other channel images with relatively high CCs larger than 0.89. Our results show a possibility that if three channels from photosphere, chromosphere, and corona are selected, other multi-channel images could be generated by deep learning. We expect that this investigation will be a complementary tool to choose a few UV channels for future solar small and/or deep space missions.

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[구 SS-09] Denoising solar SDO/HMI magnetograms using Deep Learning

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In this study, we apply a deep learning model to denoising solar magnetograms. For this, we design a model based on conditional generative adversarial network, which is one of the deep learning algorithms, for the image-to-image translation from a single magnetogram to a denoised magnetogram. For the single magnetogram, we use SDO/HMI line-of-sight magnetograms at the center of solar disk. For the denoised magnetogram, we make 21-frame-stacked magnetograms at the center of solar disk considering solar rotation. We train a model using 7004 paris of the single and denoised magnetograms from 2013 January to 2013 October and test the model using 1432 pairs from 2013 November to 2013 December. Our results from this study are as follows. First, our model successfully denoise SDO/HMI magnetograms and the denoised magnetograms from our model are similar to the stacked magnetograms. Second, the average pixel-to-pixel correlation coefficient value between denoised magnetograms from our model and stacked magnetogrmas is larger than 0.93. Third, the average noise level of denoised magnetograms from our model is greatly reduced from 10.29 G to 3.89 G, and it is consistent with or smaller than that of stacked magnetograms 4.11 G. Our results can be applied to many scientific field in which the integration of many frames are used to improve the signal-to-noise ratio.

[구 SS-10] Solar Rotational Tomography Using the Filtered Backprojection Algorithm

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Tomography is a method to reconstruct three-dimensional structure of an optically thin object. We can obtain the three-dimensional information by combining a number of projected images at different angles. Solar rotational tomography (SRT) is the tomographic method to estimate the coronal structures using the solar rotation. There are a few practical difficulties in solar coronal observation. One of the most crucial difficulty is handling the blocking area by the occulter or the Sun itself. So we have to use the iterative reconstruction for the SRT which can resolve that problem by using the forward modeling. In this study, we propose an alternative method to reconstruct the solar coronal structure: the filtered backprojection (FBP) algorithm. The FBP algorithm is based on the simple analytic solution. Thus it is easy to understand, and the computing cost is much cheaper than that of the iterative reconstruction. Recently we found a solution for the FBP algorithm to the problem of the blocking area in the solar EUV observations. We introduce how to apply the FBP algorithm to the SRT, and show the initial results of the performance test.

[구 SS-11] Mass estimation of halo CMEs using synthetic CMEs based on a full ice-cream cone model

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A coronal mass ejection (CME) mass is generally estimated by the total brightness measured from white-light coronagraph observations. The total brightness are determined from the integration of the Thomson scattering by free electrons of solar corona along the line of sight. It is difficult to estimate the masses of halo CMEs due to the projection effect. To solve this issue, we construct a synthetic halo CME with a power-law density distribution ($\rho = \rho_0 r^{-3}$) based on a full ice-cream cone model using SOHO/LASCO C3 observations. Then we compute a conversion factor from observed CME mass to CME mass for each CME. The final CME mass is determined as their average value of several CME masses above 10 solar radii. Our preliminary analysis for six CMEs show that their CME mass are well determined within the mean absolute relative error in the range of 4 to 15 %.
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