AI in Hydroponics

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The combination of Hydroponics and AI is a very hot topic. There are news articles, research papers, and startups popping up frequently in the last couple years. One huge thing that is missing is a reliable large dataset that can be used for training AIs.

The reason why AI and Hydroponics go together is obvious: hydroponics is a more efficient growing method than soil-based farming. It uses less land, less time, even less water, and it produces higher yields for many crops. Despite all of the possible advantages, hydroponics can fail horribly when things do go wrong. Because hydroponics is so efficient, with so many plants sharing a small space and a small amount of water, a small problem can turn into a big problem very easily. Because the same water flows past many plants, PH problems, disease, temperature variations, or low oxygen levels can quickly kill an entire crop. In my hydroponics setup, I use an electric air pump with air stones to add bubbles to the water to make sure my plants have enough oxygen. A power outage can drown all my plants within a few hours if the air stones stop bubbling, or the water stops circulating and the submerged roots can't get any oxygen.

Some hydroponics techniques (such as ebb and flow, or Nutrient Film Technique) deal with power outages better, but they all have to be equally cautious of PH, disease, and nutrient imbalance issues, and many of these variables don't have a single "best" value. Optimal nutrient concentrations change during the plants lifecycle. PH, lighting, and temperature requirements can vary based on plant and lifecycle as well. It is fun and exciting to monitor your plants 24/7 for the first few days after you start growing plants hydroponically, but once the novelty wears off it can be challenging to give your plants the attention they need to thrive.

Machine Learning and AI should make it possible to automatically handle many of the most common problems faced by hydroponics systems by responding quickly to unusual changes in any of the important variables (temperature, PH, oxygen levels, nutrient concentrations, etc.) as well as slowly changing the target values for these variables over time as plants mature (plant maturity could be detected by AI using images of the plants).

AI in Hydroponics makes so much sense that when I looked it up for the first time earlier this year, I was not surprised at all to see so many news articles on the topic, or to see how many startups have been funded based on it. I was surprised, however, to find there's no large publicly available datasets for Hydroponics. There are many guidelines written by experts in the field for home or commercial growers to follow, but not the sort of minute-to-minute data along with outcomes that can be used to train an AI. A team of teenagers in the TeensInAI Accelerator program (which encourages the next generation to tackle global problems using ethical AI) had to resort to simulated data to try building a proof-of-concept AI.

I was interested in building a Machine Learning model for my home garden, but a publicly available dataset would have much further impacts. Open source models and relatively cheap hardware would allow hydroponics growers everywhere to increase the efficiency, reliability, and safety of their crops. Startups dedicated to Hydroponics in AI could focus less of their budget on data collection, and more of their budget on the actual AI part of the problem (potentially leading to new and better models that can be applied to other problems as well). Worldwide, food prices and hunger could be reduced.

If you know of anyone working in this space or funding work in this space, please let me know! There's a real opportunity for a huge change.

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