kenchi Documentation

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Contents:

CHAPTER 1

kenchi package

1.1 Subpackages

1.1.1 kenchi.datasets package

1.1.1.1 Submodules

kenchi.datasets.base module

kenchi.datasets.base.**load_wdbc**(*contamination=0.0272*, *random_state=None*, *shuffle=True*)

Load and return the breast cancer wisconsin dataset.

contamination [float, default 0.0272] Proportion of outliers in the data set.

random_state [int, RandomState instance, default None] Seed of the pseudo random number generator.

shuffle [bool, default True] If True, shuffle samples.

Returns

- **X** (*ndarray of shape (n_samples, n_features)*) – Data.
- **y** (*ndarray of shape (n_samples,)*) – Return -1 (malignant) for outliers and +1 (benign) for inliers.

References

kenchi.datasets.base.**load_pendigits**(*contamination=0.002*, *random_state=None*, *shuffle=True*)

Load and return the pendigits dataset.

contamination [float, default 0.002] Proportion of outliers in the data set.

random_state [int, RandomState instance, default None] Seed of the pseudo random number generator.

shuffle [bool, default True] If True, shuffle samples.

Returns

- **X** (*ndarray of shape (n_samples, n_features)*) – Data.
- **y** (*ndarray of shape (n_samples,)*) – Return -1 (digit 4) for outliers and +1 (otherwise) for inliers.

References

kenchi.datasets.sample_generator module

kenchi.datasets.sample_generator.**make_blobs**(*centers=5*, *center_box=(-10.0, 10.0)*, *cluster_std=1.0*, *contamination=0.02*, *n_features=25*, *n_samples=500*, *random_state=None*, *shuffle=True*)

Generate isotropic Gaussian blobs with outliers.

Parameters

- **centers** (*int or array-like of shape (n_centers, n_features), default 5*) – Number of centers to generate, or the fixed center locations.
- **center_box** (*pair of floats (min, max), default (-10.0, 10.0)*) – Bounding box for each cluster center when centers are generated at random.
- **cluster_std** (*float or array-like of shape (n_centers,), default 1.0*) – Standard deviation of the clusters.
- **contamination** (*float, default 0.02*) – Proportion of outliers in the data set.
- **n_features** (*int, default 25*) – Number of features for each sample.
- **n_samples** (*int, default 500*) – Number of samples.
- **random_state** (*int, RandomState instance, default None*) – Seed of the pseudo random number generator.
- **shuffle** (*bool, default True*) – If True, shuffle samples.

Returns

- **X** (*ndarray of shape (n_samples, n_features)*) – Generated data.
- **y** (*ndarray of shape (n_samples,)*) – Return -1 for outliers and +1 for inliers.

References

1.1.1.2 Module contents

1.1.2 kenchi.outlier_detection package

1.1.2.1 Submodules

kenchi.outlier_detection.angle_based module

class kenchi.outlier_detection.angle_based.**FastABOD**(*algorithm='auto'*, *contamination=0.1*, *leaf_size=30*, *metric='minkowski'*, *novelty=False*, *n_jobs=1*, *n_neighbors=20*, *p=2*, *metric_params=None*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Fast Angle-Based Outlier Detector (FastABOD).

Parameters

- **algorithm** (*str, default 'auto'*) – Tree algorithm to use. Valid algorithms are ['kd_tree'|'ball_tree'|'auto'].
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **leaf_size** (*int, default 30*) – Leaf size of the underlying tree.
- **metric** (*str or callable, default 'minkowski'*) – Distance metric to use.
- **novelty** (*bool, default False*) – If True, you can use predict, decision_function and anomaly_score on new unseen data and not on the training data.
- **n_jobs** (*int, default 1*) – Number of jobs to run in parallel. If -1, then the number of jobs is set to the number of CPU cores.
- **n_neighbors** (*int, default 20*) – Number of neighbors.
- **p** (*int, default 2*) – Power parameter for the Minkowski metric.
- **metric_params** (*dict, default None*) – Additioal parameters passed to the requested metric.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

n_neighbors_
int – Actual number of neighbors used for *kneighbors* queries.

X_
array-like of shape (n_samples, n_features) – Training data.

References

X_

kenchi.outlier_detection.base module

kenchi.outlier_detection.base.**is_outlier_detector**(*estimator*)
Return True if the given estimator is (probably) an outlier detector.

Parameters **estimator** (*object*) – Estimator object to test.

Returns **out** – True if estimator is an outlier detector and False otherwise.

Return type bool

class kenchi.outlier_detection.base.**BaseOutlierDetector**(*contamination=0.1*)
Bases: sklearn.base.BaseEstimator, abc.ABC

Base class for all outlier detectors in kenchi.

References

anomaly_score(*X=None*, *normalize=False*)
Compute the anomaly score for each sample.

Parameters

- **X** (*array-like of shape (n_samples, n_features), default None*) – Data. If None, compute the anomaly score for each training sample.
- **normalize** (*bool, default False*) – If True, return the normalized anomaly score.

