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2022 Earth Observation and Sustainable Development Goals Contest Winners

The Technical Committee Remote Sensing Environment, Analysis, and Climate Technologies (REACT) of the IEEE Geoscience and Remote Sensing Society (GRSS) is proud to announce the winners of the 2022 Earth Observation and Sustainable Development Goals (EO4SDG) contest. The miniprojects for the Sustainable Development Goals competition are an initiative of the Technical Committee REACT to support science and to motivate local students to work together on a specific topic related to EO4SDG. The focus is on local regional problems and how remote sensing can help to identify and quantify environmental/societal impacts of a changing Earth. More details can be found at www.grss-ieee.org/resources/news/new-react-eo4sdg-competition/.

The winning team this year is a group from the Remote Sensing and Spatial Analytics Lab of the Information Technology University in Lahore, Pakistan, with a miniproject entitled: "Deep Learning for Mapping Glacial Lakes in Hindu Kush & Himalayas using Sentinel-2 Multi-Spectral Data" from Abdul Basit, research associate, Ehtasham Naseer, Ph.D. fellow, and Nida Qayyum, research associate (Figure 1).

FIGURE 1. The winning team of the EO4SDG contest: Abdul Basit, research associate, Ehtasham Naseer, Ph.D. fellow, and Nida Qayyum, research associate.

The abstract of their miniproject is that glacial lake outburst floods (GLOFs) are recurrent phenomena in high mountain regions around the globe. They are caused by rapid discharge of millions of cubic meters of melt water and ice debris in a short interval of time. They are one of the major environmental threats for local communities residing downstream. Recent decades have witnessed a rapid increase in the number of glacial lakes and subsequent GLOFs, which requires continuous monitoring of expansion of existing glacial lakes and formation of new ones (Figure 2). With the availability of open-source remote sensing data, it is now possible to monitor potentially dangerous zones at a large scale. Moreover, deep

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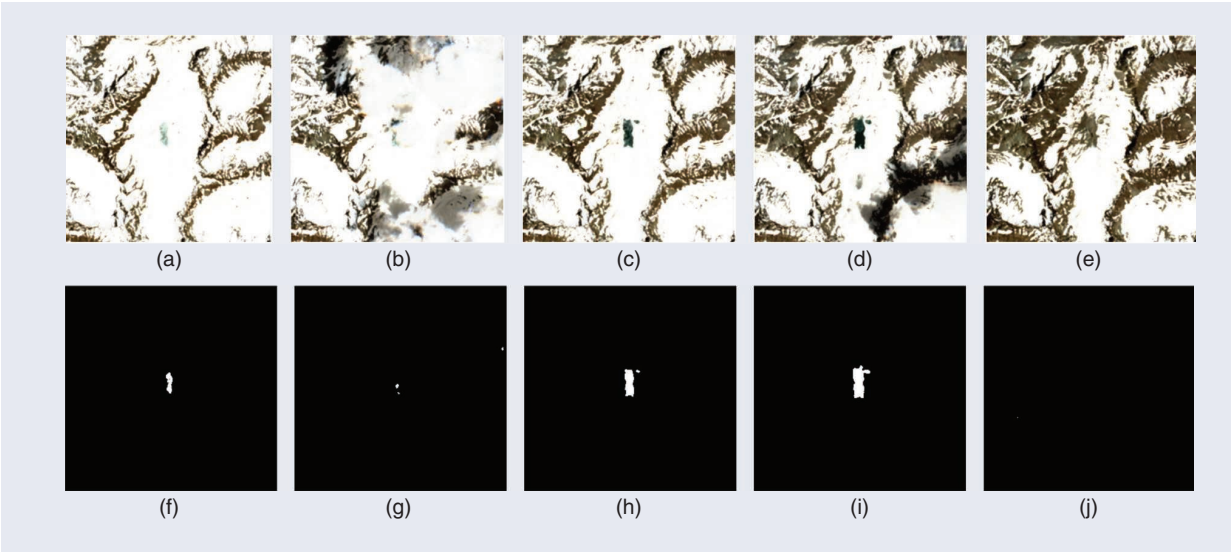

FIGURE 2. A time series of satellite data (a)–(e), along with its predicted class labels (f)–(j), to monitor a glacial lake formation over Chitral, Pakistan. (a) and (f) Lake birth observed on 19 June 2019. (b) and (g) Lake covered with clouds as observed on 23 June 2019. (c), (d), (h), and (i) Lake size significantly increased as observed on 28 June 2019 [(c) and (h)] and 03 July 2019 [(d) and (i)]. (e) and (j) Lake caused a GLOF and water has been drained as observed on 08 July 2019.

learning techniques can be used to automatically classify glacial lakes in remote sensing data. Towards this end, a glacial lakes inventory covering the entire high mountain Asia region is used to locate glacial lakes. It contains 30,121 glacial lakes, covering an approximate area of 2,080 km^2. After that, true color (red, green, and blue bands) imagery, acquired by the Sentinel-2 mission, is collected from the ESA's Sentinel hub's EO browser, a cloud platform for visualizing and downloading satellite data. It provides data every five days with a fine resolution of 10 m. For preparation of the glacial lakes detection dataset, nearly 400 cloud-free acquisitions are used. These data are further processed to prepare 1,200 crops of size 320 by 320, with each crop containing at least one lake. Each image is associated with its binary ground measurements mask with two classes: lake and no lake. The dataset contains sufficient training examples of glacial lakes with different shape, size, and radiometric signature. For glacial lakes classification, an encoder–decoder based a convolutional neural network is used. It is trained on the labeled dataset for semantic segmentation of true color images. The performance of the proposed model is evaluated using an intersection over union (IoU) score. It classifies glacial lakes accurately with an IoU score of 79.90%, which is quite good as far as the complexity of the lake classification problem is concerned.

We want to thank all of the entrants to this year's contest! It has been an honor to witness the work of each of you. Please check the IEEE GRSS home page regularly—because we will launch the next competition in 2023 May—and do not miss the competition opportunity.

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