Examining Machine Learning Models as An Alternative to DARTS for Nowcasting in Dallas Forth Worth Urban Testbed

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Nowcasting is a short period of time forecasting for about 0 to 3 hours. The purpose of nowcasting is public safety to issue warnings. Accurate and early prediction of storms is very useful for issuing live saving alerts. The most methods used for nowcasting is based on extrapolation of echoes that process frequent observation of weather radar images and makes short term prediction based on their space time variability. In recent years, machine learning based approaches are emerging and outperforming the traditional methods that it can be used as an alternative to nowcasting. This paper presents experiments with machine learning models for nowcasting and compare it to traditional nowcasting method based on space time models such as DARTS (Ruzanski and Chandrasekar, "The CASA Nowcasting System", Journal of Atmospheric and Oceanic Technology, 642-643) using observations over the Dallas Fort Worth (DFW) radar testbed.

In this paper, we introduce different machine learning models for nowcasting and evaluate the performance based on different evaluation metrics and compare models developed here to DARTS. We approach machine learning models using both pure convolutional layer and combination of convolution and recurrent layers using National Weather Service, dual-polarized Doppler radar (WSR-88D) observations of reflectivity. More concretely, we propose residual Convolution (resConv) model and residual convolutional Gated Recurrent Unit (resGRU) model for nowcasting. The model is constructed with encoder-decoder structure with different number and type of layers. The numbers are differed in length of history used for predictions and the number of predicted frames. The radar data was collected from Dallas Fort Worth (DFW) radar for both training and testing in different range of period. The models trained in this structure are compared to DARTS and evaluated using different metrics.