

# TRAVERSABILITY LEARNING FROM AERIAL IMAGES WITH FULLY CONVOLUTIONAL NEURAL NETWORKS

Carlos David Braga Borges, NULL, Jarbas Joaci de Mesquita Sá Junior

A traversability map is a simple way to distinguish traversable from non-traversable terrain and apply this knowledge to navigation strategies for robots. Traversability is a quantification of how much a given region is suitable to be crossed by a moving robot or vehicle. This concept was widely applied in robot planning tasks and researchers used a wide range of sensing devices and methods to estimate traversability maps from the ground level. With a rise in the popularity of low cost multirotor drones and the increased availability of high resolution satellite imagery, an idea was proposed to improve robot navigation: using aerial images to add long range planning capabilities to ground robots. This idea was explored by other researchers, who developed a number of methods to estimate traversability maps were developed with varied inputs and computation approaches. With regard to input data, some of the presented methods are based on depth information, while others use two-dimensional aerial images or a combination of both. Concerning the traversability computation approaches, two main categories can be identified: some works use heuristics, while others employ terrain classification combined with fixed traversability costs for each class. However, classification is computationally expensive if executed over all sub-regions of an image. On the other hand, using only handcrafted heuristics disregards the possible advantage of discovering hidden structures in image data via machine learning. This work proposes a supervised learning approach to compute traversabilities from raw image data. We replace the heuristic based sub-region computations with end-to-end traversability estimation based on a fully convolutional neural network and analyze the technical features of this approach relative to other methods. Our experiments yield evidence that the proposed model can generate traversability maps faster while also providing lower error outputs.

Palavras-chave: traversability, mapping, convolutional neural networks, aerial images, ground robot, path planning.