Returns **anomaly_score** – Anomaly score for each sample.

Return type array-like of shape (n_samples,)

decision_function(*X=None*, *threshold=None*)
Compute the decision function of the given samples.

Parameters

- **X** (*array-like of shape (n_samples, n_features), default None*) – Data. If None, compute the decision function of the given training samples.
- **threshold** (*float, default None*) – User-provided threshold.

Returns **y_score** – Shifted opposite of the anomaly score for each sample. Negative scores represent outliers and positive scores represent inliers.

Return type array-like of shape (n_samples,)

fit(*X*, *y=None*)
Fit the model according to the given training data.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Training data.
- **y** (*ignored*) –

Returns **self** – Return self.

Return type object

fit_predict(*X*, *y=None*)
Fit the model according to the given training data and predict if a particular training sample is an outlier or not.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Training Data.
- **y** (*ignored*) –

Returns **y_pred** – Return -1 for outliers and +1 for inliers.

Return type array-like of shape (n_samples,)

plot_anomaly_score(*X=None*, *normalize=False*, ***kwargs*)

Plot the anomaly score for each sample.

Parameters

- **X** (*array-like of shape (n_samples, n_features), default None*) – Data. If None, plot the anomaly score for each training samples.
- **normalize** (*bool, default False*) – If True, return the normalized anomaly score.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **bins** (*int, str or array-like, default 'auto'*) – Number of hist bins.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **hist** (*bool, default True*) – If True, plot a histogram of anomaly scores.
- **kde** (*bool, default True*) – If True, plot a gaussian kernel density estimate.
- **title** (*string, default None*) – Axes title. To disable, pass None.
- **xlabel** (*string, default 'Samples'*) – X axis title label. To disable, pass None.
- **xlim** (*tuple, default None*) – Tuple passed to *ax.xlim*.
- **ylabel** (*string, default 'Anomaly score'*) – Y axis title label. To disable, pass None.
- **ylim** (*tuple, default None*) – Tuple passed to *ax.ylim*.
- ****kwargs** (*dict*) – Other keywords passed to *ax.plot*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

plot_roc_curve(*X*, *y*, ***kwargs*)

Plot the Receiver Operating Characteristic (ROC) curve.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*array-like of shape (n_samples,)*) – Labels.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **title** (*string, default 'ROC curve'*) – Axes title. To disable, pass None.
- **xlabel** (*string, default 'FPR'*) – X axis title label. To disable, pass None.

- **ylabel** (*string, default 'TPR'*) – Y axis title label. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *ax.plot*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

predict(*X=None*, *threshold=None*)

Predict if a particular sample is an outlier or not.

Parameters

- **X** (*array-like of shape (n_samples, n_features), default None*) – Data. If None, predict if a particular training sample is an outlier or not.
- **threshold** (*float, default None*) – User-provided threshold.

Returns **y_pred** – Return -1 for outliers and +1 for inliers.

Return type array-like of shape (n_samples,)

kenchi.outlier_detection.clustering_based module

class kenchi.outlier_detection.clustering_based.**MiniBatchKMeans**(*batch_size=100*, *contamination=0.1*, *init='k-means++'*, *init_size=None*, *max_iter=100*, *max_no_improvement=10*, *n_clusters=8*, *n_init=3*, *random_state=None*, *reassignment_ratio=0.01*, *tol=0.0*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Outlier detector using K-means clustering.

Parameters

- **batch_size** (*int, optional, default 100*) – Size of the mini batches.
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **init** (*str or array-like, default 'k-means++'*) – Method for initialization. Valid options are ['k-means++'|'random'].
- **init_size** (*int, default: 3 * batch_size*) – Number of samples to randomly sample for speeding up the initialization.
- **max_iter** (*int, default 100*) – Maximum number of iterations.
- **max_no_improvement** (*int, default 10*) – Control early stopping based on the consecutive number of mini batches that does not yield an improvement on the smoothed inertia. To disable convergence detection based on inertia, set max_no_improvement to None.

- **n_clusters** (*int, default 8*) – Number of clusters.
- **n_init** (*int, default 3*) – Number of initializations to perform.
- **random_state** (*int or RandomState instance, default None*) – Seed of the pseudo random number generator.
- **reassignment_ratio** (*float, default 0.01*) – Control the fraction of the maximum number of counts for a center to be reassigned.
- **tol** (*float, default 0.0*) – Tolerance to declare convergence.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

cluster_centers_
array-like of shape (n_clusters, n_features) – Coordinates of cluster centers.

inertia_
float – Value of the inertia criterion associated with the chosen partition.

labels_
array-like of shape (n_samples,) – Label of each point.

cluster_centers_

inertia_

labels_

score(*X*, *y=None*)
Compute the opposite value of the given data on the K-means objective.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*ignored*) –

Returns **score** – Opposite value of the given data on the K-means objective.

