My name is Lu Zhuoyi, an undergraduate studying Mechanical Engineering in Robotics and Mechatronics stream at NTU Singapore. My research interest mainly lies on Compliance Force Control in Manipulation and Locomotion for quadruped and bipedal robots.

With a growing fascination for motor dynamics and robot kinematics, I approached Prof. Domenico and secured a research intern role at the Robotics Research Centre at NTU. My first research focused on exploring the electromechanical model of a series-elastic actuator using "HEBI motor". Using the MATLAB API, I modified code to design experiments for estimating motor dynamics. After extensive experiments, I discovered discrepancies between the estimated parameters and those in the datasheet, which prompted me to reflect on experimental errors, motor aging phenomena, and related factors.
Under the guidance of PhD student Yang Lin, I began reading *Modern Robotics* by Kevin M. Lynch and Frank C. Park, which introduced me to new perspectives on robot kinematics. Concepts such as homogeneous transformation matrices, velocity kinematics, and force control greatly enriched my understanding. Building on my prior knowledge, I was motivated to construct a planar dual-arm and a 6-DOF robotic arm using HEBI motors to test impedance control under Lin's supervision. The concept of a spring and damper attached to the end-effector, producing force in Cartesian space due to positional changes relative to the end-effector frame, made impedance control an ideal strategy for rigid environments. We characterized changes in end-point position using joystick inputs by Teleoperation, and mapped Cartesian forces calculated by the impedance algorithm to joint torques by Jacobian. The positive feedback from the robot's performance reinforced my enthusiasm for further studying robot kinematics and force control.

During my internship at Delta Electronics, I also gained practical experience with Linux OS and ROS1/2 for industrial robot control, specifically for an AGV base and a Unitree Go1 robot. Using ROS publisher/subscriber and service/client frameworks, I was able to send velocity and orientation commands to control the AGV's movement. Additionally, I learned to construct a 3D map using a 3D Lidar and to build and refine its 2D map. I am eager to further learn the Nav2 package to explore the AGV's navigation capabilities in the 2D map.
Can compliance control strategies be applied not only to manipulation but also to provide robust control for the locomotion of Quadruple/Bipedal robot for challenging terrain? This curiosity led me to investigate research such as "Quadruped-Frog: Rapid Online Optimization of Continuous Quadruped Jumping." Through Gazebo simulations using the "Unitree guide," I successfully implemented a virtual spring-damper system—attached between the hip and foot of each robot leg—to enable upward jumping. With further study on Optimal Control and sim-to-real gap, I hope I can implement the jumping motion in the real world.

The **Department of Computer Science** in George R. Brown School of Engineering and Computing at Rice University is renowned for its robotics research and cutting-edge expertise. I am particularly interested in **Prof. Kaiyu Hang**'s work on robust object manipulation and looking forward to join **RobotΠ Lab.** Participating in the Summer Research at RobotΠ Lab will allow me to delve deeper into manipulation and while preparing for my future graduate studies in Rice. I am confident that my strong academic background, diverse research experiences, and passion for robotics make me well-prepared to contribute to the lab and thrive in this extraordinary

opportunity.