

# GEO-AI Challenge on Cropland mapping with satellite imagery

Led by: UN Open GIS Initiative, Geo-AI Working Group-5

In collaboration with: FAO, ITU, Politecnico di Milano

# Outline

- ▶ Background
- ▶ Objectives
- ▶ Overall Plan of the challenge
- ▶ Details for this Geo-AI challenge
- ▶ Take-home message

# Background

- ▶ **Agricultural Remote Sensing applications with AI**
- ▶ Extensive application of remote sensing in agricultural community
- ▶ Use of satellite imagery for cropland and crop type mapping
- ▶ Cropland extent/intensity provide basic information for crop growth monitor and yield forecast and land cover change monitor
- ▶ Artificial intelligence and machine learning are promising to improve crop mapping and land cover classification accuracy and robustness with time-series satellite images and remote sensing big data



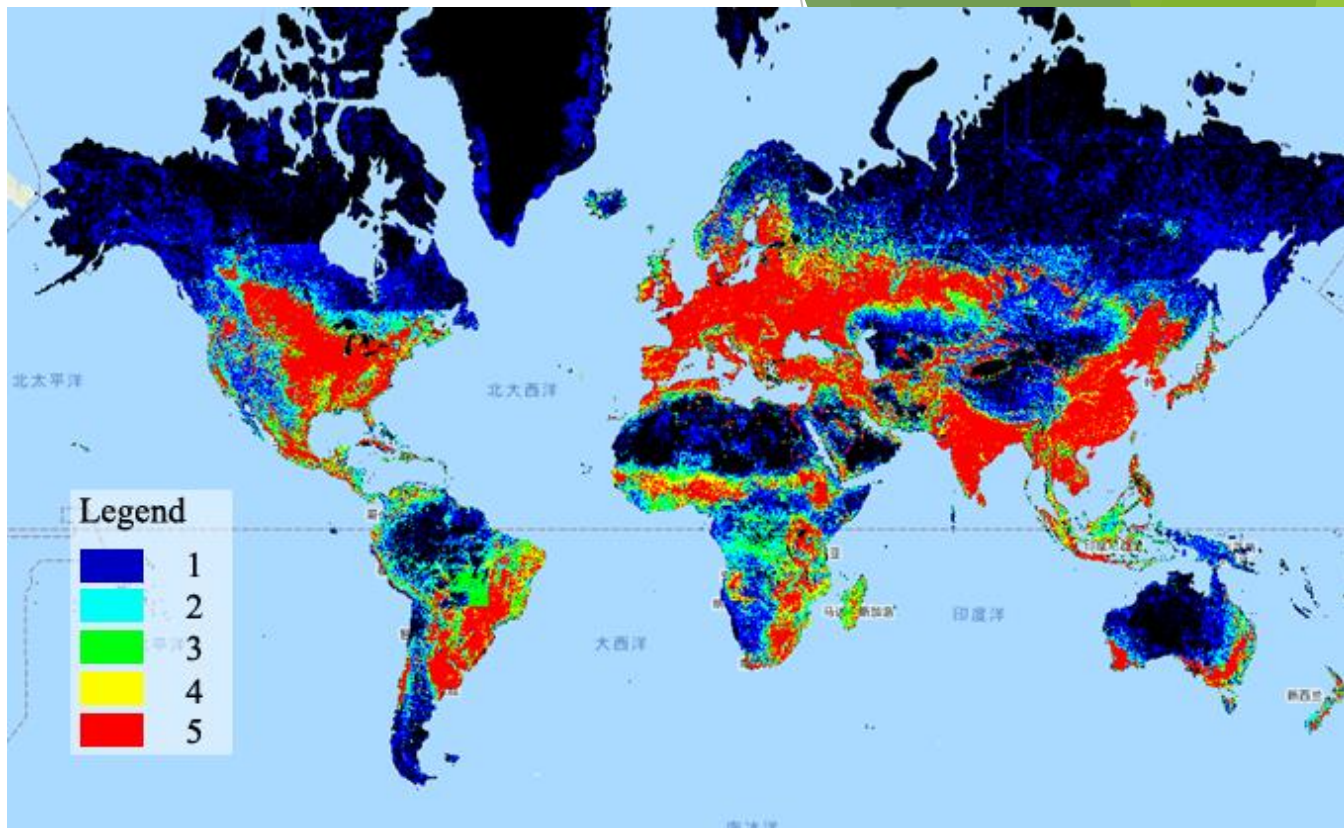
# Background & Objective

## ► Existing cropland maps at global level

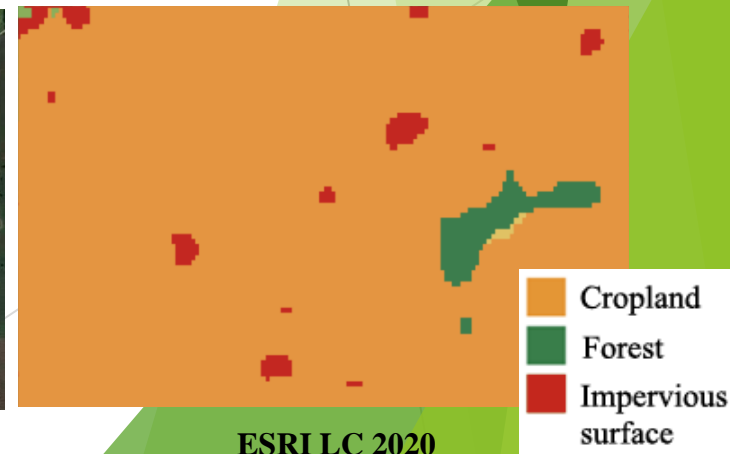
- Serious disagreement of the existing cropland extent maps
- Land surface patterns are not well-described
- “Cropland” are not of the same definition

## ► Objectives

- Developing machine-learning-based extendable algorithms for cropland extent and crop intensity mapping
- Enrich GEO-AI algorithms and use cases
- Contribute to UN GEO-AI community