Return type float

kenchi.outlier_detection.density_based module

class kenchi.outlier_detection.density_based.**LOF**(*algorithm='auto', contamination=0.1, leaf_size=30, metric='minkowski', novelty=False, n_jobs=1, n_neighbors=20, p=2, metric_params=None*)
Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Local Outlier Factor.

Parameters

- **algorithm** (*str, default 'auto'*) – Tree algorithm to use. Valid algorithms are ['kd_tree'|'ball_tree'|'auto'].
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.

- **leaf_size** (*int, default 30*) – Leaf size of the underlying tree.
- **metric** (*str or callable, default 'minkowski'*) – Distance metric to use.
- **novelty** (*bool, default False*) – If True, you can use predict, decision_function and anomaly_score on new unseen data and not on the training data.
- **n_jobs** (*int, default 1*) – Number of jobs to run in parallel. If -1, then the number of jobs is set to the number of CPU cores.
- **n_neighbors** (*int, default 20*) – Number of neighbors.
- **p** (*int, default 2*) – Power parameter for the Minkowski metric.
- **metric_params** (*dict, default None*) – Additioal parameters passed to the requested metric.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

negative_outlier_factor_
array-like of shape (n_samples,) – Opposite LOF of the training samples.

n_neighbors_
int – Actual number of neighbors used for *kneighbors* queries.

X_
array-like of shape (n_samples, n_features) – Training data.

References

X_

n_neighbors_

negative_outlier_factor_

kenchi.outlier_detection.distance_based module

class kenchi.outlier_detection.distance_based.**KNN**(*aggregate=False*, *algorithm='auto'*, *contamination=0.1*, *leaf_size=30*, *metric='minkowski'*, *novelty=False*, *n_jobs=1*, *n_neighbors=20*, *p=2*, *metric_params=None*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Outlier detector using k-nearest neighbors algorithm.

Parameters

- **aggregate** (*bool, default False*) – If True, return the sum of the distances from k nearest neighbors as the anomaly score.
- **algorithm** (*str, default 'auto'*) – Tree algorithm to use. Valid algorithms are [‘kd_tree’|’ball_tree’|’auto’].

- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **leaf_size** (*int, default 30*) – Leaf size of the underlying tree.
- **metric** (*str or callable, default 'minkowski'*) – Distance metric to use.
- **novelty** (*bool, default False*) – If True, you can use predict, decision_function and anomaly_score on new unseen data and not on the training data.
- **n_jobs** (*int, default 1*) – Number of jobs to run in parallel. If -1, then the number of jobs is set to the number of CPU cores.
- **n_neighbors** (*int, default 20*) – Number of neighbors.
- **p** (*int, default 2*) – Power parameter for the Minkowski metric.
- **metric_params** (*dict, default None*) – Additioal parameters passed to the requested metric.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

n_neighbors_
int – Actual number of neighbors used for *kneighbors* queries.

X_
array-like of shape (n_samples, n_features) – Training data.

References

X_

class kenchi.outlier_detection.distance_based.**OneTimeSampling**(*contamination=0.1*, *metric='euclidean'*, *novelty=False*, *n_subsamples=20*, *random_state=None*, *metric_params=None*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

One-time sampling.

Parameters

- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **metric** (*str, default 'euclidean'*) – Distance metric to use.
- **novelty** (*bool, default False*) – If True, you can use predict, decision_function and anomaly_score on new unseen data and not on the training data.
- **n_subsamples** (*int, default 20*) – Number of random samples to be used.
- **random_state** (*int, RandomState instance, default None*) – Seed of the pseudo random number generator.

- **metric_params** (*dict, default None*) – Additional parameters passed to the requested metric.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

subsamples_
array-like of shape (n_subsamples,) – Indices of subsamples.

S_
array-like of shape (n_subsamples, n_features) – Subset of the given training data.

References

kenchi.outlier_detection.ensemble module

class kenchi.outlier_detection.ensemble.**IForest**(*bootstrap=False*, *contamination=0.1*, *max_features=1.0*, *max_samples='auto'*, *n_estimators=100*, *n_jobs=1*, *random_state=None*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Isolation forest (iForest).

Parameters

- **bootstrap** (*bool, False*) – If True, individual trees are fit on random subsets of the training data sampled with replacement. If False, sampling without replacement is performed.
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **max_features** (*int or float, default 1.0*) – Number of features to draw from X to train each base estimator.
- **max_samples** (*int ,float or str, default 'auto'*) – Number of samples to draw from X to train each base estimator.
- **n_estimators** (*int, default 100*) – Number of base estimators in the ensemble.
- **n_jobs** (*int*) – Number of jobs to run in parallel. If -1, then the number of jobs is set to the number of CPU cores.
- **random_state** (*int or RandomState instance, default None*) – Seed of the pseudo random number generator.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

estimators_
list – Collection of fitted sub-estimators.

estimators_samples_
int – Subset of drawn samples for each base estimator.

max_samples_
int – Actual number of samples.

