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# HIRISE\_api

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HIRISE Api tool

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*HIRISE\_api*

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## HIRISE\_API

### Modules

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*HIRISE\_api.hirise*

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*HIRISE\_api.models*

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*HIRISE\_api.preprocessing*

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*HIRISE\_api.tests*

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## 1.1 HIRISE\_api.hirise

### Modules

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*HIRISE\_api.hirise.Hirise\_Image*

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*HIRISE\_api.hirise.Image\_Client*

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*HIRISE\_api.hirise.utils*

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### 1.1.1 HIRISE\_api.hirise.Hirise\_Image

#### Classes

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<code>HiriseImage(file_name)</code>	Class that creates an HIRISE image object that has specific attributes including latitude longitude
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### 1.1.2 HIRISE\_api.hirise.Image\_Client

#### Classes

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ImageClient()
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### 1.1.3 HIRISE\_api.hirise.utils

#### Functions

LBL_parser(label_url)	Function that parses the .LBL file in NASA's Planetary Data System
append_float_data_without_strip(param, ...)	Function that validates floating point data without stripping the last characters
downloadRange(start_range, end, step)	
file_parameters_list()	Function that returns file parameters list
get_website_data(base_url, page_key[, sub_key])	Function that assistes in wescaping the NASA website
image_map_parameters_list()	Function that returns image mapping parameters list
other_parameters_list()	Function that returns scaling factor, offset, center filter wavelength parameters list
timing_parameters_list()	Function that returns timing parameters list
validate_append_float_data(param, list_of_params)	Function that validates floating point data
viewing_parameters_list()	Function that returns viewing parameters list

## 1.2 HIRISE\_api.models



## Modules

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*HIRISE\_api.models.Affinity\_Propagation*

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*HIRISE\_api.models.Agglomerative\_Clustering*

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*HIRISE\_api.models.BIRCH*

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*HIRISE\_api.models.DBSCAN*

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*HIRISE\_api.models.Ensemble\_Models*

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*HIRISE\_api.models.HDBSCAN*

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*HIRISE\_api.models.KMeans*

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*HIRISE\_api.models.Mean\_Shift*

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*HIRISE\_api.models.OPTICS*

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*HIRISE\_api.models.metrics*

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*HIRISE\_api.models.utils*

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### 1.2.1 HIRISE\_api.models.Affinity\_Propagation

#### Functions

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<code>affinity_propagation_analysis(...[, plot, ...])</code>	Function that uses as input the encoded image samples and clusters the data using affinity propogation.
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### 1.2.2 HIRISE\_api.models.Agglomerative\_Clustering

#### Functions

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<code>agglomerative_clustering_analysis(...[, ...])</code>	Function that uses as input the encoded image samples and clusters the data using aglomerative clustering.
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### 1.2.3 HIRISE\_api.models.BIRCH

#### Functions

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BIRCH_analysis(encoded_samples, ...[, plot, ...])	Function that uses as input the encoded image samples and clusters the data using affinity propagation.
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### 1.2.4 HIRISE\_api.models.DBSCAN

#### Functions

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DBSCAN_analysis(encoded_samples, true_labels)	Function that uses as input the encoded image samples and clusters the data using Density-based spatial clustering of applications with noise.
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### 1.2.5 HIRISE\_api.models.Ensemble\_Models

#### Functions

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ensemble_model(encoded_data, labels, ...[, ...])	
evaluate_model(model, translation_dataframe, ...)	Function that uses cross-validation and evaluates the stacking model.
get_models([discovery])	Function that defines specified models as an input to the ensemble model.
get_stacking([discovery, all_models])	Function that stacks specified models together as an input to the ensemble model.

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#### Classes

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AgglomerativeClusteringWrapper([n_clusters, ...])	
DBSCANWrapper([eps, min_samples, metric, ...])	
HDBSCANWrapper([min_cluster_size, ...])	
OpticsWrapper(*[, min_samples, max_eps, ...])	

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### 1.2.6 HIRISE\_api.models.HDBSCAN

#### Functions

HDBSCAN_analysis(encoded_samples[, ...])	Function that uses as input the encoded image samples and clusters the data using Hierarchical Density-based spatial clustering of applications with noise. The user must specify only the minimum samples, which is the tuning parameters for HDBSCAN.
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### 1.2.7 HIRISE\_api.models.KMeans

#### Functions

kmeans_analysis(encoded_samples[, clusters, ...])	Function that uses as input the encoded image samples and clusters the data using K Means clustering of applications with noise.
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### 1.2.8 HIRISE\_api.models.Mean\_Shift

#### Functions

mean_shift_analysis(encoded_samples[, plot, ...])	Function that uses as input the encoded image samples and clusters the data using Mean Shift Clustering Method.
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### 1.2.9 HIRISE\_api.models.OPTICS

#### Functions

OPTICS_analysis(dataframe[, eps, ...])	Function that uses as input the encoded image samples and clusters the data using Ordering Points To Identify Cluster Structure Method.
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### 1.2.10 HIRISE\_api.models.metrics

**Functions**

<code>calculate_metrics(model, labels[, verbose])</code>	Function that calculates metrics including, rand score, adjusted rand score, mutual information score, normalized mutual information score, adjusted mutual information score, balanced accuracy score, completeness score, homogeneity score and v-score for a given model.
<code>classification_metrics_dataframe(model_list, ...)</code>	Function that creates a metrics dataframe based on the calculated metrics for each model in the model list specified by the user.
<code>generate_precision_dataframe(folder_path, ...)</code>	Function that returns a generated dataframe of all the precision values evaluated for a true and predicted labels after classification analysis on a dataset.
<code>print_confusion_matrix(folder_path, ...[, ...])</code>	Function that prints the confusion matrix metric for a given set of image clustering results and the associated images.

