

令和4年度 環境科学院 修士論文内容の要旨

An investigation of drone applications to support small-scale agriculture

(小規模農業を支援するためのドローン活用の検討)

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ABSTRACT

For continued stability and improved quality of life on earth, we should strive for agriculture that is sustainable and meets the demand for food around the world. Thus, the UN Sustainable Development Goals recognise the need to improve agriculture productivity and sustainability not only in large scale commercial agriculture, but also in small-scale agriculture in developing regions around the world. These targets of improved productivity and sustainability may be realised by adopting recent technologies and techniques in agriculture, such as 'Precision Agriculture', or 'Smart Farming'. One such tool that is currently gaining traction is the use of unmanned aerial vehicles, or drones to support agriculture activities. Currently the adoption of drones in developing countries with small-scale farmers is slow. To allow for more widespread adoption, drone agriculture technologies should become more affordable, and techniques should be developed in which drones can add value for small-scale farmers. New research should focus on identifying and developing techniques for using drones in small-scale and low-cost agriculture. In this thesis research, different applications of drones remote sensing for agriculture were compiled from literature, and techniques that may be appropriate for small-scale farming sector were identified. The specific applications were then evaluated by applying the method to experimental data collected by drone field surveys at a farm in Hokkaido. The practical steps followed to implement techniques, obtained results, and scope for future research is discussed for the individual topics. This approach is intended to support and promote further research in the topics necessary to make drone agriculture more accessible to the low-cost agriculture sector. The topics discussed are (1) The use of Open-Source software for drone photogrammetry; (2) Plant-background semantic segmentation of drone imagery; (3) Using drone to estimate fertiliser requirements in rice paddy; (4) A comparison of low-cost conventional camera with high-cost multispectral camera for monitoring crops; and (5) The use of drones in agricultural demonstration or trial plots. Accompanying the manuscript is a number of hands-on tutorials and developed code that can be adopted to assist with capacity development initiatives for drone agriculture research.