R010-04
A 会場 ：9/24　PM1 （13:45-15:30）
14:30〜14:45

#藤谷　壮 [1)], 飯田　佑輔 [1)]
([1] 新潟大学大学院 自然科学研究科

Development of a coronal hole detection method from extreme ultraviolet images using deep learning

#So Fujiya[1)],Yusuke Iida[1)]
([1]Graduate School of Science and Technology, Niigata University

Coronal holes are regions of open magnetic fields which observed as dark areas in the solar corona because of their low density and temperature compared to other coronas. They are the source of high-speed solar wind streams, whose interaction with Earth's magnetosphere causes geomagnetic storms. In recent years, coronal hole detection methods based on deep learning has been reported by several researches, and detection results are expected to be more accurate than conventional detection methods with image processing technique. On the other hand, although the significant correlation between the coronal hole area and the solar wind parameter has been reported, the model accuracy for coronal hole detection has not been directly evaluated. In this study, we developed a coronal hole detection method using machine learning, evaluated, and improved it focusing on the area of coronal holes.

We developed a coronal hole detection model using U-Net, a semantic segmentation model that classifies each pixel to the defined categories. The detection model uses the full-disk EUV images from SDO/AIA as input, and classifies each pixels whether it is a coronal hole. We used 754 images of three types in the 171 angstrom, 193 angstrom, and 211 angstrom waveband for about two years. Also, we used the coronal hole identification via multi-thermal emission recognition algorithm (CHIMERA ; Garton et al., 2017) to create class labels in ground-truth data. CHIMERA analyses multi-thermal images from the AIA/SDO to detect coronal holes with image processing by their intensity ratio across three passbands, e.g. 171 angstrom, 193 angstrom, and 211 angstrom.

We achieved F-score=0.859 and IoU=0.759 for coronal hole detection using U-Net. In addition, we evaluated using RMSE to compare the area of each coronal hole in the predicted images and the label images, as a result, we achieved RMSE=1098.0[pixel]. In the next experiment, we focused on the normalization method for input data to improve the accuracy of coronal hole detection. Finally, we achieved F-score=0.881, IoU=0.792 and RMSE=835.1[pixel] for coronal hole detection by changing to the normalization method using stretch function.