References

estimators_

estimators_samples_

max_samples_

kenchi.outlier_detection.reconstruction_based module

class kenchi.outlier_detection.reconstruction_based.**PCA**(*contamination=0.1*, *iterated_power='auto'*, *n_components=None*, *random_state=None*, *svd_solver='auto'*, *tol=0.0*, *whiten=False*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Outlier detector using Principal Component Analysis (PCA).

Parameters

- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **iterated_power** (*int, default 'auto'*) – Number of iterations for the power method computed by svd_solver == 'randomized'.
- **n_components** (*int, float, or string, default None*) – Number of components to keep.
- **random_state** (*int or RandomState instance, default None*) – Seed of the pseudo random number generator.
- **svd_solver** (*string, default 'auto'*) – SVD solver to use. Valid solvers are ['auto'|'full'|'arpack'|'randomized'].
- **tol** (*float, default 0.0*) – Tolerance to declare convergence for singular values computed by svd_solver == 'arpack'.
- **whiten** (*bool, default False*) – When True the *components_* vectors are multiplied by the square root of n_samples and then divided by the singular values to ensure uncorrelated outputs with unit component-wise variances.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

components_
array-like of shape (n_components, n_features) – Principal axes in feature space, representing the directions of maximum variance in the data.

explained_variance_
array-like of shape (n_components,) – Amount of variance explained by each of the selected components.

explained_variance_ratio_
array-like of shape (n_components,) – Percentage of variance explained by each of the selected components.

mean_
array-like of shape (n_features,) – Per-feature empirical mean, estimated from the training set.

noise_variance_
float – Estimated noise covariance following the Probabilistic PCA model from Tipping and Bishop 1999.

n_components_
int – Estimated number of components.

singular_values_
array-like of shape (n_components,) – Singular values corresponding to each of the selected components.

components_

explained_variance_

explained_variance_ratio_

mean_

n_components_

noise_variance_

score(*X*, *y=None*)
Compute the mean log-likelihood of the given data.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*ignored*) –

Returns **score** – Mean log-likelihood of the given data.

Return type float

singular_values_

kenchi.outlier_detection.statistical module

class kenchi.outlier_detection.statistical.**GMM**(*contamination=0.1*, *covariance_type='full'*, *init_params='kmeans'*, *max_iter=100*, *means_init=None*, *n_components=1*, *n_init=1*, *precisions_init=None*, *random_state=None*, *reg_covar=1e-06*, *tol=0.001*, *warm_start=False*, *weights_init=None*)
Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Outlier detector using Gaussian Mixture Models (GMMs).

Parameters

- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.

- **covariance_type** (*str, default 'full'*) – String describing the type of covariance parameters to use. Valid options are ['full'|'tied'|'diag'|'spherical'].
- **init_params** (*str, default 'kmeans'*) – Method used to initialize the weights, the means and the precisions. Valid options are ['kmeans'|'random'].
- **max_iter** (*int, default 100*) – Maximum number of iterations.
- **means_init** (*array-like of shape (n_components, n_features), default None*) – User-provided initial means.
- **n_init** (*int, default 1*) – Number of initializations to perform.
- **n_components** (*int, default 1*) – Number of mixture components.
- **precisions_init** (*array-like, default None*) – User-provided initial precisions.
- **random_state** (*int or RandomState instance, default None*) – Seed of the pseudo random number generator.
- **reg_covar** (*float, default 1e-06*) – Non-negative regularization added to the diagonal of covariance.
- **tol** (*float, default 1e-03*) – Tolerance to declare convergence.
- **warm_start** (*bool, default False*) – If True, the solution of the last fitting is used as initialization for the next call of *fit*.
- **weights_init** (*array-like of shape (n_components,), default None*) – User-provided initial weights.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

converged_
bool – True when convergence was reached in *fit*, False otherwise.

covariances_
array-like – Covariance of each mixture component.

lower_bound_
float – Log-likelihood of the best fit of EM.

means_
array-like of shape (n_components, n_features) – Mean of each mixture component.

n_iter_
int – Number of step used by the best fit of EM to reach the convergence.

precisions_
array-like – Precision matrix for each component in the mixture.

precisions_cholesky_
array-like – Cholesky decomposition of the precision matrices of each mixture component.

weights_
array-like of shape (n_components,) – Weight of each mixture components.

converged_

covariances_

lower_bound_

means_

n_iter_

precisions_

precisions_cholesky_

score(*X*, *y=None*)
Compute the mean log-likelihood of the given data.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*ignored.*) –

Returns **score** – Mean log-likelihood of the given data.

Return type float

weights_

class kenchi.outlier_detection.statistical.**HBOS**(*bins='auto'*, *contamination=0.1*, *novelty=False*)
Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Histogram-based outlier detector.