Google Earth image

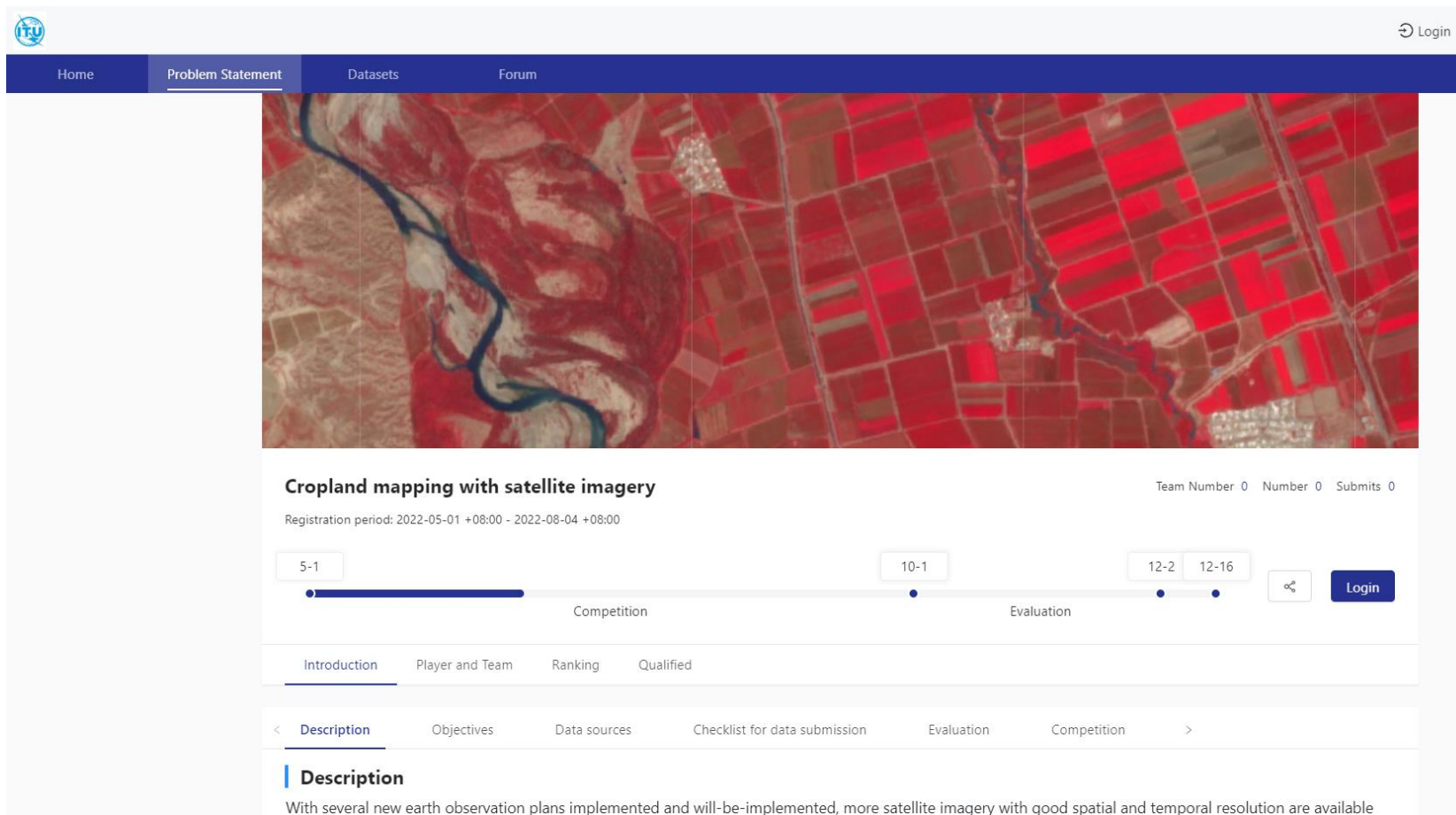


ESRI LC 2020



# Overall Plan of the challenge ---- website

<https://geoaichallenge.aiforgood.itu.int/match/matchitem/61>



The screenshot shows the website interface for the 'Cropland mapping with satellite imagery' challenge. At the top, there is a navigation bar with 'Home', 'Problem Statement', 'Datasets', and 'Forum'. A 'Login' button is in the top right corner. The main content area features a large satellite image of a landscape with a river and agricultural fields. Below the image, the challenge title 'Cropland mapping with satellite imagery' is displayed, along with the registration period '2022-05-01 +08:00 - 2022-08-04 +08:00' and statistics for 'Team Number 0', 'Number 0', and 'Submits 0'. A progress bar indicates the current stage of the challenge, with markers for '5-1', '10-1', '12-2', and '12-16'. The progress bar is divided into 'Competition' and 'Evaluation' phases. Below the progress bar, there are tabs for 'Introduction', 'Player and Team', 'Ranking', and 'Qualified'. At the bottom, there is a 'Description' section with a sub-header 'Description' and a paragraph of text: 'With several new earth observation plans implemented and will-be-implemented, more satellite imagery with good spatial and temporal resolution are available'.

