Sustainable Crop Management with Deep Reinforcement Learning

DS251 Artificial Intelligence

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Problem Statement: *Modern Indian Agriculture is facing significant challenges. We need to move urgently towards Sustainable Agriculture Systems. Today's farmer needs an intelligent agricultural management system. We developed a fertilizer and crop recommendation system for different seasons and an RL chatBot to provide farmers effective solutions.*

Challenges for Modern Agriculture

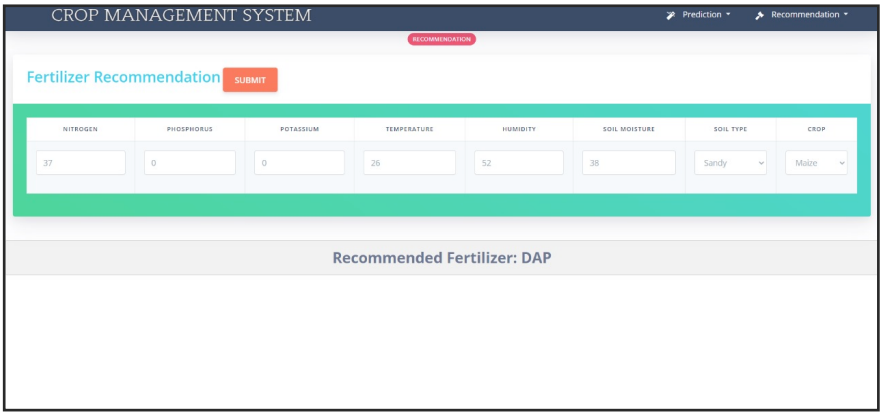
The agriculture sector of India has many challenges like climate change, water scarcity and soil degradation. We need to increase food production by 56% to feed 9.8 billion people by 2050 [1]. We need to shift towards sustainable agriculture systems urgently. By Integrating an Intelligent Crop Management System, we can increase productivity, optimise the resources and doubles the farmer's income.

Crop Management

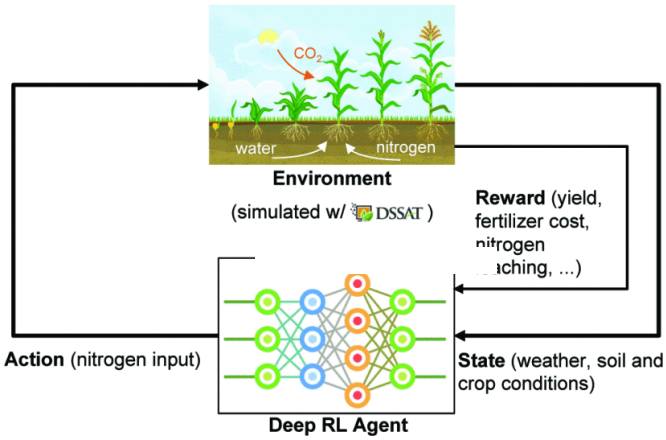
- Among different factors, crop management is a key controllable one influencing crop production, resource usage, and environmental impact.
  - Optimizing crop management is essential for sustainable agriculture.
- There are many management practices involved
  - Fertilization, irrigation, tillage, cover crops.
- Crop management is essentially a sequential decision making (SDM) problem.
  - A few decisions (e.g., when, which and how much to fertilize) need to be made sequentially across a period.
- Reinforcement learning (RL), has achieved remarkable performance on various SDM tasks in board games, video games, and robotic control.
- RL has great potential for optimizing crop management.

Fertilizer and Crop Recommendation System

Our fertilizer recommendation system takes input from users, Nitrogen, Phosphorus, Potassium, Temperature, Humidity, Soil moisture, Soil type and Crop, to prescribe optimal fertilizer types. Similarly, our crop recommendation system utilizes Nitrogen, Phosphoros, Potassium, Temperature, humidity, pH,



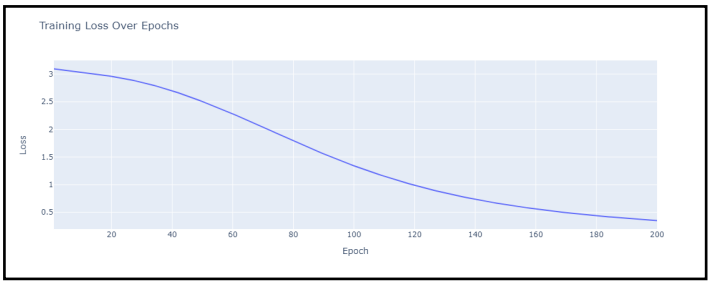
and rainfalls to advise farmers on crop selection.



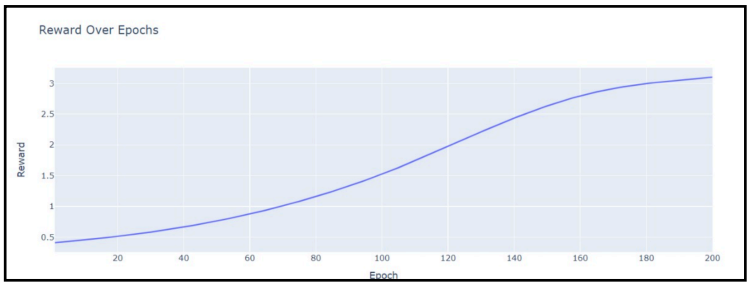
crop_yield = (18.48*(nitrogen_level * crop_params['nitrogen_slope']) +15.32*(phosphorous_level * crop_params['‘phosphorous_slope']) 14.98*(potassium_level * crop_params['‘potassium_slope’']))

Reward function

Results



Training Loss



Reward

Policy consistently converges within roughly 300 epochs.

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