Parameters

- **bins** (*int, str or array-like, default 'auto'*) – Number of hist bins.
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **novelty** (*bool, default False*) – If True, you can use predict, decision_function and anomaly_score on new unseen data and not on the training data.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

bin_edges_
array-like – Bin edges.

bin_widths_
array-like – Bin widths.

data_min_
array-like of shape (n_features,) – Per feature minimum seen in the data.

data_max_
array-like of shape (n_features,) – Per feature maximum seen in the data.

hist_
array-like of shape (n_features, bins) – Values of the histogram.

X_
array-like of shape (n_samples, n_features) – Training data.

References

class kenchi.outlier_detection.statistical.**KDE**(*algorithm='auto'*, *atol=0.0*, *bandwidth=1.0*, *breadth_first=True*, *contamination=0.1*, *kernel='gaussian'*, *leaf_size=40*, *metric='euclidean'*, *rtol=0.0*, *metric_params=None*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Outlier detector using Kernel Density Estimation (KDE).

Parameters

- **algorithm** (*str, default 'auto'*) – Tree algorithm to use. Valid algorithms are ['kd_tree'|'ball_tree'|'auto'].
- **atol** (*float, default 0.0*) – Desired absolute tolerance of the result.
- **bandwidth** (*float, default 1.0*) – Bandwidth of the kernel.
- **breadth_first** (*bool, default True*) – If true, use a breadth-first approach to the problem. Otherwise use a depth-first approach.
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **kernel** (*str, default 'gaussian'*) – Kernel to use. Valid kernels are ['gaussian'|'tophat'|'epanechnikov'|'exponential'|'linear'|'cosine'].
- **leaf_size** (*int, default 40*) – Leaf size of the underlying tree.
- **metric** (*str, default 'euclidean'*) – Distance metric to use.
- **rtol** (*float, default 0.0*) – Desired relative tolerance of the result.
- **metric_params** (*dict, default None*) – Additional parameters to be passed to the requested metric.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

X_
array-like of shape (n_samples, n_features) – Training data.

X_

score(*X*, *y=None*)
Compute the mean log-likelihood of the given data.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*ignored*) –

Returns **score** – Mean log-likelihood of the given data.

Return type float

class kenchi.outlier_detection.statistical.**SparseStructureLearning**(*alpha=0.01*, *assume_centered=False*, *contamination=0.1*, *enet_tol=0.0001*, *max_iter=100*, *mode='cd'*, *tol=0.0001*, *apcluster_params=None*)

Bases: *kenchi.outlier_detection.base.BaseOutlierDetector*

Outlier detector using sparse structure learning.

Parameters

- **alpha** (*float, default 0.01*) – Regularization parameter.
- **assume_centered** (*bool, default False*) – If True, data are not centered before computation.
- **contamination** (*float, default 0.1*) – Proportion of outliers in the data set. Used to define the threshold.
- **enet_tol** (*float, default 1e-04*) – Tolerance for the elastic net solver used to calculate the descent direction. This parameter controls the accuracy of the search direction for a given column update, not of the overall parameter estimate. Only used for mode='cd'.
- **max_iter** (*integer, default 100*) – Maximum number of iterations.
- **mode** (*str, default 'cd'*) – Lasso solver to use: coordinate descent or LARS.
- **tol** (*float, default 1e-04*) – Tolerance to declare convergence.
- **apcluster_params** (*dict, default None*) – Additional parameters passed to *sklearn.cluster.affinity_propagation*.

anomaly_score_
array-like of shape (n_samples,) – Anomaly score for each training data.

threshold_
float – Threshold.

covariance_
array-like of shape (n_features, n_features) – Estimated covariance matrix.

graphical_model_
networkx Graph – GGM.

isolates_
array-like of shape (n_isolates,) – Indices of isolates.

labels_
array-like of shape (n_features,) – Label of each feature.

location_
array-like of shape (n_features,) – Estimated location.

n_iter_
int – Number of iterations run.

partial_corrcoef_
array-like of shape (n_features, n_features) – Partial correlation coefficient matrix.

precision_
array-like of shape (n_features, n_features) – Estimated pseudo inverse matrix.

References

covariance_

featurewise_anomaly_score(*X*)
Compute the feature-wise anomaly scores for each sample.

Parameters **X** (*array-like of shape (n_samples, n_features)*) – Data.

Returns **anomaly_score** – Feature-wise anomaly scores for each sample.

Return type array-like of shape (n_samples, n_features)

graphical_model_

isolates_

labels_

location_

n_iter_

partial_corrcoef_

plot_graphical_model(***kwargs*)
Plot the Gaussian Graphical Model (GGM).

Parameters

- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **random_state** (*int, RandomState instance, default None*) – Seed of the pseudo random number generator.
- **title** (*string, default 'GGM (n_clusters, n_features, n_isolates)'*) – Axes title. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *nx.draw_networkx*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

plot_partial_corrcoef(***kwargs*)
Plot the partial correlation coefficient matrix.

Parameters

- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **cbar** (*bool, default True.*) – Whether to draw a colorbar.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.

- **title** (*string, default 'Partial correlation'*) – Axes title. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *ax.pcolormesh*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

precision_

score(*X*, *y=None*)

Compute the mean log-likelihood of the given data.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*ignored*) –

Returns **score** – Mean log-likelihood of the given data.

