Topological Map Extraction for Path Planning in Robotic-Aided Farming

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ABSTRAK

Abstract: The penetration of robots in traditional agriculture is still a challenging task. When it comes to performing tasks such as spraying crops on a field, there is a need for initial maps commonly obtained from the first robot visit, performing new path planning, or GPS-assisted, but accuracy is slack in precision farming. Choosing to use satellite topology maps for ground spray robots is a challenge in itself. This work proposes a new approach— DALSatPath —to independently extract the robot movement flow plan from satellite imagery. This preliminary map is used by the robot on its first visit, reducing the need for human intervention and making the path planning algorithm more efficient. DALSatPath consists of two stages: detecting chili farm rows and extracting topological maps. For the detection of mounds of chili plantations, we use a traditional approach based on conventional machine learning techniques by considering Deep Action Learning with features based on Local Binary Patterns. After the local binary pattern is obtained, the robot's motion points are determined, including the direction of the arcs. From detecting rows of chili plantations, we extracted a map grid by considering advanced image processing techniques and the concept of Voronoi diagrams and obtained a topological map along with the nodes of the distance of the robot movement. Our results show an overall accuracy higher than 87% for detecting chili orchards and accessible paths for robotic navigation. Deep Action Learning (DAL) based approach shows the best performance in terms of precision and light computing resources. The DALSatPath-bridge demonstrates a relevant contribution to simplifying the application of robots in agriculture.

Kata Kunci: *automated guided robot, chili farming, deep learning; path planning, deep reinforcement learn-ing, SOM*