**[Preference card (for Master's Program)]**

Department of Mechano-Informatics, Graduate School of Information Science and Technology, The University of Tokyo

| Program | Master's Program |
|---|---|
| Examinee's name | CHOU, YU-LUN |
| Willingness to enroll (circle "Yes" or "No") | If you are not assigned to any of the preferred advisors that you have indicated in the "WEB Application System", will you still pursue enrollment?<br>(Yes) / No |
| Field of interest and research plan (Please describe in as much detail as possible) | **Field of interest:**<br>I'm fascinated by Robotics, especially Quadruped Robots, Humanoids, and Unmanned Aerial Vehicles (UAVs). Also, living in a generation of Artificial Intelligence (AI), I aim to integrate this technique into my major and make robots cleverer, then coexist with all creatures, not just humans.<br>**Research plan (Quadruped):**<br>To my knowledge, some institutions work well on quadrupeds. For instance, Spot and Mini Cheetah belong to Boston Dynamics and MIT CSAIL, respectively. Considering some advantages of 2 robots, I propose my plan for Quadruped, including its applications, how to help us improve our societies, and the approach to the goal, which will be invaluable to my research and future applications.<br>Spot is one of the most famous robots in the world. It can achieve self-inspections in hazardous areas such as tunnels and nuclear facilities. For example, as Paris turns to night, the Autonomous Parisian Transportation Administration utilizes Spot to scrutinize metro infrastructure. Therefore, it can avoid accidents during an inspection and work a night shift without inspectors.<br>Moreover, the robot can use as a rescue robot, which would play an important role in countries near seismic zone like Japan, Taiwan, and Turkey. In detail, integrating sensors and mechanisms with the robot, including thermal sensors (temperature), LiDAR (depth), and manipulators, to support the rescue team's search for survivors under quake rubble within a crucial 72 hours.<br>As for Mini Cheetah, MIT showcased the learning-based method that outperformed the previous human-designed one. There is a comparison of the learned controller and the human-designed one in the demo. The learned controller can adapt the system behavior to diverse fields, such as gravelly hills or slippery ice, to prevent the robot from stumbling in those challenging terrain. To reach stability, one significant quality of a reliable system, we can use a simple neural network as the controller. Then, let the robot learn to run in a simulator and realistically overcome trouble in those situations.<br>However, this technique won't be exclusive to Quadruped. AI can also apply to other kinds of robots mentioned above. Following my statement at first, combining Robotics and AI can make the robot works better, benefiting the world ultimately. |

- Submit this form along with your application.
- There is a possibility you will not pass the examination if you circle "No" in the "Willingness to enroll" box and are not assigned to any preferred advisor.
- Use a computer to prepare this card.
- Do not extend to the next page. The font size should be 12pt or larger.

# [Expertise Assessment Card]

Department of Mechano-Informatics,
Graduate School of Information Science and Technology, The University of Tokyo

Examinee's name : CHOU, YU-LUN

- ◆ Write down the examinee's name.
- ◆ Use this two A4 pages to write your expertise. No additional pages are allowed.
- ◆ Use a computer to prepare this card.
- ◆ The font size should be more than 12 pt. Images and diagrams can also be used.

Firstly, the research activities I've done at National Taiwan University (NTU) before included Autonomous Mobile Robots (AMR), Unmanned Aerial Vehicles (UAVs). Secondly, the university lecture or practicum contained Propeller-Powered vehicles and Billiard Cars. Lastly, the Japan exchange student program at Aoyama Gakuin University (AGU) and FIRST Robotics Competition (FRC), Sacramento Regional in California is for extracurricular activities. Besides, the contents below are in a time order starting with the latest.

1. **Autonomous and Soft Robotics LAB (ASR)** - ME Dept. at NTU, Mar. 2023-Present

In the ASR lab, I'm also conducting research in AMR, as I've done in the former lab, the Intelligent Robot (IR) Lab. Compared to one years ago, I have a deeper understanding of AMR, including the concept of Simultaneous Localization and Mapping (SLAM), and relative algorithms and theories such as Gmapping, A* algorithms (path planning), AMCL (localization), and Kalman Filter (trajectory optimization).

