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GEO-REFERENCING CROP LABELS FROM STREET-LEVEL IMAGES USING STRUCTURE FROM MOTION

Abstract

Ground-truth labels on crop locations are critically needed to develop machine learning models to accurately identify croplands on satellite imagery for rural planning and combating food insecurity. The process of generating large quantities of crop labels from the field is challenging and financially prohibitive, especially in Sub-Saharan Africa where the majority of the fields are small and difficult to access. The NASA Harvest Street2Sat framework tackles this by labeling street-level images taken with vehicle-mounted cameras. This paper proposes a method of georeferencing these labels through estimation of depth from camera location to crops. The method is based on Structure from Motion (SfM) theory, which entails the use of Feature Extractors (FEs), on street-level images, within bounding boxes overlaid on crops, and Feature Matchers (FMs) on consecutive image pairs. Thereafter, the estimation of crop distances from camera location is performed using triangulation. The GPS label location is then updated to the crop position. This study also evaluates the accuracy of various FEs and FMs on crop fields. With such automation of crop location labeling, vast quantities of street-level image data can be easily processed, making the approach highly scalable. Using preliminary street level image data from Kenya and Uganda, we show promising results of distance estimation to crops in roadside images. With further optimization, this method can be implemented in at least four other countries where data is being collected with the same approach.