Sustainable Crop management with Deep Reinforcement Learning

DS251 Artificial Intelligence

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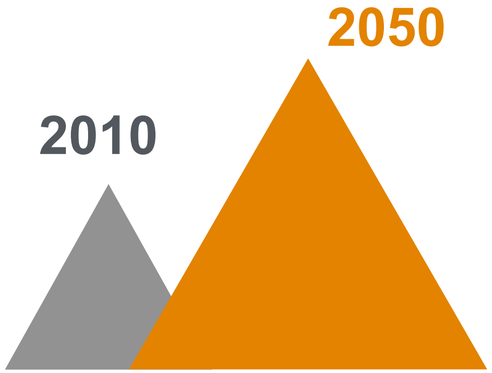
Challenges for Modern Agriculture

Problem faced by Indian Agriculture

Food Gap



56% Required increase in food Production to feed 9.8 billion people by 2050 [1]

Water Shortage

Source: earth.org

Irregular Monsoon

Source: business-standard.com

We need to move urgently towards Sustainable Agriculture Systems.

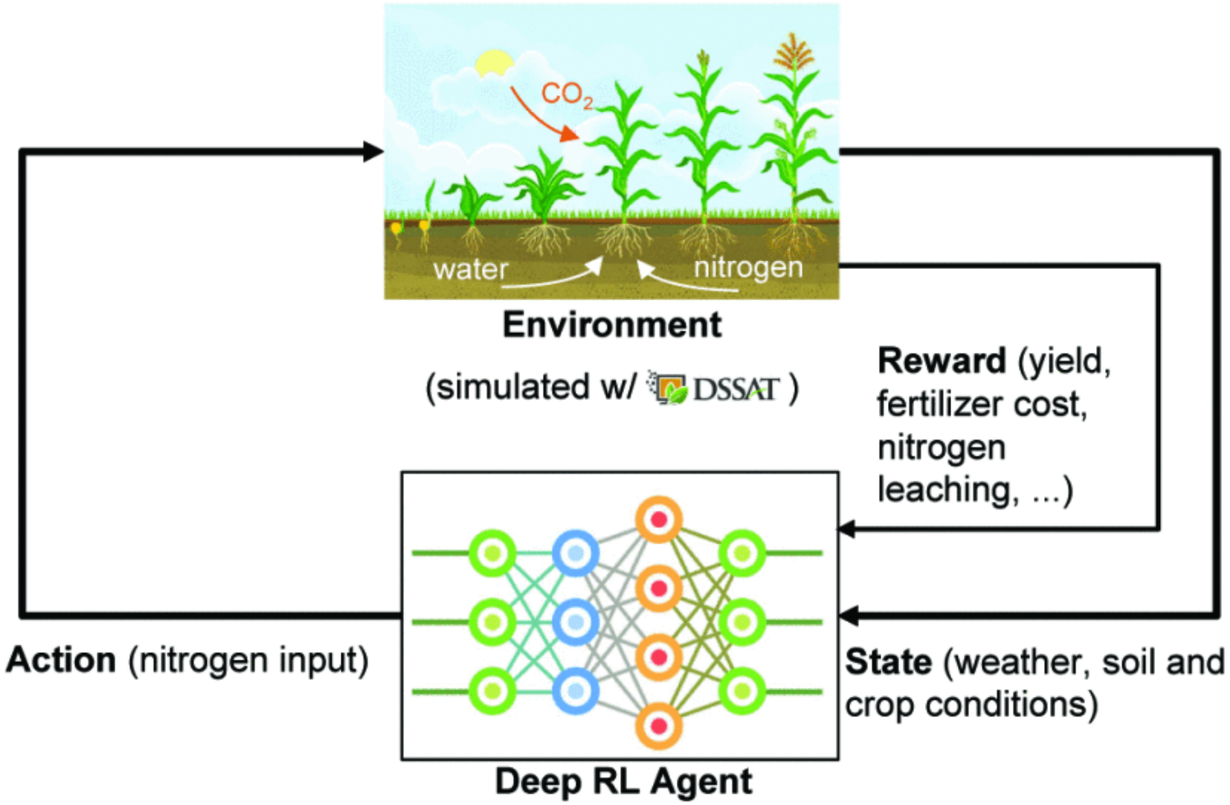
[1] CREATING A SUSTAINABLE FOOD FUTURE https://research.wri.org/wrr-food

Introduction

Towards an intelligent agricultural management system, we can use :

