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Framework for Detection and Localization of Extreme Climate Event with Pixel Recursive Super Resolution

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Deep learning techniques have been successfully applied to solve many problems in climate and geoscience using massive-scaled observed and modeled data. For extreme climate event detections, several models based on deep neural networks have been recently proposed and attend superior performance that overshadows all previous handcrafted expert based method. The issue arising, though, is that accurate localization of events requires high quality of climate data. In this work, we propose framework capable of detecting and localizing extreme climate events in very coarse climate data. Our framework is based on two models using deep neural networks, (1) Convolutional Neural Networks (CNNs) to detect and localize extreme climate events, and (2) Pixel recursive recursive super resolution model to reconstruct high resolution climate data from low resolution climate data. Based on our preliminary work, we have presented two CNNs in our framework for different purposes, detection and localization. Our results using CNNs for extreme climate events detection shows that simple neural nets can capture the pattern of extreme climate events with high accuracy from very coarse reanalysis data. However, localization accuracy is relatively low due to the coarse resolution. To resolve this issue, the pixel recursive super resolution model reconstructs the resolution of input of localization CNNs. We present a best networks using pixel recursive super resolution model that synthesizes details of tropical cyclone in ground truth data while enhancing their resolution. Therefore, this approach not only dramatically reduces the human effort, but also suggests possibility to reduce computing cost required for downscaling process to increase resolution of data.