# Overall Plan of the challenge ----

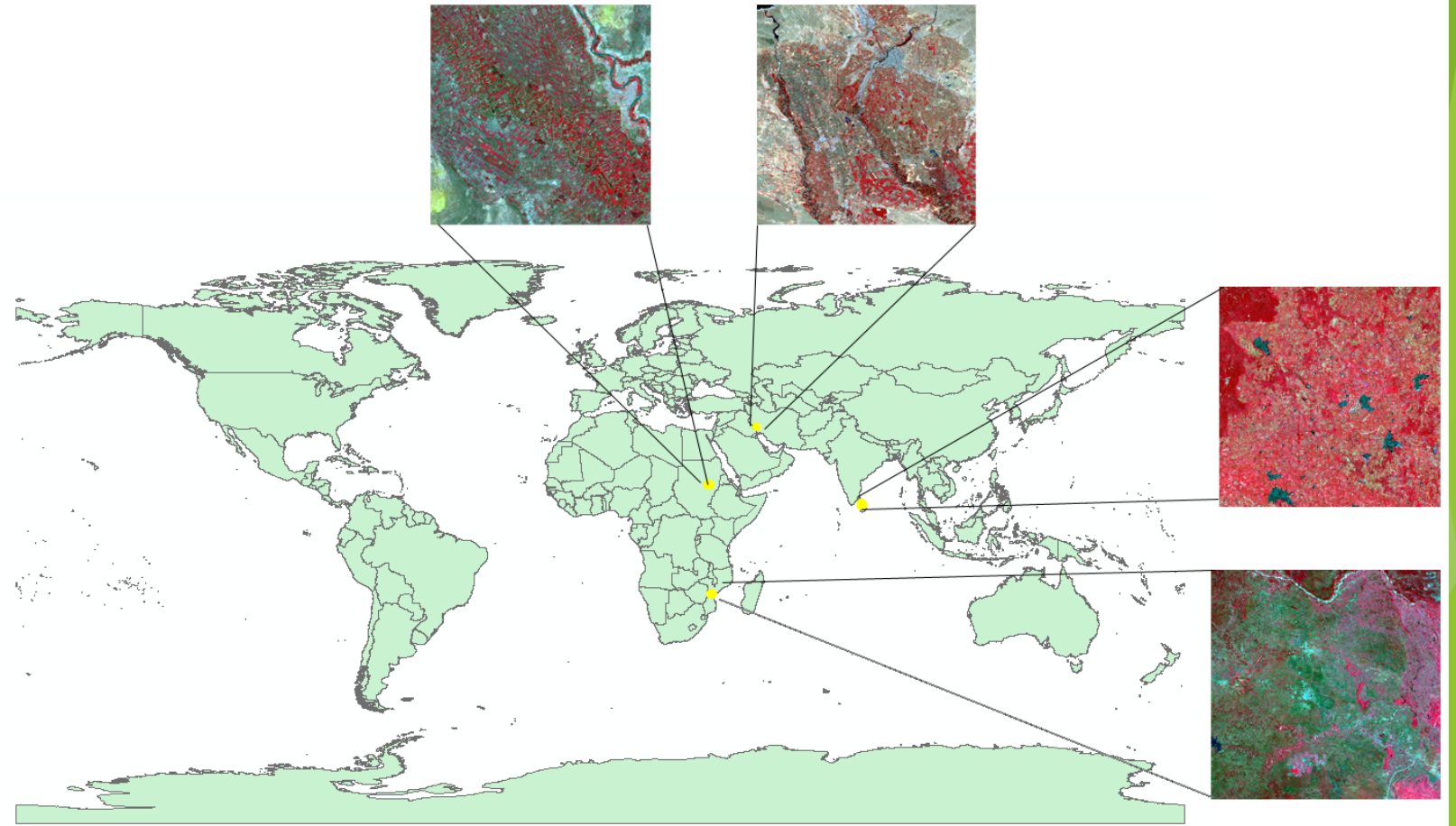
## Important Date

- ▶ Call for submission  
**June 28th, 2022**
- ▶ Deadline of submission  
**Sep 30<sup>th</sup>, 2022**
- ▶ Notification of the second-round submission  
**Oct 16<sup>th</sup>, 2022**
- ▶ Deadline of second-round submission  