- ➢ Recommendation of Crop Fertilizer as a finite Markov decision process (MDP) problem
- ➢ Recommendation of Crop for different Season by Bellman equation .
- ➢ Optimize management policies using deep reinforcement learning (RL)
  - Policy training with deep Q-network (DQN)
  - Multiple Design of Reward functions

Overall framework



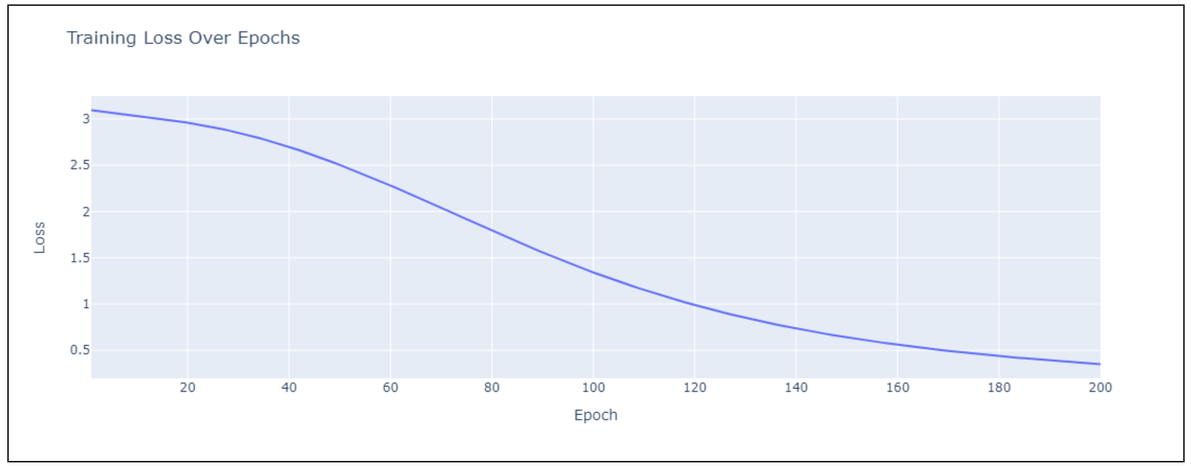
Method

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’]))*

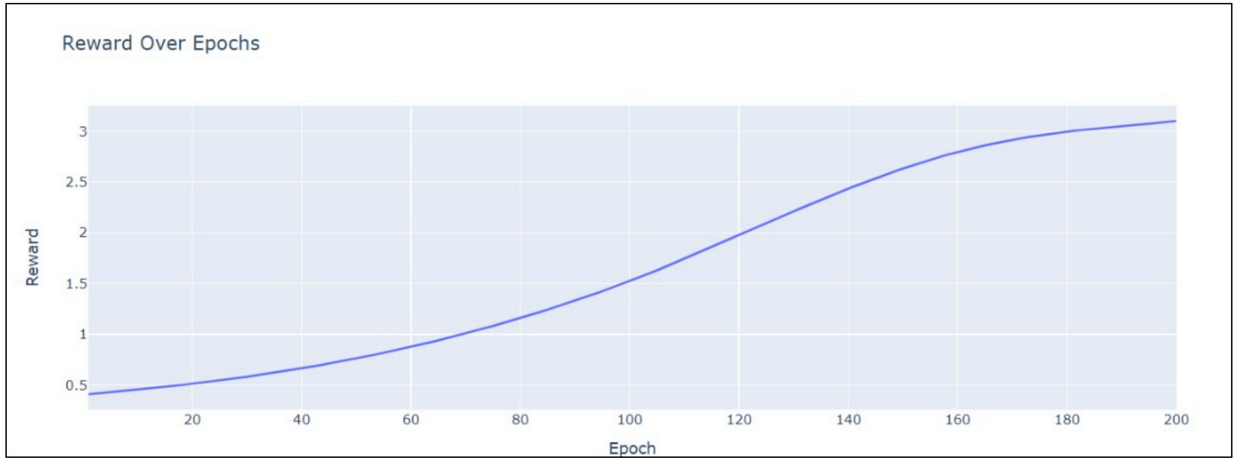
Reward function

Results

Training Loss



Reward



Policy consistently converges within roughly 300 epochs.

Future Steps

- We want To develop a Crop simulator and want to make different policies, to plan the time of giving fertilizer and maximize the yield.
- We replicate this for Irrigation, how much and When to give water to plant to maximize it.

Thank you!