Developping New Nowcasting Method by Using Convolution Neural Network

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More precise short-time quantitative precipitation forecasting is required, because convective rain causes urban flash flooding. We developed new forecasting method by using Convolution Neural Network (CNN-Nowcast). Our method can forecast growth or decay of rain cells without any a priori knowledges.

We applied the CNN-Nowcast method to observation data of the Phased Array Weather Radar (PAWR) in Suita city, Osaka prefecture. The PAWR can observe 3-dimentional structure of clouds every 30 seconds. Our CNN is composed of 3 Convolution Layers, 2 Max Pooling Layers and 3 Full Connected Layers. Input data of the CNN is the PAWR observation data, its time duration is 5 minutes and interval are 1 minute. The CNN outputs 2.5 km mesh rain fall rate forecast (5 minutes after). We trained the CNN using 17252 of training data (86 days), then we evaluated accuracy of the CNN-Nowcast. Comparing with a previous method, we employed the 3D-Nowcast that forecast using PAWR 3-dimentional observation data. As a result, the CNN-Nowcast could forecast in coming rain cells which wasn't observed in input observation data and achieved higher threat score than the previous method with 5~14 mm/hr rain intensity threshold. But, the CNN-Nowcast underestimate for 25~ mm/hr rain area. It is because we didn't have enough high rain intensity (25~ mm/hr) data (0.07% of total training data). We will train the CNN with a lot of high rain intensity training data to improve accuracy. We used 2-dimentional observation data for this experiment. But, the CNN can work with various input data. We will use 3-dimentional observation data of the PAWR in order to estimate vertical advection speed and improve high intensity rain forecasting.

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