Nishanth J Kumar

In one or two sentences, describe your career goals and professional aspirations (see example below). This statement will be used in publications if you are selected as a scholar or honorable mention.

Obtain a PhD in Artificial Intelligence. Conduct research aiming to develop intelligence algorithms to enable practical and collaborative robots.

What are your career goals and professional aspirations? Indicate which area(s) of mathematics, science or engineering you are considering pursuing in your research career and specify how your current academic program and your overall educational plans will assist you in achieving your career goals and professional aspirations.

Humans have been dreaming of creating intelligent robots for many centuries now. Intelligent and collaborative robots could enable everything from creating an extraterrestrial habitat on Mars to making nuclear fusion reactors a viable source of clean and safe energy. The potential applications of these robots are so vast that it seems like their development could fundamentally change the world for the better, similar to how computers have changed our world by an unprecedented factor in only the last 50 years. The prospect of having widespread intelligent and collaborative machines at our disposal is thus exciting indeed.

Given this, my primary career goal is to accelerate the development of such intelligent and collaborative robots.

I recognize that creating such robots is not a simple task in the slightest. Such intelligent and collaborative robots have not even been created in a laboratory setting yet. Hence, it is clear to me that I need to spend time learning as much as I can about these fields and attempt to advance the state-of-the-art in research as much as I can.

To this end, I am pursuing an undergraduate degree in Computer Engineering. I believe that to create truly useful robots, we must make progress in creating increasingly intelligent algorithms in addition to cheaper, more accurate sensors and actuators. Thus, I see the challenges of robotics as fundamentally being challenges of computer science and engineering.

I chose to study computer engineering because it enables me to gain foundational knowledge in both fields.

Outside of my curriculum, I am a member of a Robotics and Artificial Intelligence lab on campus. As a lab member, I am able to learn and work on

independent research projects to advance the current state-of-the-art in various sub-fields like Planning, Reinforcement Learning, Imitation Learning and Human-Robot Interaction. I am also able to constantly learn about the field from my fellow researchers within the lab and around the world.

After graduation, I intend to pursue a Ph.D. in Computer Science with a focus on artificial intelligence for robots. I want to build upon the foundation I will have laid to focus both on developing intelligence algorithms for robots and on creating interfaces to facilitate better human-robot collaboration. At the completion of my Ph.D., I hope to have made significant contributions to the state-of-the-art for robot learning and be well-equipped to help build the robots of our dreams.

Describe an activity or experience that has been important in helping shape or reinforce your desire to pursue a research career in science, mathematics or engineering

My first research internship involved helping a colleague with his project: using data from expert demonstrations to teach a robot how to press buttons. My colleague already had an algorithm; all that was left was to implement it on our lab's mobile robot. We didn't think this would take more than two months.

As it turned out, we were very wrong. Our initial attempts resulted in our robot's arm frequently hitting obstacles. Some weeks of debugging yielded a flaw in our algorithm. Some more weeks and extensive tests revealed our data-collection programs weren't actually collecting data. Weeks continued to pass until my colleague graduated and we lost hope that the idea would work.

However, on the urging of an advisor, another colleague and I began re-examining the project. We ran meticulous experiments until we finally discovered a small error with our data collection. Days later, approximately one year after having gotten involved in the project, I held my breath and watched the robot press a button.

While button-pressing may seem a trivial task, that moment was one of the most profound experiences of my life. Despite the many setbacks and frustrations, I continue with research to this day because such moments of discovery, of knowing that I have created something significant, novel and potentially impactful, have made everything else well worth it. Research is the most exciting and fulfilling pursuit I have ever known and I'm excited to spend the rest of my life doing it.

Goldwater Scholars will be representative of the diverse economic, ethnic and

occupational backgrounds of families in the United States. Describe any social and/or economic impacts you have encountered that influenced your education – either positively or negatively – and how you have dealt with them.

I grew up in my father's relatively small hometown in South India where opportunities were scarce. My high school had no guidance counselor and the nearest SAT Testing Center was a three-hour drive. However, my parents are both hard-working immigrants to the US who taught me to dream big and then persevere relentlessly for those dreams. So, I did.

I taught myself electronics and computer programming and began competing in national – and eventually international – robotics competitions and science fairs. I took a ninety-minute bus ride every day for six years to attend my city's only international school. Eventually, I was able to achieve my dream of being accepted to study engineering at a research-driven college in the U.S.

I should emphasize that I've had the good fortune of being supported by great people throughout my journey thus far. My parents have never spared expenses on my education or pursuit of opportunity. My high school teachers nominated me for every relevant extracurricular opportunity they could and stayed after school hours to mentor me. My school's chairman even fully-sponsored our Robotics team when costs became prohibitive.

My experiences have taught me that it's important to encourage and support students everywhere to pursue opportunity, no matter how scarce it may be. Sometimes, this support can change a life, as it did mine. In this spirit, I hope that my career and life can contribute to making the world have more opportunity for everyone, everywhere.