A Study on the Path Planning Algorithm for AI-Based Optimal Flowing Into ridges in Soybean Cultivation in Paddy Fields

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Abstract

Recently, policy projects to improve soybean self-sufficiency are being actively promoted in Korea. According to data from the National Statistical Office, the soybean cultivation area in Korea increased by 33.6% from 50,638ha in 2018 to 67,671ha in 2023, and the self-sufficiency rate also increased from 25.3% to 34.7%. In particular, the soybean cultivation rate in paddy fields is showing a remarkable increase, more than tripling from 7% in 2010 to 22% in 2024. As of 2024, the soybean cultivation area of Jeollabuk-do is the highest in the country at 19,956ha, of which 66% is grown as soybean in paddy fields. However, soybean cultivation in paddy fields frequently causes flooding damage due to drainage problems, and it is necessary to respond to this. In this study, we present the development status of AI-based agricultural work path planning algorithms for soybean cultivation optimization in paddy fields being carried out by JonbukState. Drones and sensors are used to secure spatial data such as high-precision boundary measurements and slopes for unstructured agricultural land, Based on this, an AI model was developed to create an optimal ridge length path plan for improving training conditions and maximizing yield.An end-to-end AI model was designed that collects RGB images using RTK drones at 20m above the sky and detects drainage channels through preprocessing processes such as image augmentation. As a result of model learning and verification in the test field, the following error within 7 cm during work was confirmed through an autonomous driving-based head-forming agricultural work map algorithm. In the future, by securing various types of unstructured agricultural land data and improving the speed of path planning generation, the algorithm is advanced, and the connection with autonomous driving systems is strengthened, suggesting the possibility of development from paddy fields into a practical platform that can realize practical reduction of flooding damage, labor reduction, and yield increase in soybean cultivation.

Keywords: Soybean, AI, Path Panning, autonomous driving system