# Introduction

Quadrupedal robots or legged robots research is a popular research direction in the field of Robotics. Characterized by their animal-like figure, quadrupedal robots are considered to have excellent talent of traversing challenging environments, such as stairs, rocky terrain, and cluttered spaces. In contrast to wheeled robots, which are typically constrained to pre-designed, artificial and predominantly level terrains, legged robots demonstrate greater adaptability, enabling their deployment in intricate and high-risk environments. This applications encompass tasks such as research and rescuemissions, military operations and exploration of challenging and uneven terrains.

However, unlike directions such as Unmanned Arieal Vehicle (UAV), robot manipulators or wheeled robots whose robot dynamic model and control algorithms have reached a nearly SOTA extend, legged robots are still facing challenges coming from complex dynamic model and control, which greatly limits the development of legged robot’s traversability. Furthermore, wheeled robots or manipulators have established a mature industrial market, whereas there is still a large gap for legged robots to realize commercialization for practical use, due to several technical limits such as battery life, manufacturing costs, and versatility.

Characterized by the advantage of learning complex control policy in an End-to-End way, Deep Reinforcement Learning method holds the promise in training legged robots and have been used successfully in various research and application domains. Besides, Deep RL method gain several advantages over conventional control methods (such as MPC). After training, robots can show their stronger ability in generating complex locomotion patterns (walking, running, crawling…) and a good performance while generalizing to different tasks and situations.

The primary objective of this research project is to enhance the traversability of legged robots when operating in challenging terrains. Specifically, I seek to accomplish this goal through the implementation of Deep Reinforcement Learning on a lightweight legged robot platform known as DOGZILLA. Furthermore, the training and learning of control policy obeys a“Sim-to-Real” idea. The idea is implemented by firstly training and testing algorithms in a simulation environment. When control policy or ability reached a satisfying level, it will be transferred to real robot and conduct real-world testing. In this way we can assure the training safety and improve learning efficiency.

This paper is structured into the following sections: Section 2 provides a review of related literature, Section 3 presents the research methodology, Section 4 discusses the findings, and Section 5 offers conclusions and recommendations.

**Background / Related Works**

**Requirements Analysis or Research Methodology**