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C0370 DESIGN AND DEVELOPMENT OF A ROBOTIC PLATFORM FOR THE EVALUATION OF SEARCH ALGORITHMS

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1 Keywords

Disease-control, Crop-production, Search-algorithms, Robotics, Odour-sensing,

2 Introduction

Plant diseases represent a major economic and environmental problem in agriculture and forestry. Upon infection, a plant develops symptoms that affect different parts of the plant causing a significant agronomic impact. As many such diseases spread in time over the whole crop, a system for early disease detection can aid to mitigate the losses produced by the plant diseases and can further prevent their spread [1]. In recent years, several mathematical algorithms of search have been proposed [2,3] that could be used as a non-invasive, fast, reliable and cost-effective methods to localize in space infectious focus by detecting changes in the profile of volatile organic compounds. Tracking scents and locating odor sources is a major challenge in robotics, on one hand because odour plumes consists of non-uniform intermittent odour patches dispersed by the wind and on the other hand because of the lack of precise and reliable odour sensors. Notwithstanding, we have develop a simple robotic platform to study the robustness and effectiveness of different search algorithms [4], with respect to specific problems to be found in their further application in agriculture, namely errors committed in the motion and sensing and to the existence of spatial constraints due to land topology or the presence of obstacles.

3 Material and Methods

An indoor robotic platform has been fully develop with the NXT Lego Mindstorm set and programmed with Java as a scale prototype for future developments. It consists of two motors controlling navigation plus an optical sensor. To overcome the technological limitations of electronic noses the search is done by means of optical detections. We evaluate two search algorithms anemotactic active search [2] and infotaxis [3]. The concentration field of odour molecules is simulated in silico and visually projected from above on the area in which the robot moves. The algorithms have been programmed in fortran 90 and communicate with the robot through a blue-tooth channel.

4 Results/Conclusions

We have found that while infotaxis remains a robust algorithm against errors, under wind conditions anemotaxis yield shorter mean search times and is less sensitive to errors in the robot position. Spatial constraints make both algorithms to fail. However, our studies identify possible modifications in the original algorithms that may solve the limitations. Finally the sensible parts of the robotic platform producing the larger errors were also identified.

5 Acknowledgements/References

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