Statement of Purpose

My primary research objective and interest is in the area of robot perception. I am currently a research and design engineer in HTC VIVE, and I am actively involved in a research project that is developing object recognition for VR/AR. My work focuses on analyzing point cloud from stereo-scene to recognize objects and obstacles in the indoor environment and lining up a safe playing region for VR/AR players. This project links up my SLAM(Simultaneous Localizationa and Mapping) and Robotics background, and some ideas spring in my head. For example, “How to make point cloud(or other sensor data) become semantic for robot?” and “How to use dynamic objects or semantic objects in the map to benefit SLAM?” These ideas stimulate me to undertake further study through your research program.

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I am currently working in “Advanced and Creative Team” in HTC VIVE, and involved in a new VR/AR project, which’s goal is to make the users interact VR/AR with the environment. My work in this project focuses on detecting and classifying the objects and the obstacles in the indoor environment. In this project, I found that there are lots of powerful 2-dimensional image classifier, but when it comes to 3-dimensional domain, such as voxel or point cloud, the classifiers seem not to be as mature as 2-dimenional classifier. Moreover, “How the identified object feedback to robot reasoning, such as SLAM and path planning” seems not to be well-developed. Therefore, the research experience in the project ignite my interest in the field, and I start to search research opportunity.

Before joining the new VR/AR project, I was a SLAM researcher, focusing on localizing VR device. The special effects in VR’s virtual world depends on users’ motion in the real world. Though SLAM becomes well-studied in these years, the robustness of SLAM for VR devices are a still challenging topic. Unlike robot or self-driving car, the SLAM algorithm on VR device has to tolerate fast scene changing because human head move in this way. Therefore, implementing visual-inertial SLAM is necessary. The performance of IMU generally is powerful in fast moving situation. Also, IMU’s speedy update rate compensates the duration of camera frame. Furthermore, we developed “Multi-Frame System”, which means that our SLAM is able to handle multiple cameras and IMUs at the same time, and computing an optimized state of VR device in the environment. I studied comprehensive SLAM papers in these years and combine their strengthens into our product. These research results are implemented to my career milestone “VIVE COSMOS”, which is the newest VR device in HTC VIVE.

HTC VIVE taught me that collaboration and communication are the disciplines to accomplish a mature product. I handled many projects in HTC VIVE, and in some of them, I was the leader or the core engineer. Developing a commercial product requires an immense of consideration. Finishing personal research is just a part of a product. Conversely, organizing a team to be productive is a big thing. For example, my SLAM algorithm has to be implemented on different VR/AR products. Different products have different requirements. In order to fit my SLAM into each product, I had to discuss with firmware team to secure CPU’s computing resource, evaluate sensors with multi-media team to make sure that the data are stably offered by sensors, and inform the mechanic team how important is the location of cameras for SLAM’s robustness. These works are based on the collaboration with other team and communication skills. In addition, I used to record every discussion and meeting in e-mail. This habit makes sure that the members in meeting and I understand the collaboration and have consensus.

The competition in HTC VIVE rigorously distills my research ability. The management of HTC VIVE prefers to allocate a topic to different teams in order to spread risk. That means only one team’s research result will be product and earn money. AC-TEAM is talents’ gathering. It is not easy to be outstanding in this environment. In order to competing these talents, I cultivate the habit of updating the lastest papers and technology news. I take one hour every morning to watch top conferences videos. If the video is strongly related to my professionals, I will read its paper even download its source code and learn some from it. This habit has been kept three years. In the first two years, I concentrated more on SLAM and robot perception. However, I gradually change my focus to machine learning and robot reasoning in this year because machine learning become powerful in computer vision in these decades. I consider that machine learning will be broadly applied in the future.

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花太多的篇幅寫HTC，算是險招，沒做相關研究的教授可能忽略你的申請

(Experience in robotics lab)

My research journey started from Robotics Lab under Prof. Han-Pang Huang in the graduate school of Mechanical Engineering at National Taiwan University (NTU). Robotics Lab equipped me with diversity robot-related knowledge because it is the largest lab in the graduate school of mechanical engineering. Robotics Lab have many fields, including manipulation robot, humanoid (biped) robot and mobile robot. The most attracting thing in Robotics Lab is that the members like to discuss and are glad to share research result and suggestion. During the discussion, my robot knowledge is broadly extended, and some idea and research are figured out. For example, my master thesis combines SLAM and humanoid robot’s path planning. This research is beholden to the researchers of both humanoid (biped) robot and mobile robot. The experience in Robotics Lab constructed my research foundation. Until today, in HTC VIVE, I use Robotics knowledge on my work.

(Explain your fail at the beginning of ML)

You committee may notice my transcript that I did not pass “Machine Learning Foundation”. This may damage my chance to get admission from your committee, so I have to explain. That was because I did not adapt to the teaching way in this class. The professor in this class only played precedent videos instead of teaching by himself or updating new knowledge. However, though I did not pass the course, I took another online course “Machine Learning” by Hung-yi Lee instead, who is an associate professor in department of Electrical Engineering at National Taiwan University. Moreover, because I knew I did not get a proof of my Machine Learning knowledge, I took more time researching Machine Learning. Until today, I work in HTC VIVE, I often study Machine Learning and implement it to our project. For example, I used supervised learning to estimate the state of product in space, and the cost function is designed to fit the transformation in 6 degree of freedom. I did not get the proof, so I care and study harder.

不建議提自己被當，很多教授其實不會看成績單，提了反而會知道，建議刪除

(Tell me why you choose the program)

For these reasons, the Robotics Institute at Carnegie Mellon University is especially attractive to me. I am intrigued by several interesting research projects carried on by its faculty members. In particular, Professor Sebastian Scherer’s research in autonomous aerial robots is fascinating. His research recently tends to integrate robot perception and automatic control with machine learning. This integrated research is what I desire to do. For example, (…)

My career goal is to develop a robot system that senses the world like human beings. Robot perception becomes powerful in these years. However, there is still challenges. For example, human beings sense objects in the environment directly by objects’ location instead of point cloud or voxel. “How object recognition feedback to robot’s state estimation?” is not well-defined as I know. To study this question and the questions I mentioned in the first paragraph, I desire to do research in advanced degree, and I believe that the Robotics Institute at Carnegie Mellon University is good fit for me. The resources and breadth of robot research performed at CMU will provide me with the experience that I need to pursue my passion in robot perception.

HTC的篇幅佔了很多，但是HTC的內容其實跟robotics只有間接關係，建議把HTC所學的跟Robotics的關聯交代清楚一點