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CLASSIFICATION OF INCOMING RADIO DATA FROM A SOLAR RADIO SPECTROMETER

Abstract

This study proposes using deep learning implementations to analyze solar activity data collected from the solar radio spectrometer at the Sharjah Academy for Astronomy, Space Sciences, and Technology (SAASST) Radio Astronomy Laboratory. The spectrometer operates in the frequency range of 14-45 MHz and records events, including solar and noise, which are currently reviewed manually by operators to determine the presence of solar events. However, this manual process is time-consuming and challenging, leading us to propose using deep Convolutional Neural Networks (CNN) to classify the radio solar burst data and differentiate it from noise. The detection of solar bursts will occur within two stages. The initial stage will use a LeNet-based CNN model, which would perform binary classification as to whether there is a solar burst event. The second stage will use a Visual Geometry Group (VGG)-based CNN model that will further identify the burst type, either type II or type III. To build the training dataset, we will consider solar burst observations collected in 2022. First, the data will undergo pre-processing to enhance the color space transformation using the OpenCV package. This process will allow for random color balance perturbations while preserving the underlying shapes and content of the images. Second, the Radio-Sky Spectrograph software will be used to manipulate the color offset and gain, thereby increasing the dataset samples. Finally, we aim to automate the detection and classification process, providing a solution for researchers in this field. The automation process will run simultaneously with the mentioned software, keeping track of time and updating the model with new images for immediate classification. With this, we aim to make the detection of solar bursts more efficient and effective, paving the way for further integration of deep learning with radio astronomy. Future work includes the utilization of solar bursts tabular data on top of the current existing visual data. This could lead to a potential enhancement in the model's accuracy in detecting solar bursts.