I was invited to present it the following semester at the UH Research Day.

I was honored to be invited to go back to UH the following summer. I was offered the opportunity to follow through with the project and test the software's effectiveness by comparing the results of using this contact-free technology against the traditional Galvanic Skin Response method in polygraph testing. The analysis demonstrated that the technology is close to being used in practical applications. Working on this served to further convince me that research is the right career choice for me, as well as showed me what it means to work on a project from the beginning to its completion.

Last summer I went to Clemson, seeking a challenge through a different type of research. I participated in their REU in Human Centered Computing and worked on the project "Egocentric Distance Estimation in Virtual Environments". The purpose was to model a virtual environment for an experiment comparing reaching distance estimations between virtual and real environments, with applications in various virtual-reality (driving, flight) simulations. In the experiment, subjects view a target placed within reaching distance and then, while blindfolded, reach to it. This project introduced me to modeling software, head-mounted displays (HMDs) and tracking systems, topics in the research area that I would like to pursue. The experiment is still being conducted at Clemson and a paper on the research is in progress.

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As our technological capabilities increase, so will the level of sensory engagement. The uses for this promise to be immense: every field from medicine to cinema entertainment can be impacted and improved through these resources, and I want to be at the forefront of this developing arena. I am interested in pursuing graphics as a research field and strongly believe that both my studies and my research experiences have prepared me for it. Graphics has immense potential to solve real-world problems, as some of the current uses of the technology show: architects use it to design better buildings faster, psychologists to help patients learn to cope with disorders in balance, phobias and PTSD, archaeologists in artifact reconstruction, and biologists in a number of ways, from genomic visualization, to MRIs and other imaging technologies.

Computer generated worlds have always fascinated me, but the opportunity to experience them hadn't arisen before last summer. Much to my dismay, however, the technology hasn't advanced far enough for virtual reality to be experienced by people with my condition. I am part of the small percentage of the population (still amounting to 300 millions) who perceive depth differently than how the technology presumes, because they do not possess binocular (let alone stereoscopic) vision. This so-called disadvantage did not hinder my summer research, but got me thinking about a potential research topic to pursue in the future: making an HMD-like device that would take into consideration other ways people perceive depth. Such a device would allow people that rely primarily on visual cues other than stereoscopy (such as relative size, perspective, and motion parallax) to perceive 3D graphics in virtual worlds in the same manner they do in reality. I believe that, as the use of computer graphics in solving real-life problems increases, the availability of such a device for having more people exposed to the technology will become imperative. Moreover, research on the topic is bound to provide a deeper understanding of depth perception, and insight into possible improvements for current devices as well as for more-realistic computer rendering. A thorough computer graphics education at the Washington University in Saint Louis would enable me to acquire the necessary expertise to pursue this topic, whether while doing my PhD or afterwards.

From my research on the university's website, I believe I have similar interests and would be interested in working with the professors in the Media and Machines Lab, including Prof. Cindy Grimm, Prof. Tao Ju, Prof. Robert Pless, Prof. Burchan Bayazit and Prof. Bill Smart. My main interest lies in 3D computer graphics, so I will be very happy to work on projects in the field. At Clemson I developed, using Maya, an interactive virtual environment that was identical to a real environment in a room and enabled people to interact with objects in that environment using OpenSceneGraph. I am interested in exploring alternative techniques for modeling and rendering (by working on projects such as Surface Modeling, Art-based interaction and rendering, Barycentric Coordinates with Applications in Mesh Deformation, and Volumetric methods in mesh processing), as well as have an interest in and believe there is a lot of work to be done in image and video processing and I am interested in working on projects to help advance knowledge in these areas (the Deformable imaging using anatomical atlases and the Manifold Learning and Medical Imaging projects for example). My senior thesis work is in fact in the area, as I am trying to write a computer program that recognizes image near-duplicates using Voronoi diagrams. As I stated in the beginning, I am also interested in applications in bioinformatics (for example the Skeleton-based analysis of 3D Cryo-EM protein structures at intermediate resolutions and the Optimization of Complex Biomechanical Systems projects), as well as in robotics and artificial intelligence (the Motion Planning Group's work is interesting, as well as the New Robot Photographer, the Remote Robotic Exploration and Experimentation and the Control of a Robotic Hand Prosthesis Using Cortical Signals projects). I am sure that, in the Media and Machines Lab, I will find many of the areas stated here overlapping, as well as get to work on a research project I will really enjoy.

After graduating, I intend to continue doing research, whether in academia or in the industry. I believe that while at the Washington University in Saint Louis I will be able to receive useful information from more experienced people in order to make the right choice for my future.