

1 Introduction

Effective identification of traversable terrain is essential to operate mobile robots in the environment. Today, there are two main different approaches used today in the industry to correctly move a robot in a new environment: online and offline. The first one uses local sensors to map new surroundings while the second equips the mobile robot with an already labeled map of the terrain.

In most indoor scenarios, specific hardware such as infrared or LIDAR sensors is used to perform online mapping while the robot is exploring for the first time. This is the case of most vacuum cleaners.

Indoor scenarios share similar features across different places shifting the problem from which ground can be traversable to which obstacle must be avoided. For example, the floor is always flat without any bumps or holes due to its artificial design. Usually, traversability must be estimated on the fly due to the high number of possible obstacles and to the layout of the objects in each room may not be persistent in time.

On the other hand, outdoor scenarios may have less artificial obstacles but they have a homogeneous ground making it challenging to estimate where the robot can properly travel. Moreover, a given patch may not be traversable by all directions due to the non-uniform features of the terrain. But, a map of the ground can be obtained easily by using third-party services such as Google Maps or mapped with a flying drone.

These two different scenarios have different challenges. Usually, in control environments such as indoor it is easier to move the robot on the ground but harder to perform obstacle avoidance while in outdoor scenarios it is hard to first estimate where the robot is able to move. Furthermore, data gathering may not be straightforward. In indoor terrain, data is collected most of the times by driving the robot in the environment by a human or an artificial controller. While in the outdoor scenario the data is usually gathered using simulations since it is faster.

Our approach aims to estimate traversability on uneven ground, mostly outdoor scenarios. Our framework has two main phases, we first run different simulations by spawning the robot on custom created maps with different ground configurations, walls, bumps, and slopes. We record the robot pose at each time, then we crop a patch from the height map used in each run such that it included the robot in the center and its footprint for a selected minimum advancement. This value is calculated by observing the advancement of the given robot on flat ground and taking its half. So, each patch contains the current robot position on the map and the future position in the future if the robot will move at the selected value. To create the dataset for the classifier, we label each patch using the selected minimum advancement.

The report is organized as follows, the next chapter introduces the related work, Chapter 2 describes our approach, Chapter 3 talks in depth about the implementation details, Chapter 4 shows the results and Chapter 5 discusses conclusion and future work.