Application of deep-learning-based video frame interpolation technique for geostationary meteorological satellite images

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Geostationary meteorological satellite images provide critical information for real-time weather monitoring with relatively higher spatial and temporal resolutions. The higher resolution is essential to monitor rapidly developing extreme weather events, including convective systems and tropical cyclones. Although the images from recently launched geostationary satellites have a spatial resolution of 2-3 km and a temporal resolution of 2-10 minutes, there is still a limitation to capturing the local weather event between the temporal gap. Recent advance in deep learning shows a great possibility to enhance image resolutions using various super-resolution techniques. However, most previous studies focus on improving spatial resolution. Therefore, in this study, we consider enhancing temporal resolution using a deep learning-based video interpolation technique. To solve this problem, we proposed a warp and refine network (WR-Net) that warps images using the estimated optical flow based on a non-parametric approach and refines the warped images for intensity change through time. We applied proposed WR-Net for GK2A satellite imagery and compared the results of our models with current video frame interpolation methods. The results showed that the performance of our model with the refinement network is superior for generating higher temporal resolution images.

Key words: Geostationary satellite imagery, Video frame interpolation, Deep-learning, Image super resolution