



July 20, 2020

To Whom It May Concern,

I am writing this letter to strongly recommend Tse-Hou Hung for a scholarship to support his upcoming PhD career. Tse-Hou just finished his first year of the Master study at the Institute of Information Systems and Applications, National Tsing Hua University. He has recently applied to transfer into the PhD program at the same institute. Tse-Hou has been admitted and will start his PhD study after this summer. As my Master student, Tse-Hou has been working with me since July 2019. It has been my pleasure to working with him in the past year and I look forward to continue working with him in the following years.

Tse-Hou received his undergraduate degree from the Department of Health Policy and Management, Chung Shan Medical University (CSMU). When he first contacted me, I wasn't sure if we should take him because he did not take too many computer science courses during his undergraduate time<sup>1</sup>. However, when interviewing Tse-Hou, I found that he is extremely motivated to *fill up* the gaps. Because of his enthusiasm in computer systems, he quickly picked up the tools that we use every day, including python, C++, matlab, Linux, subversion, and latex. He continues maintaining such a proactive attitude in the past months. For example, Tse-Hou has volunteered to attend quite a few workshops, including a Raspberry Pi workshop held in Feng-Chia University last summer and a 5G core network workshop held in National Chiao Tung University earlier this month. I want to point out that although I am willing to cover all the expenses for attending these workshops, most of my students would prefer to skip them because they simply think the topics are irrelevant to their thesis topics. Among my 15 current students, Tse-Hou is the *only* student who never misses any of these opportunities. I think this demonstrates his strong willingness to learn. Indeed, in the past year, I have observed his tremendous improvements in various aspects and I'm happy to say that, as of today, there is very little, if any, gap between Tse-Hou and those students with computer science undergraduate degrees.

What makes Tse-Hou unique, compared to other students is his "can-do attitude". Late last year, I asked Tse-Hou to write up his research work into a conference paper for a submission to ACM Multimedia Conference 2021 (MM'21). MM is the premier international conference series on multimedia research, which is very competitive. Most of my Master students, and even PhD students, would hesitate to send their work to MM; instead, they prefer to aim lower for workshop papers.

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<sup>1</sup>Tse-Hou is probably the only non-STEM student in my lab. Ever since he joined us, he has brought very different views on many issues in our research work. We are blessed to have him with us.

This, however, didn't happen to Tse-Hou. Despite knowing the venue is difficult, Tse-Hou has been tirelessly working on his 6 Degree-of-Freedom (DoF) streaming work since late last year, through the lunar New-Year break, and submitted the paper titled "Optimizing Immersive Video Streaming Using Deep Learning Approaches: A Case Study on TMIV" to MM'21 in late April.

In particular, the MPEG TMIV codec supports: (i) multi-view video streaming and (ii) client-side view synthesis, so that Head-Mounted Displays (HMDs) can render the viewports from arbitrary positions and angles from a limited number of input videos. *One challenging problem in TMIV streaming systems is the vast number of system parameters that need to be carefully set in the configuration files.* Tse-Hou proposed to employ Reinforcement Learning (RL) and Convolutional Neural Network (CNN) to determine the configurations to maximize the synthesized HMD viewport quality. This is not an easy task because collecting datasets from multi-view videos and real HMD users is time-consuming, tedious, and error-prone. In addition, the huge search space makes solving this optimization problem in real-time virtually impossible. Tse-Hou has been very patient and addressed many issues before solving the problem. Without that, we couldn't get the paper submitted to MM'21. Our submission received quite positive feedback at MM'21. Tse-Hou and I have just submitted our rebuttals to the reviewers last week to clarify a few things. We hope to receive positive news from the organizing committees this week. I, however, would like to add that it is impressive for Tse-Hou to generate a *publishable* paper in such a short time period. I am especially happy to see how fast he learns in these few months. I am sure he will become a seasoned researcher in no time.

In addition to the technical side, Tse-Hou also has very nice inter-personal skills. He has been maintaining positive relation with fellow labmates, both senior and junior members. I noticed that he is very good at coordinating meetings and discussion sessions. He seems to have no problem with distributing workload among labmates and collecting their inputs in time. This demonstrates his leadership, which could be attributed to his rich experience in organizing extracurricular activities in his undergraduate years. He can also efficiently communicate with our external collaborators from the industry (like UMC) and the academia (like UC Davis). I think these soft skills are crucial for a successful PhD and professional career.

In summary, Tse-Hou is a dedicated, hard-working, creative, and easy-going student. He has learned quite a few things in the past year and have got his first manuscript submitted to MM'21. I'm extremely happy to learn that Tse-Hou had decided to transfer to our PhD program. I am confident that his PhD career will be fruitful, e.g., he has been extensively working on the journal extension of his 6 DoF immersive streaming paper, a magazine paper discussing the future direction of 6-DoF XR (Extended Reality) applications, and another conference paper on Quality-of-Experience modeling of HMD users.

I am convinced that he indeed demonstrates the following positive personalities:

- Persistent
- Good at communication & cooperation

- Pursuing the sense of accomplishment

which were listed in his resume when he contacted me in March 2019. I believe receiving a PhD scholarship from our university will further encourage Tse-Hou to keep up all his good work and contribute to the broader research areas of XR, Augmented Reality (AR), Virtual Reality (VR), immersive content representations, Quality-of-Experience modeling, computer vision, and multimedia networking. All his contributions will enable next-generation XR/VR/AR applications and change our daily life. Hence, I strongly recommend Tse-Hou for a PhD scholarship with zero reservation.

Thanks for your considerations. Should you have any questions, please don't hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'Cheng-Hsin Hsu', with a stylized, flowing script.

Cheng-Hsin Hsu  
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