# Utilizing Machine Learning to Develop Image-Based Agricultural Optimization Software

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Hydroponic farming is rapidly gaining popularity because of its consistency and sustainability. Thousands of hydroponic farms are being built around the world as reliable food sources to match the increasing demand for food. Hydroponic farms are able to grow sensitive crops quickly and efficiently, but emerging technologies are inconsistently integrated within hydroponic production. My goal was to find a way to integrate emerging deep-learning technologies within hydroponic production to give the hydroponic farmer useful information about their crops. First, I needed to collect data from hydroponic farms to use for deep learning. I used nine hydroponic farms to simulate nine different growing conditions to grow champion collards, georgia southern collards, romaine lettuce, buttercrunch lettuce, blue scotch curled kale, and premier kale. Every week, I measured the shoot length and took pictures of these plants. After six weeks, I uprooted the plants to measure the chlorophyll content of the leaves, shoot length, root length, wet shoot mass, wet root mass, dry shoot mass, and dry root mass of the plants. This data was used to train a deep-learning model that is able to accurately predict these characteristics of a plant from a picture of the plant. I found that deep-learning models can be created to assist hydroponic farmers by giving them useful information about their crops. Systems involving deep learning are vital to the future of agriculture to ensure the sustainability of hydroponic farming. These technologies can be easily integrated into mobile applications or automated systems to improve hydroponic farming practices.

**Awards Won:**

Fourth Award of $500