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Identification of Palmer Amaranth in Cotton Utilizing Deep Learning

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Abstract

Increased integration of technology into the agricultural industry has opened vast new opportunities for problem solving and has further pushed the boundaries on what is possible. With recent advancements in drone and camera technologies, the capabilities of unmanned aerial systems (UAS) has improved significantly. One of the advancements in drone technologies is the creation of UAS which carry agricultural product payloads, either in liquid or granular form, and have the precision to apply said payload in target areas. With the ability to selectively and remotely apply products to agricultural land, the need for the identification of the target or problematic areas has come to light. Palmer amaranth is a weed species that has developed increased resistance to many herbicidal modes of actions. Upland cotton, a major cash crop for the state of Georgia, is one of the crops which is affected by Palmer amaranth. Crop yield reductions caused by this weed can negatively affect the net profit a grower will see upon harvest. Utilizing new machine learning algorithms alongside UAS can help identify weed population hot spots within a cotton crop. The use of the YoloV5x classification algorithm trains a computer to identify the weed within scouting images. With the ability to identify the weed, growers can improve on-farm sustainability and economics when applying treatments to neutralize the harmful weed. With the algorithm currently trained with a suboptimal dataset, 805 images split 85:15 between training and testing, current Palmer amaranth identification is up to 87% and mean average precision of 0.79. Additional images will be collected this season as to increase the algorithm's accuracy and train more robustly.

Keywords: Cotton, Machine Learning, Image Classification, Drone