**MIT-Palestine UROP project**

Project title:

**Deep Q-Networks for Automated Irrigation and Fertilization Control**

Palestine Faculty

Name, Department, Institution, email

MIT Faculty: Munther Dahleh, Mardavij Roozbehani, Institute for Data, Systems, and Society (IDSS), EECS, [Dahleh@mit.edu](mailto:Dahleh@mit.edu), [mardavij@mit.edu](mailto:mardavij@mit.edu)

**Overview**

Developing countries particularly in sub-Saharan Africa face a large gap in productivity and agricultural yield compared with western countries. While absence of advanced technology and machinery contribute to this gap, suboptimal agro-management practices are also important and need to be addressed. The current approach from governments in Africa to address this problem is investing in educational projects to teach farmers how to correctly use fertilizers. However, this strategy is fairly expensive and hard to scale because it relies on hiring experts. We propose to use existing and simulated data train a Deep Q-Network to learn automated policies for optimal decision making in irrigation and fertilization. Such decisions can be then tailored and specialized to a specific farm and crop based on the known parameters. This project builds on our previous work in which we built a reinforcement learning model that could learn how to provide daily agro-management recommendations based solely in information from the weather, training on simulated crop yields and policies that were generated using the WOFOST model (Van Diepen et al., 1989). In the next phase we aim at developing a model that can incorporate sensory feedback from the levels of nutrients and moisture in the soil. This is a particularly challenging learning problem because the reward (yield) evolves with a much slower dynamics compared to the rest of the system parameters, including moisture and nutrients. In addition, for practical purposes we are interested in developing simplified strategies that require infrequent and/or quantized action.

Start date: Flexible / ASAP

End date: ditto

Estimated hours per week: 10-15

Required student skillset: The project is for students with strong background in ML, Q-Learning, and Neural Networks. Python proficiency is required. Cloud computing skills and Interest in Agriculture are a plus.

How can the J-WEL project help? Computation capabilities for student in Palestine.

Contacts: Prof. Munther Dahleh (MIT), Mardavij Roozbehani (MIT)