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AI-BASED OCEAN INFORMATION MINING FROM LARGE SATELLITE REMOTE SENSING DATA SET

Abstract

Artificial intelligent (AI) technology has been utilized widely in many fields since the training of deep learning (DL) neural network (NN) became possible in 2006. Compared with human brain, DL has many advantages in dealing with multi-dimensional data sources that are usually required to address information mining for scientific problems. These advantages include: 1) the DL can mine the multi-dimensional data in a unified and effective way; 2) the features for information retrieval are mined from data, and they are more robust than human-crafted features; and 3) some latent factors, which are previously neglected or not easy to be included, are discovered by the DL. Taking the world-wide ILSVRC contest (object recognition over 1 million images and 1000 categories) held in 2012 as an example, the error rate of DL decreased to 16

We divide the AI applications in oceanography into four major categories: 1) image classification (oil, ship, coastal zone, inundation, harmful algal bloom, cloud, eddy, internal wave, etc.; 2) data fusion (altimeter, scatterometer, radiometer, hyperspectral, aerial photos, etc.); 3) algorithm development (sea surface temperature, ocean color, wind, wave, dynamic topography, sea ice, etc.); and 4) phenomenon forecast (ocean current, wind, storm, etc.). Figure 1 shows the framework of AI oceanography. The inner circle represents the examples of widely used AI core developed by Google, Facebook, Microsoft among others. The middle ring represents Ocean DL interface that different applications interact with the inner core for training of different DL models. Small circles around each application represents existing DL models that have been

In this study, we took advantage the large remote sensing database offered by government agencies, i.e., NASA, NOAA and European Space Agency (ESA) and implemented the U-Net and LSTM DL models for coastal zone human-developed area classification and Sea Surface Temperature (SST) forecast in the equatorial Pacific. Case studies show that this approach worked very efficiently in identifying coastal inundation area after the passage of hurricanes and the forecasting the tropical instability wave propagation in the equator Pacific.