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Learning to Learn Ahead: Parameter Forecasting in Neural Networks for the Prediction of Remote Sensing Observations

The growing volume and frequency of streaming remote sensing data present challenges for real-time modeling and forecasting. Traditional batch learning is unsuitable for such dynamic environments, while standard online learning frameworks, though more adaptive, face key limitations. These include one-step-ahead forecasting, prediction latency due to retraining dependencies, and vulnerability to huge shifts in data distribution over time. To address these issues, we propose a novel framework that models the evolution of neural network parameters in relation to specific predictor variables. Our method trains an initial CNN on historical data, captures successive model weight snapshots during online updates, and applies an ML algorithm (e.g., Polynomial Regression) to forecast future parameter states. A new model instantiated with these forecasted weights can predict future data without waiting for retraining. This approach enables multi-horizon prediction, eliminates retraining delays, and, most importantly, is more robust to shifts in distribution. Experiments were conducted on the AMOC (Atlantic Meridional Overturning Circulation) collapse dataset to validate the performance of our model and compare it with traditional batch learning techniques.

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