**Oct 20<sup>th</sup>, 2022**
- ▶ Webinar for presentation  
**Late November or early December 2022**
- ▶ Award Ceremony  
**Dec 14<sup>th</sup> ~ 16<sup>th</sup>, 2022**

# Test Region

- 1. Sudan
- 2. Sri Lanka
- 3. Iran
- 4. Mozambique

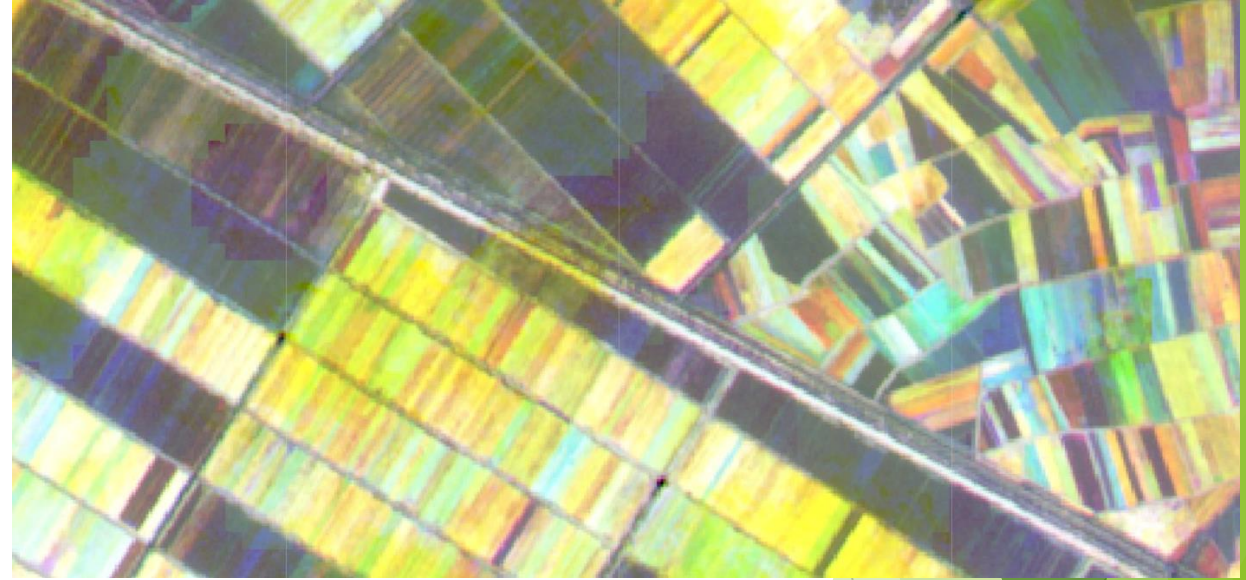
**Size for each test region,  
is 0.5 degree by 0.5 degree.**





