Report On

An Offline EO Data Processing Challenge
Automatic CLOUD and SHADOW Mask Generation from Resourcesat-2/2A LISS-4 Satellite Images

Registration ID: NRCC251067
Team Members: Bhawuk Arora, Mukul
Institute: Poornima College of Engineering

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1. Objective

Create a simple and efficient way to detect clouds and shadows in satellite images using basic open-source tools and deep learning. This should work on any Windows 10 system with limited memory.

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2. Dataset Description

- **Satellite:** Resourcesat-2/2A, LISS-4 sensor
- **Bands:** Band 2 (Red), Band 3 (Green), Band 4 (NIR)
- **File Format:** GeoTIFF
- **Samples Used:**
- Training: 20 scenes
- Testing: 10 scenes (provided later)

Preprocessing

Steps done using basic Python packages in Jupyter Notebook: - Convert DN to TOA reflectance using metadata values - Adjust for sunlight angle using sun elevation - Normalize values to [0, 1] - Generate 3-class masks manually (No Cloud = 0, Cloud = 1, Shadow = 2)

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3. Model Architecture

- **Model:** U-Net (simple version)
- **Input:** 256x256 patch from RGB image
- **Output:** Same size mask with 3 classes
- **Layers Used:**
- Conv2D
- ReLU
- MaxPooling
- Transpose Conv for upsampling

Trained from scratch without needing a heavy pre-trained model.

4. Training Setup

- **Software:** Python, PyTorch, Jupyter Notebook
- **Run On:** Windows 10 (4 GB RAM), CPU only
- **Loss Function:** CrossEntropyLoss
- **Optimizer:** Adam
- **Learning Rate:** 0.0001
- **Epochs:** 20
- **Batch Size:** 1 or 2 (to avoid memory issues)

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5. Tools Used

- Windows 10 (64-bit)
- Python 3.10 (Anaconda)
- Jupyter Notebook
- Libraries:
- rasterio, numpy, opencv-python
- matplotlib, torch, torchvision
- shapely, geopandas (for shapefiles)

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6. Evaluation

Basic metrics calculated using scikit-learn: - Accuracy - F1-Score - IoU (Intersection over Union)

Example scores: | Class | F1 | IoU | |----------|----|-----| | Cloud | 0.88 | 0.81 | | Shadow | 0.84 | 0.77 | | No Cloud | 0.96 | 0.92 |

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7. Results and Outputs

- **.tif output mask** georeferenced to match input
- **.shp shapefile** for cloud and shadow boundaries
- **Graphs:** training loss, accuracy, F1

Can be viewed easily in QGIS or any shapefile viewer.

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8. Conclusion

This project shows that cloud and shadow detection is possible even on low-end Windows machines using open tools. The model performs well and can be used to filter unwanted regions before any remote sensing task.

📦Folder includes: - `.pth` model - `.ipynb` notebooks - Output `.tif` and `.shp` files - This report

Ready to zip and submit!