

Web Services and Convolutional Neural Networks for Satellite Image Classification

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Web Map Service (WMS) and Web Processing Service (WPS) are the main services currently used for geospatial data rendition and processing within the online environment, respectively. While many satellite image data providers are currently sharing remotely sensed data as WMS, very few WPS are available for satellite image processing. Formulating WPS to classify satellite images shared as WMS provides a very accessible and useful computing resource for many applications. Convolutional Neural Networks (CNN) have been used for pattern recognition in images, including satellite image classification. Unlike the conventional parametric statistic classifiers, CNN can accurately classify images that have high spatial frequency where the spectral patterns of land cover types are not normally distributed. Furthermore, CNN can be trained to include pixel contextual information, the spatial signature of land cover types, increasing the classification accuracy. This study focuses on the formulation of WPS using CNN to classify satellite images served as WMS. The study successfully formulated the CNN WPS and used to classify satellite images served as color composite WMS. The classification results also show that the CNN classifier is more accurate compared to the conventional Maximum Likelihood Classifier (MLC). A WebGIS portal is also successfully developed as WMS and WPS client for easy web service implementation. The study highlights the feasibility of using color composite WMS, from data exclusively used for visual interpretation, to inputs for important image processing computations.

Keywords: Web Map Service, Web Processing Service, Convolutional Neural Networks, Satellite Image Classification, WebGIS

Web Services and Machine Learning Algorithms for Satellite Image Processing
Geological Survey of Japan, AIST

The Admin

Available Satellite Images for Classification Machine Learning App Registered Images Tools Add Map (WMS) Map Overlays Logout

Satellite Image Classification Using Machine Learning

Catalogs

Available Satellite Images for Classification
Change Map Catalog

Available Satellite Images for Classification

Sentinel 2 Almaty, Kazakhstan (Clipped) 2025-07-13 (CCOP_T43)
Sentinel 2 Tsukuba City, Ibaraki Prefecture, Japan 2025-06-05 (T54SV)

Select a Satellite Image (Top Most Highlighted)

Sentinel 2 Tsukuba City, Ibaraki Prefecture, Japan 2025-06-05 (T54SV)

Samples for Training		Samples for Verification	
Sample Name	Sample Points	Sample Name	Sample Points
Others			
Rice Paddies			

Add New Sample Start Sampling Upload Sample File
Save Changes Delete Sample Delete Point Display All Points

Pixel Window Size => 9

Start ANN Training & Classification
Start CNN Training & Classification (Fixed Kernels)
Start CNN Training & Classification
Start Maximum Likelihood Classification

Press 'Ctrl' and drag the mouse to define bounding box. Click for Extent of Satellite Image to be Used.

Classification Result Maps

Register Map (Top Most Selected) Delete Map (Top Most Selected)
Compute Accuracy Show CNN Close

Satellite Image Classification Using Convolutional Neural Network

By Dr. Joel Bandibas

Machine Learning for Sat Features Identification

Initial Error: 0.195416
Current Error: 0.142076
Number of Iterations: 227
Training Time: 00:00:17.4
Input, Middle, Output Neurons: 45, 55, 5

Start Classification Using Trained CNN Start Classification Using Trained CNN

Middle Layer Nodes 55 Learning Rate 0.010 MSE Limit 0.02 Iterations Limit 1000

Start Stop Pause Re-Start Hide Abort/Reset Save Trained CNN

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