Time series prediction of cloud cover using whole-sky images and meteorological elements

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Prediction of the sky conditions is becoming important in several sectors of society. The most typical codition of the sky is cloud cover (CC). CC should have a correlation to air temperature, ground temperature, humidity, and solar radiation, etc. Therefore, prediction of CC is highly significant from the perspective of social application and should have a large impact on accuracy of time-series prediction of other variables.

We have developed a novel method for segmentation of cloud areas in whole-sky images using an encoder-decoder based convolutional neural network to derive CC from images observed by an omnidirectional camera. F-measure for cloud obtained by 10-fold cross validatoin was 0.86. We could generate time series of daytime CC for 1.5 years using the proposed method.

We have tried to predict CC after one hour based on time series of CC itself and solar radiation using recurrent neural network. RMSE of CC between the observed and predicted time series is 0.022 and the predicted time series of CC is more accurate than the persistence model. However, predicted CC tends to get close to 0.4-0.5 and the phase shift like the persistence model is partially seen.

Keywords: time-series prediction, image segmentation, deep learning