# Remote sensing data set

- ▶ The 15-day composited Sentinel-2 data with 10m resolution are provided in geotiff format, the data are collected between July 2019 and June 2020. The scenes include the four test regions used in this challenge, and the data are available in both Google drive and Google Earth Engine asset





# Preparing training data set

- ▶ Visually interpreting cropland/non-cropland samples
- ▶ Export the samples and create the training dataset for cropland extent mapping (binary map: cropland/non-cropland)
- ▶ As for the crop intensity, both training sample-based and non-training sample approaches are encouraged



# Implementing cropland extent and crop intensity mapping

- ▶ Using Python-based platform (such as Colab) to implement the cropland extent and crop intensity mapping

The data processing may include:

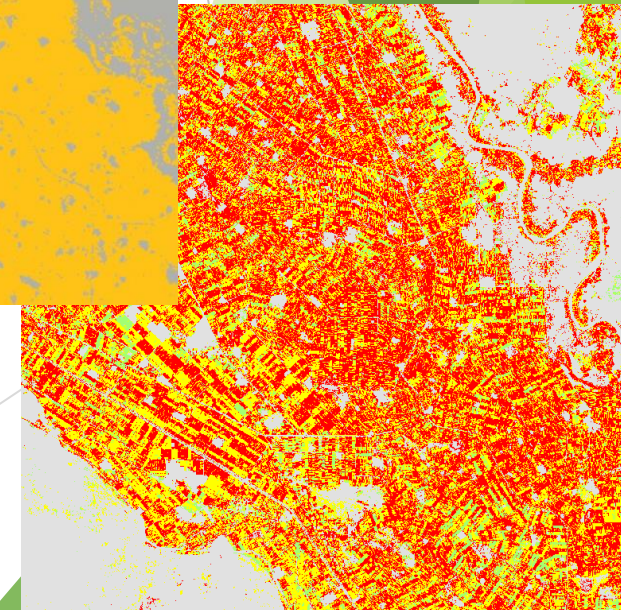
- (1) Gap filling
- (2) Data processing for cropland extent mapping (binary map)
- (3) Data processing for crop intensity mapping

```
GEO_AI_croplandmapping.ipynb ☆
文件 修改 视图 插入 代码执行程序 工具 帮助 已保存所有更改

+ 代码 + 文本

1 import os
2 import glob
3 import gdal
4 from google.colab import drive
5 from google.colab import auth
6
7 import sklearn.datasets
8 import pandas as pd
9 import numpy as np
10 from sklearn.model_selection import train_test_split
11 from sklearn import metrics #Import scikit-learn metrics module for accuracy calculation
12 import sklearn
13 from sklearn.ensemble import RandomForestClassifier
14 #auth.authenticate_user()
15 #drive.mount("/content/drive")
16
17 #get the names of files needed to be mosaic
18 #files = glob.glob('/content/drive/MyDrive/GEO-AI/new/*.tif')
19 RS_file = '/content/drive/MyDrive/GEO-AI/new/Sudan_NDVI.tif'
20 #print(files)
21 |
```

['/content/drive/MyDrive/GEO-AI/new/Iran\_2019-08-01\_SR.tif', '/content/drive/MyDrive/GEO-AI/new/Iran\_2019-07-01\_SR.tif', '/content/drive/MyDrive/GEO-AI/new/Iran\_2



# Checklist for the submission

- ▶ **First round**
- ▶ Cropland extent map for all four test regions
- ▶ Crop intensity map for all four test regions
- ▶ Technical report with accuracy assessment report
  
- ▶ **Second round (selected teams)**
- ▶ Training dataset
- ▶ Script for data processing in Colab



# Evaluation

- ▶ **We will have a two-round evaluation**

- ▶ **First round (automatic evaluation)**

- ▶ Using ground truth samples to generate accuracy assessment report for each cropland extent/crop intensity map
- ▶ Size of training samples for each map

## **Selected submissions will be further evaluated in the second round**

- ▶ **Second round (selected teams)**

- ▶ Performance of training samples and scripts
- ▶ Novelty and practicality of the proposed procedure based on technical reports
- ▶ Performance of the presentation in the webinar

**One winner, second prize, third prize, student prize**



# Take-home message

- ▶ Organizer provide
- ▶ Test regions, satellite imagery, legend
  
- ▶ Participants prepare
- ▶ Training samples, cropland extent/intensity maps, scripts
  
- ▶ Organizer evaluation
- ▶ Two-round evaluation
- ▶ Three teams on podium + one student prize
  
- ▶ Submission deadline:
- ▶ **Sep 30<sup>th</sup>, 2022**

# THANKS

► Contact info:

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Question about data source and data processing

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