**Project Suggestion:**

*Topic*. Burnt area detection with satellite images

*Description*. Seasonal forest fire has long been one of the significant problems causing adverse changes in climate, health, and loss in wildlife and natural resource management in several of the ASEAN countries. The need for detection models for forest fire risk forecasting is significant. This initial study of AI assisted framework, which assesses the risk of forests, could support decision-making for fire control and prevention. The project explores the use of deep learning and satellite images for burnt scar profiling. This project is suitable for students who would like to learn more and have experience in machine learning and satellite image analysis.

This topic could be run as a few distinct projects. The possible variations would be using different data sources (different satellites, Google Earth Engine, etc.), data preprocessing and data modelling.

*Indicative tasks*. This data science project consists of the following tasks.

1. Literature review, for background and related work,
2. Analysis framework design and implementation,
3. Satellite image collection (e.g., Sentinel-2) and data preparation,
4. Model evaluation and parameter analysis,
5. Documentation and report (with a possible draft of manuscript).

*Experience*. These are preferred.

1) Software development methodology

2) Python programming language

***Indicative tasks*.** This data science project consists of the following tasks.

1. Literature review, for background and related work,
   1. Burnt area detection: problem definition, process
   2. Sentinel-2 images – bands and combinations
   3. Data preparation process
   4. Data modelling process and commonly used detection models + pre-trained models
   5. Model evaluation metrics
2. Analysis framework design and implementation,
   1. Collect public datasets (with labels)
   2. Design experiment
      1. Data sets
      2. Methods + parameters
      3. Evaluation metrics
3. Satellite image collection (e.g., Sentinel-2) and data preparation,
   1. Explore public data sets of satellite images (with labels)
   2. Perform data exploration and preparation
4. Model evaluation and parameter analysis,
   1. Perform experiments
   2. Compare results using appropriate evaluation metrics
   3. Perform more experiments on parameter analysis to get the best parameter setting/best results
5. Documentation and report (with a possible draft of manuscript).
   1. Report
   2. Python Scripts/Modules/Packages
   3. Manuscript (if interested)

**Tools**

* Anaconda
* MS Teams/Git

**Output**

* Comparison result on model performance
* Parameter analysis result
* Python Scripts/Modules

**Starting points:**

* Satellite-image-deep-learning

<https://github.com/satellite-image-deep-learning/techniques>

* Segmentation - Fire, smoke & burn areas

<https://github.com/satellite-image-deep-learning/techniques#24-segmentation---fire-smoke--burn-areas>

For example:

* + 2.4.5. [IndustrialSmokePlumeDetection](https://github.com/HSG-AIML/IndustrialSmokePlumeDetection) -> using Sentinel-2 & a modified ResNet-50
  + 2.4.6. [burned-area-detection](https://github.com/dymaxionlabs/burned-area-detection) -> uses Sentinel-2
  + 2.4.10. [Burned\_Area\_Detection](https://github.com/prhuppertz/Burned_Area_Detection) -> Detecting Burned Areas with Sentinel-2 data
  + 2.4.11. [burned-area-baseline](https://github.com/lccol/burned-area-baseline) -> baseline unet model accompanying the Satellite Burned Area Dataset (Sentinel 1 & 2)
  + 2.4.12. [burned-area-seg](https://github.com/links-ads/burned-area-seg) -> Burned area segmentation from Sentinel-2 using multi-task learning <https://arxiv.org/pdf/2309.08368v1.pdf>
* 15 Free Satellite Imagery Data Sources

<https://gisgeography.com/free-satellite-imagery-data-list/>

* How to Download Free Sentinel Satellite Data

<https://gisgeography.com/how-to-download-sentinel-satellite-data/>

* Sentinel 2 Bands and Combinations

<https://gisgeography.com/sentinel-2-bands-combinations/>

<https://www.sentinel-hub.com/explore/sentinel-playground>

* Image Classification Techniques in Remote Sensing

<https://gisgeography.com/image-classification-techniques-remote-sensing/>

<https://gisgeography.com/supervised-unsupervised-classification-arcgis/>

* Data science web development: Streamlit

<https://streamlit.io/>

*Search keywords:*

* Sentinel-2 image processing
* Burned / Burnt area from Sentinel-2
* Burned / Burnt area from Sentinel-2 with ground truth
* Burned / Burnt area from Sentinel-2 with pre-trained models

**Project Plan?**