[Brief] I want to apply for the Ph.D. program at XXX, and commit myself to pursue a Ph.D. degree in the next 5 years. Regarding doing research, I am well-motivated and focused. I have been involved in doing research and publishing papers. This experience will help transition to my Ph.D. studies at XXX.

[Part I. Research Plan] I plan to research on novel interaction technologies, specifically for 3D interactive scenarios, during my Ph.D. studies through either computation interaction approach or sensing techniques. With the rapid proliferation of new devices and interface components, users are allowed to communicate with computers directly in a 3D spatial context (e.g., AR/VR). It leads to a completely new set of vocabularies in HCI and will complement and enhance the traditional desktop- and touchscreen-based settings. The trend also suggests that designing new efficient and enjoyable 3D user interfaces (UI) is becoming very important. Computational interaction, which is able to explain and further enhance HCI through the use of algorithms and mathematical models, is one powerful means. With methods such as human-performance modeling (like Fitts's law) and machine learning, we could build systems/techniques which can generalize, customize, or even predict complex human interaction activities. Though exciting, challenges remain in many aspects and call for more research. For example, how can we handle complex real 3D interaction activities with accurate, while efficient, models? What algorithms should we use for certain 3D interactions conditions?

Meanwhile, a wide range of sensing techniques is also an adequate means for designing 3D interfaces. They can sense input, track positions, and recognize user activities. However, the choice of a sensor for different applications could be a difficult task by balancing factors such as sensing fidelity, cost, and obtrusiveness. Problems remain to be explored, for example, how to enable low-cost, versatile, and robust 3D UI for interactivity with sensing modalities? How can we embed sensors to everyday objects for smart interaction?

This is just a tentative research plan, and I will be happy to adjust this based on the research focus of the HCI group at XXX. In the short-term, I plan to pursue a Ph.D. and aim to publish at least one best paper in top venues of HCI during my Ph.D. My long-term career goal is to be a faculty member in universities. Through my experiences, I truly believe the power of teaching and advising. I aim to find out the exact shape of students’ genius and inspire their real potential.

[Part II. Why Ph.D. in XXX?] XXX not only offers comprehensive and top-ranked curriculum along with cutting-edge research opportunities which can boost my research skills. Furthermore, XXX has well-recognized faculty and outstanding students who are pushing the boundaries of core and emergent research fields. I see researchers from XXX get best paper awards in top-tier conferences and are pushing the boundary of the research fields. At XXX, there are two professors whose projects are especially appealing to me: Profs. XXX and XXX. After studying several papers and reading their websites, I think it would be really nice for me to work with them.

[Part III. Research Experience] Over the past two years, I’ve been involved in numbers of research projects centered around the field of HCI and have co-authored 8 papers in various projects. Please refer to https://difeng.me for more details. My undergraduate research has concentrated on i) designing novel interactive techniques in augmented or virtual reality systems; and ii) evaluating and modeling the user performance in a 3D user interface (UI).

The first project I led was about target visualization. The project aimed to devise new techniques to help users infer target locations in a 3D environment (see Fig. 1). Without much experience, me and my group encountered numerous problems. However, the experience was proved to be the most memorable one during my undergraduate studies and I felt about my passion, my love, and even obsession in doing research. I found that I really enjoyed this problem-solving process with all kinds of creative ideas coming up from my brain. I also would never forget the sense of achievement when the project was completed successfully. After the project, I finished the whole draft of the paper with the help of my supervisor, and the paper was accepted recently by IEEE Transactions on Visualization and Computer Graphics (TVCG) which is one of the top journals in the field of visualization.
After some trial-and-error practices, I became more mature and independent in doing research. I have led a team in developing a new text entry technique called PizzaText for VR systems using dual-thumbsticks (see Fig. 2). This technique makes text entry simple, easy, and efficient in VR head-mounted displays (HMD) using game controllers. At the beginning of the project, I identified the potential needs for a new text entry method in current consumer VR systems and came up with three design rationales based on my literature review. I also developed and tested multiple potential layouts and finalized the experiment design. I’ve led the team to conduct two rigorous user studies to evaluate user performance and analyzed the data. I further summarized the results and drafted the full paper. The paper has been accepted by IEEE ISMAR and published in the IEEE TVCG special issue.

Recent work explores user performance modeling and sensing techniques. For example, I modeled the human forward and backward movements through Fitt’s law and its 2-factor variances and further developed and optimized a new interaction technique called DepthMove. We also employed machine learning techniques to allow directional full-body movements in AR (accepted in CHI 2019). Moreover, I built a new text input method based on the built-in sensor of the mobile VR and wrote a statistical decoding algorithm to filter noisy input. The discussed work has all been accepted or submitted to top conferences regarding HCI. Apart from carrying out research projects, I also have some experiences in supporting the writing of funding proposal writing, patent application, and also paper reviewing.

**[Part IV. (a) Teaching and Mentoring]** I work as a teaching assistant for several modules. I helped update teaching materials and oversee the lab sessions. I enjoy this teaching experience and feel great when students truly learn something from what I present. I am also mentoring some students with their projects.

**[Part IV. (b) Research Motivation]** My life goal is to make the world a better place. After some working and volunteering experiences, I believe that doing research, specifically in the field of HCI, is one of the best ways for me to achieve the goal. Two main reasons are listed below:

- I believe in the value of doing research in HCI. Computing devices such as smartphones and laptops have already become part of our lives. Emergent technologies like virtual/augmented reality (VR/AR), wearable computers, and smart environments can further complement or enhance the current computing paradigm. Thus, by pushing boundaries in HCI, we are making sure that people will have powerful and enjoyable interaction experiences with future use modalities. I have seen different research from top quality papers, world-leading labs, and premium conferences. I found some studies were extremely interesting and the research outcomes had already advanced or remained considerable potential to benefit the lives of millions. By conducting research in HCI, I am confident that my research would make the world better.

- I am a good fit for doing research in HCI. First, I enjoy picking up new ideas and can learn new knowledge quickly. I find HCI is particularly suitable for me since there are endless novel and exciting possibilities across different subfields. When getting into a new subfield, I can often identify an interesting research problem and carry out the project with fresh knowledge learned in a short time. Second, I like working hard on challenging, but meaningful, problems. I take great delight in the procedure of tackling the problem and the resulting “Aha!” moment when the problem gets solved. Moreover, I value creativity and logic, both of which I bring to problem-solving. I can always come up with numbers of imaginative solutions for an unsolved problem; but I will also filter out wishful ideas, even though they seem quite interesting. With these personal characters, I believe and hope I can contribute to the HCI research at XXX.

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Fig. 2. PizzaText offers an interesting text entry approach using the dual-joystick of game controllers which is able to support a fast entry speed and can be scaled to customized sizes.