

## Landslide detection using Deep Learning Techniques



Landslide in Himachal Pradesh, India

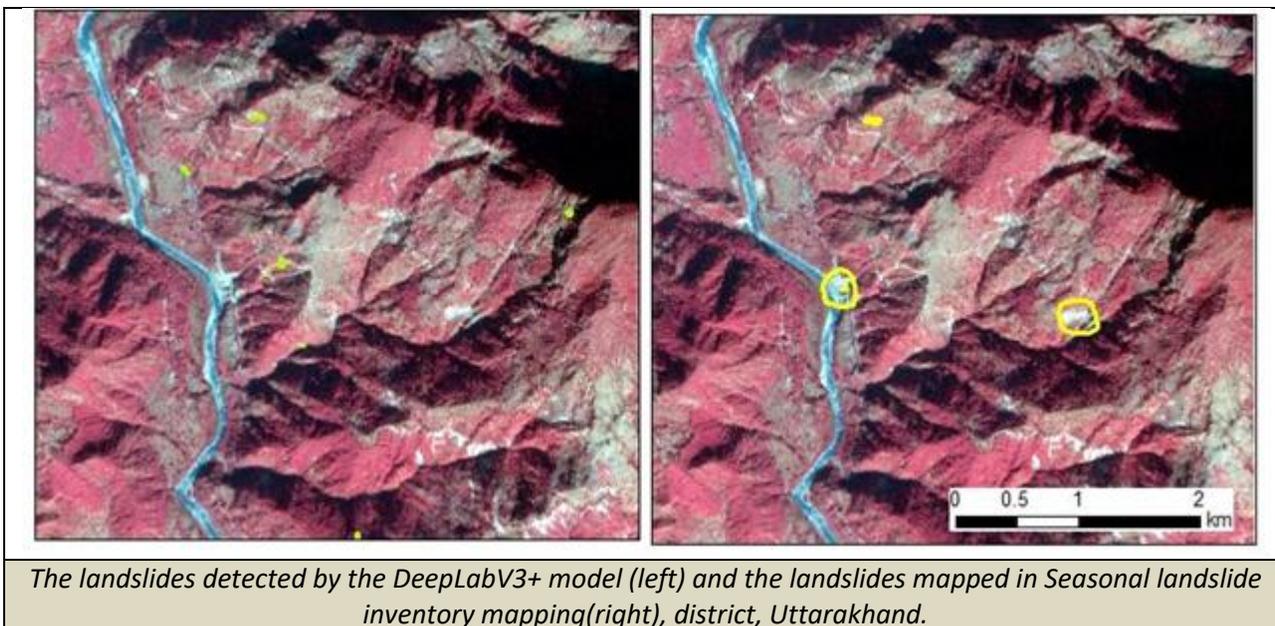
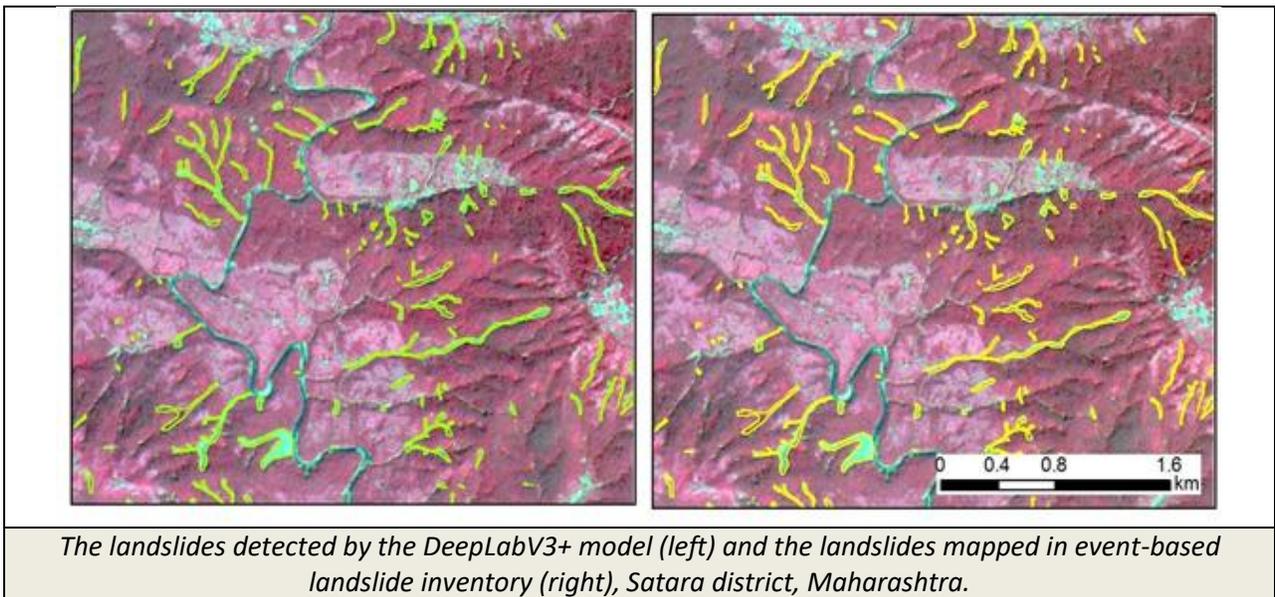
Scientists in National Remote Sensing Centre (NRSC), ISRO, India, developed a new method to detect Landslides using satellite image and Deep Learning Techniques so that large number of landslides can automatically be mapped in short period of time at regional level. This new method gives detailed landslide location maps which will be useful for decision-makers in landslide disaster risk reduction.

Mapping of large number of landslides in satellite image by manual or semi-automatic methods after a major event (such as heavy rainfall) takes long time. Therefore the rapid mapping of landslides triggered by heavy rainfalls or seismic events is essential for disaster mitigation and quick responses. The automatic detection of landslides using a deep learning model is ideal for rapid mapping at the regional level.

Landslides on steep slopes are potential hazards to life and property. Geological, meteorological and anthropogenic causes are triggering factors for occurrence of landslides. Satellite data plays important role in mapping and monitoring of landslides in inaccessible terrain. The timely detection of landslides is useful for disaster management and mitigation plans.

DeepLabV3+ model was developed for mapping landslides in Himalayas and Western Ghats of India. Input parameters such as Normalized Difference Vegetation Index (NDVI), Green Normalized Difference Vegetation Index (GNDVI) are prepared using high resolution satellite images (Resourcesat 2 and Resourcesat 2A, LISS IV) and terrain slope is prepared using CARTOSAT 10m. Digital Elevation Model (DEM).

The past inventory data of landslides were used to compare the results. The experiment was conducted for parts of Maharashtra (Satara district), Kerala (Wayanad district), Karnataka (Kodagu district), Mizoram (Lunglei district) and Uttarakhand to detect the landslide location. The following figures show the landslide mapped.



An extensive field survey was carried out in October 2021 to validate the experiment results in Satara, Ratnagiri, and Raigad districts of Maharashtra. Most of the landslides were seen in dense forests. All of these disasters happened within two days of rainfall (21-22 Jul 2021).

The DeepLabV3+ was evaluated comprehensively by comparing with machine learning techniques such as Unet, SDUNet, and MILDNet, for different metrics parameters such as IOU, precision and recall.

Results show that the DeepLabV3+ model can be used as a better landslide detection model. The automatic detection of landslides using a deep learning model is ideal for rapid mapping at the regional level.