Return type float

1.1.2.2 Module contents

1.2 Submodules

1.2.1 kenchi.pipeline module

kenchi.pipeline.**make_pipeline**(**steps*)

Construct a Pipeline from the given estimators. This is a shorthand for the Pipeline constructor; it does not require, and does not permit, naming the estimators. Instead, their names will be set to the lowercase of their types automatically.

Parameters ***steps** (*list*) – List of estimators.

Returns **p**

Return type *Pipeline*

class kenchi.pipeline.**Pipeline**(*steps*, *memory=None*)

Bases: sklearn.pipeline.Pipeline

Pipeline of transforms with a final estimator.

Parameters

- **steps** (*list*) – List of (name, transform) tuples (implementing fit/transform) that are chained, in the order in which they are chained, with the last object an estimator.
- **memory** (*instance of joblib.Memory or string, default None*) – Used to cache the fitted transformers of the pipeline. By default, no caching is performed. If a string is given, it is the path to the caching directory. Enabling caching triggers a clone of the transformers before fitting. Therefore, the transformer instance given to the pipeline cannot be inspected directly. Use the attribute named_steps or steps to inspect estimators within the pipeline. Caching the transformers is advantageous when fitting is time consuming.

named_steps

dict – Read-only attribute to access any step parameter by user given name. Keys are step names and values are steps parameters.

anomaly_score(*X*, *normalize=False*)
Apply transforms, and compute the anomaly score for each sample with the final estimator.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **normalize** (*bool, default False*) – If True, return the normalized anomaly score.

Returns **anomaly_score** – Anomaly score for each sample.

Return type array-like of shape (n_samples,)

featurewise_anomaly_score(*X*)
Apply transforms, and compute the feature-wise anomaly scores for each sample with the final estimator.

Parameters **X** (*array-like of shape (n_samples, n_features)*) – Data.

Returns **anomaly_score** – Feature-wise anomaly scores for each sample.

Return type array-like of shape (n_samples, n_features)

Raises ValueError

plot_anomaly_score(*X*, ***kwargs*)
Apply transoforms, and plot the anomaly score for each sample with the final estimator.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **bins** (*int, str or array-like, default 'auto'*) – Number of hist bins.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **hist** (*bool, default True*) – If True, plot a histogram of anomaly scores.
- **kde** (*bool, default True*) – If True, plot a gaussian kernel density estimate.
- **title** (*string, default None*) – Axes title. To disable, pass None.
- **xlabel** (*string, default 'Samples'*) – X axis title label. To disable, pass None.
- **xlim** (*tuple, default None*) – Tuple passed to *ax.xlim*.
- **ylabel** (*string, default 'Anomaly score'*) – Y axis title label. To disable, pass None.
- **ylim** (*tuple, default None*) – Tuple passed to *ax.ylim*.
- ****kwargs** (*dict*) – Other keywords passed to *ax.plot*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

plot_graphical_model
Apply transforms, and plot the Gaussian Graphical Model (GGM) with the final estimator.

Parameters

- **ax** (*matplotlib Axes, default None*) – Target axes instance.

- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **random_state** (*int, RandomState instance, default None*) – Seed of the pseudo random number generator.
- **title** (*string, default 'GGM (n_clusters, n_features, n_isolates)'*) – Axes title. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *nx.draw_networkx*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

plot_partial_corrcoef

Apply transforms, and plot the partial correlation coefficient matrix with the final estimator.

Parameters

- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **cbar** (*bool, default True.*) – Whether to draw a colorbar.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **title** (*string, default 'Partial correlation'*) – Axes title. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *ax.pcolormesh*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

plot_roc_curve (*X*, *y*, ***kwargs*)

Apply transoforms, and plot the Receiver Operating Characteristic (ROC) curve with the final estimator.

Parameters

- **X** (*array-like of shape (n_samples, n_features)*) – Data.
- **y** (*array-like of shape (n_samples,)*) – Labels.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **title** (*string, default 'ROC curve'*) – Axes title. To disable, pass None.
- **xlabel** (*string, default 'FPR'*) – X axis title label. To disable, pass None.
- **ylabel** (*string, default 'TPR'*) – Y axis title label. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *ax.plot*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

1.2.2 kenchi.visualization module

kenchi.visualization.**plot_anomaly_score**(*anomaly_score*, *ax=None*, *bins='auto'*, *figsize=None*, *filename=None*, *hist=True*, *kde=True*, *threshold=None*, *title=None*, *xlabel='Samples'*, *xlim=None*, *ylabel='Anomaly score'*, *ylim=None*, ***kwargs*)

Plot the anomaly score for each sample.

