

Package ‘OtsuSeg’

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Type Package

Title Raster Thresholding Using Otsu’s Algorithm

Version 0.1.0

Description Provides tools to process raster data and apply Otsu-based thresholding for burned area mapping and other image segmentation tasks. Implements the method described by Otsu (1979) <[doi:10.1109/TSMC.1979.4310076](https://doi.org/10.1109/TSMC.1979.4310076)>, a data-driven technique that determines an optimal threshold by maximizing the inter-class variance of pixel intensities. It includes validation functions to assess segmentation accuracy against reference data using standard accuracy metrics such as precision, recall, and F1-score.

URL <https://github.com/olgaviedma/OtsuSeg>

Encoding UTF-8

License GPL-3

Depends R (>= 3.0.0)

Imports raster, zoo, sf

Suggests testthat (>= 3.0.0), curl

RoxygenNote 7.3.2

NeedsCompilation no

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BugReports <https://github.com/olgaviedma/OtsuSeg/issues>

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binarize_raster	<i>Binarize a Raster Using Otsu's Thresholding (with Inter-Class and Intra-Class Variance)</i>
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Description

This function computes deltaNBR (difference between post-fire and pre-fire NBR), rescales it, applies a smoothed histogram, and uses Otsu's thresholding to create a binary raster representing burn scars. It also generates and saves plots of the smoothed histogram, inter-class variance curve, and the inter-class and intra-class variance curves on separate plots.

Usage

```
binarize_raster(
  x,
  y,
  output_shapefile = TRUE,
  shapefile_path = "binary_raster.shp"
)
```

Arguments

x RasterLayer. A raster layer object representing pre-fire NBR (e.g., 'raster::RasterLayer').

y RasterLayer. A raster layer object representing post-fire NBR (e.g., 'raster::RasterLayer').

output_shapefile Logical. If TRUE, saves the binary raster as a shapefile. Default is TRUE.

shapefile_path Character. Path to save the shapefile. Used only if output_shapefile is TRUE.

Value

A list containing:

best_threshold Numeric. The computed Otsu threshold value.

area_hectares Numeric. The estimated burned area in hectares.

binary_raster_smoothed RasterLayer. The binary raster created using the Otsu threshold.

binary_shapefile sf object. The binary shapefile created, if output_shapefile is TRUE.

shapefile_path Character. Path where the shapefile was saved, if output_shapefile is TRUE.

Examples

```
#For CRAN checks, a temporary directory is used to avoid leaving files.
#For permanent use, specify a path like "results/binary_raster.shp"
pre_fire <- get_external_data("NBRpre.tif", load = TRUE)
post_fire <- get_external_data("NBRpost.tif", load = TRUE)
shapefile_path <- file.path(tempdir(), "binary_raster.shp")
result <- binarize_raster(pre_fire, post_fire, shapefile_path = shapefile_path)
print(result$area_hectares)
# Clean up (optional)
unlink(list.files(tempdir(), pattern = "binary_raster\\.(shp|shx|dbf|prj)$", full.names = TRUE))
```

get_external_data *Download and load example data for OtsuSeg*

Description

Downloads a ZIP file with example rasters and shapefiles from GitHub releases and optionally loads a specific file.

Usage

```
get_external_data(filename = NULL, path = tempdir(), load = FALSE)
```

Arguments

filename	Optional. The name of the file to return (after extraction).
path	Local directory to download and extract files. Default is a temp folder.
load	Logical. If TRUE, returns a loaded object (RasterLayer for .tif, sf for .shp). Default is FALSE.

Value

File path or loaded object if 'load = TRUE'.

Examples

```
# Download example data and list contents
data_dir <- get_external_data(path = tempdir())
list.files(data_dir)

# Load a specific raster file (.tif)
pre_fire <- get_external_data("NBRpre.tif", path = tempdir(), load = TRUE)
print(pre_fire)

# Load a specific shapefile (.shp)
shape_data <- get_external_data("shapefile_reference.shp", path = tempdir(), load = TRUE)
print(shape_data)
```

Description

This function calculates various metrics (e.g., Precision, Recall, F1 Score) to quantitatively compare a binary raster (in shapefile format) with a reference vector shape. It provides insights into how well the detected (binary) shape matches the reference shape.

Usage

```
Quality_control(binary_shape, reference_shape, metrics = NULL)
```

Arguments

binary_shape A shapefile (sf object) representing the binary raster (e.g., burn scars).

reference_shape A shapefile (sf object) representing the reference vector shape (e.g., actual burn scars).

metrics A vector of metric names to calculate. If NULL, all available metrics are computed. Available metrics are: - "Precision": The proportion of the detected shape that correctly overlaps the reference. - "Recall": The proportion of the reference shape that is correctly detected. - "F1_Score": The harmonic mean of Precision and Recall, balancing both. - "IoU" (Intersection over Union): The ratio of the intersection area to the union area. - "OS" (Omission Error): The proportion of the reference shape that was missed (1 - Recall). - "US" (Commission Error): The proportion of the detected shape that is false (1 - Precision). - "E" (Overall Error): The combined error of omission and commission. - "SimSize" (Size Similarity): The relative similarity in size between the two shapes. - "Loc" (Location Error): The Euclidean distance between the centroids of the two shapes. - "AFI" (Area Fit Index): The ratio of the intersection area to the difference between total areas. Default is NULL, which computes all metrics.

Value

A data frame containing the computed metrics and their values.

Examples

```
library(sf)
# Create a simple binary shape (square)
binary_shape <- st_as_sf(st_sfc(st_polygon(list(rbind(
  c(0, 0), c(1, 0), c(1, 1), c(0, 1), c(0, 0)
))))))

# Create a reference shape (slightly shifted square)
reference_shape <- st_as_sf(st_sfc(st_polygon(list(rbind(
```

```
c(0.1, 0.1), c(1.1, 0.1), c(1.1, 1.1), c(0.1, 1.1), c(0.1, 0.1)
)))))
```

```
# Apply Quality Control
result <- Quality_control(binary_shape, reference_shape)
print(result)
```

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