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Geomagnetic Forecasting with Neural Networks

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Geomagnetic storms, resulting from solar activity, pose significant risks to satellite operations, communication systems, and power grids. Accurate forecasting of these storms is crucial for mitigating their impacts. As the final project in the course “Applied Machine Learning” at the University of Copenhagen, we explore the application of convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to forecast geomagnetic storms using satellite image data from the Solar Dynamics Observatory (SDO). By leveraging solar images capturing phenomena such as solar flares and coronal mass ejections (CMEs) in the 171Å band, our neural network models are trained to identify patterns and temporal sequences indicative of the geomagnetic activity. Preliminary results demonstrate that the neural networks work well for geomagnetic forecasting on short timescales. Future work should focus on extending the models for predictions further into the future and perhaps also more specifically optimizing the models for geomagnetic storm prediction, if this is desired.

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