DeepReinforcement Learning-DeepRecurrentQ-Networkmodel-CropYieldPredictionUsingModelforSustainable Agri related Applications

ABSTRACT

Machine learning has emerged with big data technologies and high-performance computing to create new opportunities for data intensive science in the multi-disciplinary agri-technologies domain.Predictingcropyieldbasedontheenvironmental,soil,waterandcropparametershasbeena potential research area. Deep-learning-based models are broadly used to extract significant crop features for prediction. Though these methods could resolve the yield prediction problem there exist the following inadequacies: Unable to create a direct non-linear or linear mapping between the raw data and crop yield values; and the performance of those models highly relies on the quality of the extracted features.

Deep reinforcementlearningprovidesdirectionandmotivationfortheaforementionedshortcomings.Combining theintelligenceofreinforcementlearninganddeeplearning,deepreinforcementlearningbuildsacomplete cropyieldpredictionframeworkthatcanmaptherawdatatothecroppredictionvalues.Theproposedwork constructsaDeepRecurrentQ-NetworkmodelwhichisaRecurrentNeuralNetworkdeeplearningalgorithm over the Q-Learning reinforcement learning algorithm to forecast the crop yield.

The sequentially stacked layers of Recurrent Neural network is fed by the data parameters. The Q-learning network constructs a crop yield prediction environment based on the input parameters. A linear layer maps the RecurrentNeural Network output values to the Q-values. The reinforcement learning agent incorporates a combination of parametric features with the threshold that assist in predicting crop yield. Finally, the agent receives an aggregate score for the actions performed by minimizing the error and maximizing the forecast accuracy. The proposed model efficiently predicts the crop yield outperforming existing models by preserving the original data distribution with an more accuracy.

KEY WORDS-Machine learning,Crop yield prediction, deep recurrent Q-network, deep reinforcement learning, agri-application