Jihyeon
Son
Korea Astronomy and Space Science Institute, South Korea
Yong-Jae Moon, Kyung Hee University, South Korea
Young-Sil Kwak, Korea Astronomy and Space Science Institute, South Korea / University of Science and Technology, South Korea
Poster
We have developed two deep learning models to forecast two space weather components: 3-day solar wind speeds and 6-hour interplanetary magnetic field (IMF) Bz components. Firstly, the solar wind speed prediction model uses the last five days of SDO/AIA 19.3 and 21.1 nm images, along with solar wind speeds as input data. It consists of two networks: a convolutional layer-based network for images and a dense layer-based network for solar wind speeds. Our model successfully predicts solar wind speeds for the next 3 days, with a root mean square error (RMSE) ranging from 37.4 km/s (6-hour prediction) to 68.2 km/s (72-hour prediction). These results are much better than those of previous studies. The model can accurately predict sudden increases in solar wind speeds caused by equatorial coronal holes. Secondly, the Bz prediction model is a bidirectional long short-term memory (BiLSTM) based model using solar wind data (V, N, T) and IMF (Bt, Bx, By, Bz) in OMNI from 2000 to 2022 as input data. We use the preceding 12 hours of data as input and the next 6 hours of data as target data. We consider Bz values below the negative standard deviation (about -3 nT) for at least 6 hours. We apply 12-fold cross-validation to our model, using 8 months for training sets and 4 months for test sets. Consequently, a total of 12 models are trained, and they show an averaged RMSE ranging from 1.75 nT (30-minute prediction) to 2.55 nT (6-hour prediction). Our model can capture both declining and increasing phases of Bz. Although this study presents preliminary results in Bz prediction, we find a sufficient possibility for predicting Bz under specific conditions. We plan to develop deep learning models for other space weather components, such as solar wind density or geomagnetic indices.
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