Abstract No: SI-08

Image-based deep learning approach for flood impact level identification

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Disasters are a global issue that could have catastrophic consequences on the local economy of the country. While they can be natural disasters or man-made, among natural disasters, floods can be classified as the most common disaster that disrupts human lives regularly in Sri Lanka. Floods contribute to the disruptions of people's day to day activities as well as causing economic hardship and property damage. It happens with little warning or prediction and to avoid the impact that can occur after flooding it is necessary to have a real-time warning system or risk analysis system. Identifying the flood impact level has become very important when managing a flood emergency in Sri Lanka. This paper proposes an image based deep learning model for automatically identifying a flood risk. The purpose of this study is to provide an approach for easily identifying the flood risk level using images. People can then easily identify the passable roads when traveling in the flood area without taking undue risk and rescue teams can easily access affected victims while avoiding the high-risk areas. The proposed methodology goes through the data collection, image pre-processing, deep learning model, active learning, performance evaluation, and practical implementation. It used social media image data because there is a huge volume of flood images shared on social media platforms like Facebook and Twitter. For this study, a total of 1543 flood images were collected. The images were classified under three risk levels, high-risk, medium-risk, and low-risk and divided into three datasets named train set (1243), test (250) and validate set (50). To analyze the most accurate models VGG16 VGG19, Mobilenet and Densenet169 were chosen for transfer learning as they are most suitable for image-based classification. Models are trained using trainset and after feature extraction, fine-tuned models performed with 63%, 68%, 86%, and 65% accuracy respectively. To test the accuracy of the model, the test set was used. In comparison to other models, Mobilenet model outperformed them with an 86% accuracy with high learning speed. To evaluate the models, validate set was used to measure the prediction accuracy and the model has an average of 83% prediction accuracy. As future work, authors suggest to improve the accuracy of the models using the ensemble method and create a real-time platform.

Keywords: Deep learning, Fine-tune, Image pre-processing**,** Transfer learning