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A SHALLOW CONVOLUTIONAL NEURAL NETWORK FOR ONBOARD CUBESAT IMAGE CLASSIFICATION

Abstract

The development of CubeSats dates back many years, and there has been much research on the payload's ability to analyze satellite images. Due to the difficulty in downlinking photographs owing to their size and communication limitations, the majority of CubeSats are currently constructed with image processing capabilities. The majority of CubeSat payloads are created using embedded technology, which fits CubeSats's size, weight, and power. However, the processing power of embedded devices is constrained. Different kinds of image classification models have been built based on fine-tuning previously trained models, which contain many parameters in this domain. While there has been some study towards creating lightweight models, it has not been extensively tested on microcontrollers or small application processors. We propose our research based on the Shallow Convolutional Neural Network, which is trained on a public dataset of satellite imagery. The proposed model architecture combines image processing techniques and shallow neural architecture to enhance both efficiency with similar accuracy. Through careful experimentation and evaluation, our model achieved remarkable results, performing with comparable training accuracy and remarkable speed (at least an order of magnitude). Furthermore, the reduced parameter count of our model addresses the challenge of resource-intensive computations and memory requirements, making it more practical and cost-effective for deploying it on spaceborne microcontrollers.