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Senior Capstone Reflection

In Science, Technology, Engineering, and Mathematics (STEM) fields, bias, discrimination, and gender gaps are still present. These issues, directly and indirectly, prevent society from better transformations and pose many challenges to underrepresented people. I've been observing bias and discrimination encoded in software and programs used in all aspects of life. I also see the need to change and the motivation to pursue my future goals. I am passionate about transforming the situations to allow the next generations of STEM students to reach their full potential as persons and as communities, which will gradually better the present status. My goals align with the mission of my school, the University of Saint Thomas, which is to advance the common good through educating students - our future leaders - to "think critically, act wisely, and work skillfully." The common good is a goal for everyone to work toward and a moral measure that institutions align with to make righteous decisions. This is precisely why I seek admission to the Ph.D. program in Computer Science (CS) at the Georgia Institute of Technology in the fall semester of 2023. I believe that the Institute could prepare me well as a student and as a person to achieve my goals. Therefore, being inspired by the mission and common good of St. Thomas, I desire to contribute my effort and my voice to help future students of computer science and advocate for mitigating existing bias and discrimination in the field.

I chose Century College and the University of Saint Thomas for my undergraduate studies to set a strong academic foundation in computer science and prepare for a successful Ph.D. program. During my time at both colleges, all computer science courses have profoundly prepared me for my higher education path. During my graduate pathway, I aim to enhance and strengthen my knowledge of computer science and strive to acquire the necessary skills to advance further in the technical field. Most importantly is the opportunity to conduct research under professors whose works align perfectly with my goals of developing insight into theoretical foundations and Artificial Intelligence (AI). I took courses in Data Structures and Algorithms, which are necessary and fundamental for all computer science students. They prepared me for any other computer science classes. I also had a class in artificial intelligence and robotics, showing me the definition of AI and how it is implemented in solving daily problems. Deep learning (DL), a sub-field of artificial intelligence, is another interesting class that I took at St. Thomas. This class showed me how DL models mimic our brains' neural networks to process the data and give expected outcomes and predictions. All classes connect computer science in theory to real-world applications and implementations.

Besides computer science theory and artificial intelligence, I have also developed a strong interest in Software Engineering. During my Computer Graphics course at St. Thomas, I have gained a fundamental understanding of computer graphics to work on multiple class projects. These projects also involved JavaScript scripting language and basic web development skills to develop a simple but attractive user interface. There are 2 prominent projects that mark my significant improvements in computer graphics. One of them is called 3D projection. In this project, the program projects virtual 3D models from world-space onto the view-plane using HTML's Canvas 2D API. In other words, it simulates how a camera views 3D objects in the real

world and projects them on a picture (or a view plane). In addition to basic 3D projections, the program also adds some rotation animations to each model with a defined rotating speed. Each model could rotate in place about 3D axes. This project also helped me learn how to implement both parallel and perspective projections to different scenes containing various object shapes.

Another computer graphics project that I have done is 3D Illumination and Shading. This project utilizes the HTML5 WebGL2 API to demonstrate the effect of multiple sources of point lights in illuminating 3D models. This program simulates how we view objects in the real world that are illuminated by different light types and sources. It also allows users to choose and apply different types of shaders to the illuminating and shading effect. It is either Gouraud or Phong shaders. Phong shader offers a smoother transition in the color of lights and models in illumination than Gouraud or flat shaders. The program also allows users to implement texture mapping to each model. In other words, it uses a random photo as a texture and applies that to a model's surfaces, creating countless beautiful objects. As a result, this project helped me understand how different types of light work together to illuminate one object in world space.

As mentioned previously, I am passionate about becoming an inspiration and a role model for the next generations of computer science students, especially women and youths, and raising my voice against bias and discrimination in STEM fields. To continue my advocacy, I desire to achieve a Ph.D. degree at the Georgia Institute of Technology and become a computer science professor in the future. Being a professor, I will be able to convey my knowledge, experience, and message to my future students. I understand that it is hard to transform the whole situation by myself, but I will contribute one helping hand in transforming it. Although I can only partially change pre-existing issues in society, I believe that our country's future leaders will be able to transform them, starting with current youths and students. Besides pursuing my

academic and career paths, I am also driven to inspire and encourage young girls to join STEM fields. I am enthusiastic about expanding existing support for women to be confident and brave to pursue their academic and career choices, narrowing the gender gaps in STEM.

In a research paper about Artificial Intelligence in the criminal justice system prepared for my Summa Oral Examination, I expressed my perspective on AI software that is being used in the legal system and how bias in the program impacts underrepresented people. Our world has witnessed the wonderful development and applications of artificial intelligence in every aspect of life. It offers countless advantages and potential for our daily life. Besides its successful development, AI also poses some significant challenges for our society. In the criminal justice system, AI software has been used in policing, sentencing, and the bail system. A study by Dartmouth University proved that AI and sophisticated technology are not inherently fairer than humans. Because AI training uses data collected and polished by humans, AI systems are simply mirroring pre-existing bias and discrimination in society. Besides biased datasets, a biased algorithm used for those software and systems also exacerbates the situation. This entails many unintended consequences that profoundly impact discriminated people. This is also an unwanted outcome in the legal system where justice is the primary priority. This research paper focuses on analyzing AI's uses in the criminal justice system and its ethical concerns. The paper also proposes some methods that government, organizations, and researchers can take to mitigate bias in AI software. For example, the government could set standards and regulations in AI software developments and applications, encouraging organizations and research institutions to follow good guidelines. Therefore, with the support and contribution of every individual, organization, and government, I believe that we could mitigate bias and discrimination in STEM fields and society in general.

Through previous experiences, I saw the great advantages and potential of computer science in our current developing world. The ever-changing and upgrading them is a force and a challenge for me every day. Having worked on different projects and courses, I am confident that I can make substantial contributions to future projects at the Georgia Institute of Technology. I also believe that I could gain valuable knowledge, skills, and experience at the Georgia Institute of Technology to support my goals. Thus, I seek to contribute to the computer science field and eventually work as a professor in computer science to teach and influence the next generations of STEM students. To begin this goal at the Georgia Institute of Technology would be the most tremendous honor of my career.