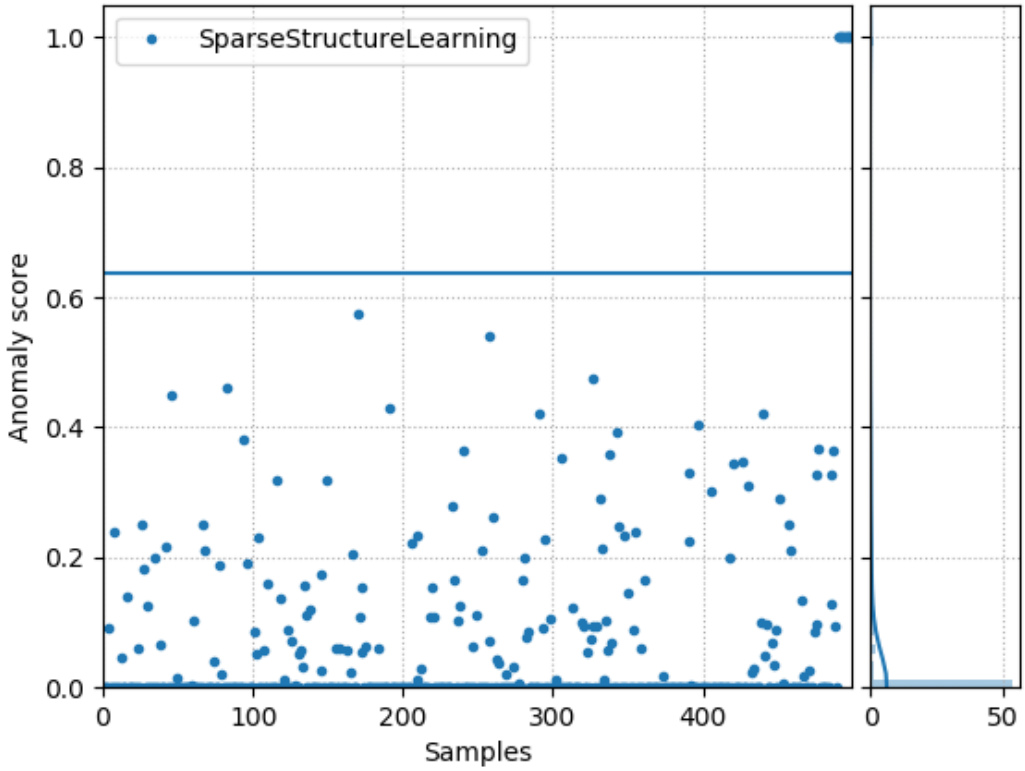
Parameters

- **anomaly_score** (*array-like of shape (n_samples,)*) – Anomaly score for each sample.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **bins** (*int, str or array-like, default 'auto'*) – Number of hist bins.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **hist** (*bool, default True*) – If True, plot a histogram of anomaly scores.
- **kde** (*bool, default True*) – If True, plot a gaussian kernel density estimate.
- **threshold** (*float, default None*) – Threshold.
- **title** (*string, default None*) – Axes title. To disable, pass None.
- **xlabel** (*string, default 'Samples'*) – X axis title label. To disable, pass None.
- **xlim** (*tuple, default None*) – Tuple passed to *ax.xlim*.
- **ylabel** (*string, default 'Anomaly score'*) – Y axis title label. To disable, pass None.
- **ylim** (*tuple, default None*) – Tuple passed to *ax.ylim*.
- ****kwargs** (*dict*) – Other keywords passed to *ax.plot*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

Examples



kenchi.visualization.**plot_roc_curve**(*y_true*, *y_score*, *ax=None*, *figsize=None*, *filename=None*, *title='ROC curve'*, *xlabel='FPR'*, *ylabel='TPR'*, ***kwargs*)

Plot the Receiver Operating Characteristic (ROC) curve.