Also, I try to implement the new version of the Robot Operating System (ROS), ROS2. Since it's complicated for a beginner like me to compare the difference in architectures of ROS2, it's still in progress.

Recently, I have had to focus on application and entrance exams. After the application season ends, I'll start to explore more about AMR. Moreover, previewing important concepts in Quadruped Robots, which is my desirable theme in my Master's.

2. **Exchange student program in Japan** - Dept. of Sci. and Eng. at AGU, Fall '22

The time in AGU is the first time I have left Taiwan for so long, not as a tourist. Here, I learned a lot of things beyond the textbook. For instance, both my English and Japanese proficiency increased a lot after the program.

Moreover, I firmly believe that I want to stay out of my comfort zone after I finish my exchange. Not just leaving Taiwan, the comfort zone here also refers to "staying away from English-speaking countries". Most of my clever friends in university will choose to go to the US directly after graduating from university. I know I can do the same, or still choose to live in Japan but only speak English, but I want to be different from my peers.

Furthermore, I love Japan a lot. I've also seen a lot of comments that if you love Japan just for the culture, don't study in Japan. However, I've lived there for half a year and I trust I can overcome all challenges there. Although sometimes it's still lonely or helpless living alone there, I'll always keep this in mind "When the going gets tough, the tough get going".

3. **Intelligent Robot and Automation Lab (IR)** - EE Dept. at NTU, Mar. 2022-Aug. 2022:

IR lab can be said as my enlightenment in Robotics. Since I was mostly responsible for mechanical design in previous projects, algorithms, software, and operating systems were so new to me.

For example, it's challenging to research the algorithms SLAM, Raspberry Pi (RPI), and Ubuntu from a naïve person who knows nothing about them before.

Moreover, it was my first time working on a robot, a differential wheeled robot performing mapping, from scratch. Although I didn't design the mechanical parts by myself, to save time and cost to research other parts mentioned before. At that time, I spent months understanding how RPI works and how to use commands properly in Linux (Ubuntu), which is totally different from Windows OS.

Recalling the process, despite it being so tough, I realized that it's so exciting to learn new things every day. That's also one motivation that drives me to dedicate my future to studying Robotics.

Lastly, supervised by Prof. Li-Chen, Fu, who devoted his life to Taiwan's Robotics research and education. I feel very thankful and regard him as my target. I want to become influential in my expertise someday, not just in Taiwan, but also make the world better with ROBOTs.

4. **Team C.K. Robotics' Youth Mentor** - at Chien Kuo High School, Feb. 2022-Present

In the school, I led high school students to fabricate and optimize the FRC Robot, which performed the assigned mission in the FRC games. We also achieved the regional final in the First Robotics Competition in Sacramento, California. In the US, I witnessed the difference between their high school students and ours. I think they're more practical than us, and I hope one day via education, I can also have an impact in the Robotics field in Taiwan.

Finally, it's a great honor to join the best boy's high school in Taiwan and lead them to the international stage for the team that has only been established for 3-4 years.

5. **2021 Taiwan TDK 25th Robocon UAV group** – at NTU, Jul. 2021- Dec. 2021

In the summer vacation of 2021, my classmate invited me to attend that competition. We spent almost every day designing and testing our robot during the two-month vacation.

It is very difficult for the drone to fly automatically along the black line on the ground, if there's any derivation, the robot needs to adjust itself to follow the line. The second difficulty is recognizing different colors of light to determine when to stop or go. Although we do simulations then, the actual result is always different from what the simulations predicted. Thus, very dangerous, the robot might sprint because of overshooting.

At that time, my other teammates were responsible for controlling, and programming the robot. As for me, I designed the structure and layout of drones and communicated with manufacturers that we had some metal parts. Fortunately, we won the Championship in that competition. It's also an acknowledgment of our effort, and encouraged me to chase my robot dream.