**1.2.11 HIRISE\_api.models.utils****Functions**

<code>elbow_curve(encoded_samples[, max_values, ...])</code>
<code>generate_precision_dataframe(folder_path, ...)</code>
<code>translate_labels(translation_list, model_results)</code>

**1.3 HIRISE\_api.preprocessing****Modules**

<code><i>HIRISE_api.preprocessing.Data_Preparation</i></code>
<code><i>HIRISE_api.preprocessing.Dimension_Reduction</i></code>
<code><i>HIRISE_api.preprocessing.Encoding</i></code>
<code><i>HIRISE_api.preprocessing.Image_Loader</i></code>
<code><i>HIRISE_api.preprocessing.utils</i></code>

### 1.3.1 HIRISE\_api.preprocessing.Data\_Preparation

#### Classes

DataPreparation()	Class that allows for data preparation as part of the preprocessing of the hirise images.
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### 1.3.2 HIRISE\_api.preprocessing.Dimension\_Reduction

#### Functions

PCA_analysis(encoded_samples, labels[, ...])	The PCA analysis allows the user to understand different aspects of the PCA method.
TSNE_analysis(encoded_samples, labels[, ...])	The T-SNE analysis allows the user to understand different aspects of the TSNE method. The user can choose to plot the 2D and 3D visualisations.
UMAP_analysis(encoded_samples[, components, ...])	The UMAP analysis allows the user to understand different aspects of the UMAP method.

### 1.3.3 HIRISE\_api.preprocessing.Encoding

#### Functions

create_encoded_samples_dataframe(folder_path)	Function that uses the autoencoder to encode the samples and return an encoded samples dataframe to the user based on latent dimensions input by the user
plot_autoencoder_results(encoder, decoder, ...)	Function that plots the original and reconstructed images from the autoencoder results
test_batches(encoder, decoder, device, ...)	Function that is used to test the Convolutional Autoencoder and return the mean loss, averaged over all input batches.
train_CAE(encoder, decoder, device, ...)	Function that is used to train using a single batch input into the autoencoder.
train_batches(encoder, decoder, device, ...)	Function that is used to train the Convolutional Autoencoder and return the mean loss, averaged over all input batches.
transfer_learning_encoding(folder_path[, ...])	The Transfer learning function takes in the folder path of the images to

**Classes**

CAEDecoder(encoded_space_dim, fc2_input_dim)	Class that supports functions needed to define the architecture and forward functions of the decoder in the Convolutional Autoencoder
CAEEncoder(encoded_space_dim, fc2_input_dim)	Class that supports functions needed to define the architecture and forward functions of the encoder in the Convolutional Autoencoder

**1.3.4 HIRISE\_api.preprocessing.Image\_Loader****Functions**

generate_dataloaders(folder_path[, transform])	Function that generates the dataloaders for a HIRISE dataset, given folder path specified by the user
generate_dataset(folder_path[, transform])	Function that generated the HIRISE Dataset given a folderpath of HIRISE Images
initialize_encoder_decoder([latent_dimensions])	Fuction that initialized the encoder and decoder depeining on the latent
show_classes(folder_path[, transform, ...])	Function that shows all classes defined by the user though the Image Folders using the Image Folder dataset
show_encoder_decoder_image_sizes(folder_path)	Function that returns the input and output image sizes of images that have been through the autoencoding process

**Classes**

HiriseImageDataset(path_to_images[, transform])	Hirise Image Dataset Class that initialize the pytorch ImageLoader Dataset with the folder images to return and image and associated folder name( label)
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**1.3.5 HIRISE\_api.preprocessing.utils****Functions**

create_image_list(file_path[, transform])	Function that creates a list of all the images in the specified folder in a PIL format
display_all_images(file_path, ...[, ...])	Function to display all the image in the folder in a flat rasterfied format.
display_image_distributions(image_file_path, ...)	Function to display all the image in the folder as images on a distributed map using TSNE,UMAP or PCA as the preprocessing function
normalize_results(encoded_samples)	Function that is used to normalize the values of the encoded samples.
read_encoded_csv(file_path[, autoencoder])	
show_cluster_images(image_file_path, ...[, ...])	Prints the image in a specified cluster, in the form of a grid with rows and columns specified by the user

## 1.4 HIRISE\_api.tests

### Modules

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*HIRISE\_api.tests.test\_hirise*

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*HIRISE\_api.tests.test\_models*

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*HIRISE\_api.tests.test\_preprocessing*

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### 1.4.1 HIRISE\_api.tests.test\_hirise

#### Functions

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test\_database\_exists()

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test\_filter\_center\_latlon()

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test\_get\_all\_parameters()

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test\_get\_images()

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test\_get\_individual\_parameters()

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### 1.4.2 HIRISE\_api.tests.test\_models

#### Functions

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test\_clustering\_results()

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test_metrics_function()	Test if metrics function returns all 9 metrics output as expected
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test_translate_labels()	Test if label translation function for classification metrics translated user defined labels as expected
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### 1.4.3 HIRISE\_api.tests.test\_preprocessing

#### Functions

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test_autoencoder()	Test if output size of the auto-encoded image is as expected
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test_pca_dimension_reduction()	Test if output of PCA Analysis is as expected
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test_tsne_dimension_reduction()	Test if output of TSNE Analysis is as expected
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test_umap_dimension_reduction()	Test if output of UMAP analysis is as expected
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