



Research article

A deep learning approach based on graphs to detect plantation lines

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ABSTRACT

Identifying plantation lines in aerial images of agricultural landscapes is required for many automatic farming processes. Deep learning-based networks are among the most prominent methods to learn such patterns and extract this type of information from diverse imagery conditions. However, even state-of-the-art methods may stumble in complex plantation patterns. Here, we propose a deep learning approach based on graphs to detect plantation lines in UAV-based RGB imagery, presenting a challenging scenario containing spaced plants. The first module of our method extracts a feature map throughout the backbone, which consists of the initial layers of the VGG16. This feature map is used as an input to the Knowledge Estimation Module (KEM), organized in three concatenated branches for detecting 1) the plant positions, 2) the plantation lines, and 3) the displacement vectors between the plants. A graph modeling is applied considering each plant position on the image as vertices, and edges are formed between two vertices (i.e. plants). Finally, the edge is classified as pertaining to a certain plantation line based on three probabilities (higher than 0.5): i) in visual features obtained from the backbone; ii) a chance that the edge pixels belong to a line, from the KEM step; and iii) an alignment of the displacement vectors with the edge, also from the KEM step. Experiments were conducted initially in corn plantations with different growth stages and patterns with aerial RGB imagery to present

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