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Immature Palm Tree Detection Using Morphological Filter for Palm Counting with High Resolution Satellite Image

Authors : Nur Nadhirah Rusyda Rosnan, Nursuhaili Najwa Masrol, Nurul Fatiha MD Nor, Mohammad Zafrullah Mohammad Salim, Sim Choon Cheak

Abstract : Accurate inventories of oil palm planted areas are crucial for plantation management as this would impact the overall economy and production of oil. One of the technological advancements in the oil palm industry is semi-automated palm counting, which is replacing conventional manual palm counting via digitizing aerial imagery. Most of the semi-automated palm counting method that has been developed was limited to mature palms due to their ideal canopy size represented by satellite image. Therefore, immature palms were often left out since the size of the canopy is barely visible from satellite images. In this paper, an approach using a morphological filter and high-resolution satellite image is proposed to detect immature palm trees. This approach makes it possible to count the number of immature oil palm trees. The method begins with an erosion filter with an appropriate window size of 3m onto the high-resolution satellite image. The eroded image was further segmented using watershed segmentation to delineate immature palm tree regions. Then, local minimum detection was used because it is hypothesized that immature oil palm trees are located at the local minimum within an oil palm field setting in a grayscale image. The detection points generated from the local minimum are displaced to the center of the immature oil palm region and thinned. Only one detection point is left that represents a tree. The performance of the proposed method was evaluated on three subsets with slopes ranging from 0 to 20° and different planting designs, i.e., straight and terrace. The proposed method was able to achieve up to more than 90% accuracy when compared with the ground truth, with an overall F-measure score of up to 0.91.

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