Meta-Learning for Monitoring Environment Systems Across the Globe

Shridhar Vashishtha
PhD student mentor: Arvind Renganathan
Faculty mentor: Vipin Kumar

Intro/abstract

- Data sparsity is a key challenge in monitoring climate because of the lack of quality data, problems in sensors, lack of historical data, or financial constraints in certain parts of the world.
- Motivation is to implement a meta-learning model that could be used to monitor environment systems across globe for multimodal carbon flux datasets.
- Mutlitmodal Model-Agnostic Meta-Learning model will provide a good model for monitoring environmental systems.

Multimodal Model-Agnostic Meta-Learning: MMAML

- Two complementary neural networks which are used together to make the model.
- First, a modulation network is implemented.
- Then, a modulated task network is adapted to target tasks.

Experimental Results: FLUXNET

- MMAML outperforms the primary baseline, Nathaniel and Liu and Gentine et al.https://doi.org/10.1038/s41597-023-02349-y, by a substantial margin for GPP flux prediction.
- The baseline model's RMSE is 3.25 which is substantially wose than any of the RMSEs from MMAML for the following few-shot years.

ARCHITECTURE	Data used for Meta Update (in Months)			
	1	3	12	24
MMAML	2.91	2.71	2.23	1.98

Mean Ensemble Root Mean Square Error (RMSE) for GPP prediction flux tower dataset

Conclusion

- MMAML performed substantially better than the baseline model. .
- MMAML can also be used in other domains such as ecology and agriculture..

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