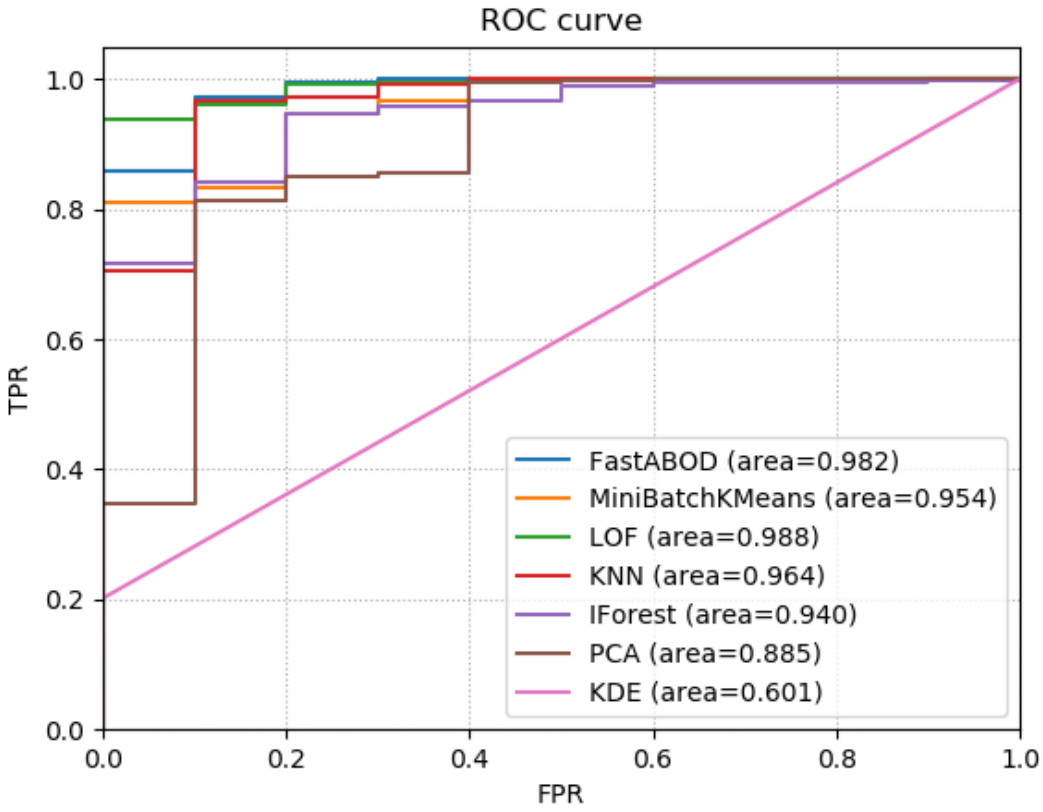
Parameters

- **y_true** (*array-like of shape (n_samples,)*) – True Labels.
- **y_score** (*array-like of shape (n_samples,)*) – Target scores.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **title** (*string, default 'ROC curve'*) – Axes title. To disable, pass None.
- **xlabel** (*string, default 'FPR'*) – X axis title label. To disable, pass None.
- **ylabel** (*string, default 'TPR'*) – Y axis title label. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *ax.plot*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

Examples



kenchi.visualization.**plot_graphical_model**(*G*, *ax=None*, *figsize=None*, *filename=None*, *random_state=None*, *title='GGM'*, ***kwargs*)

Plot the Gaussian Graphical Model (GGM).

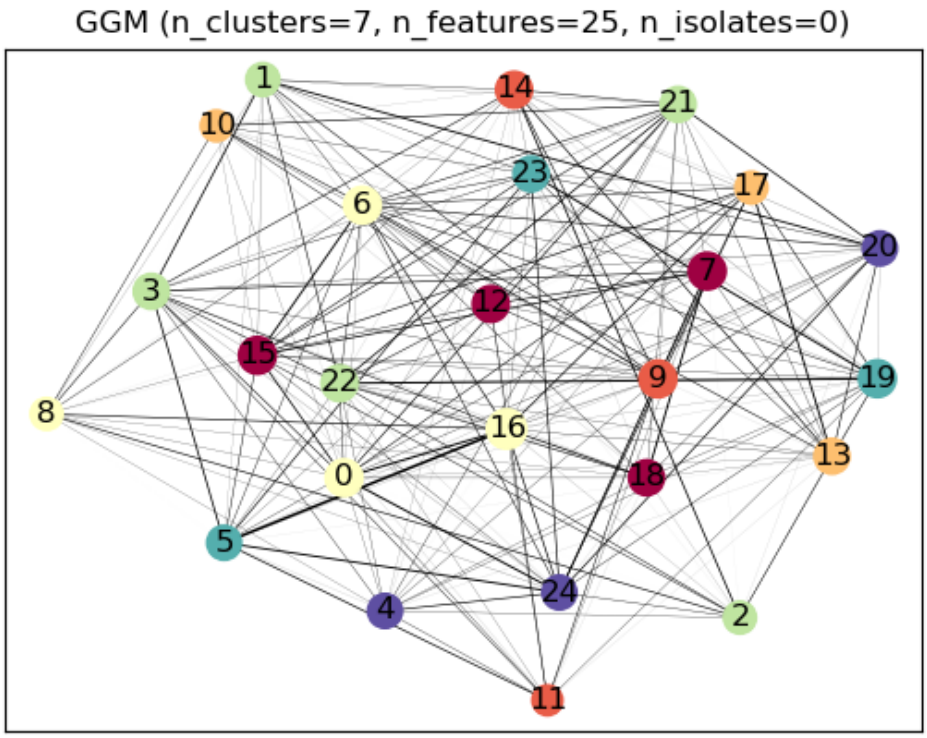
Parameters

- **G** (*networkx Graph*) – GGM.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **random_state** (*int, RandomState instance, default None*) – Seed of the pseudo random number generator.
- **title** (*string, default 'GGM'*) – Axes title. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *nx.draw_networkx*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

Examples



kenchi.visualization.**plot_partial_corrcoef**(*partial_corrcoef*, *ax=None*, *cbar=True*, *figsize=None*, *filename=None*, *title='Partial correlation'*, ***kwargs*)

Plot the partial correlation coefficient matrix.

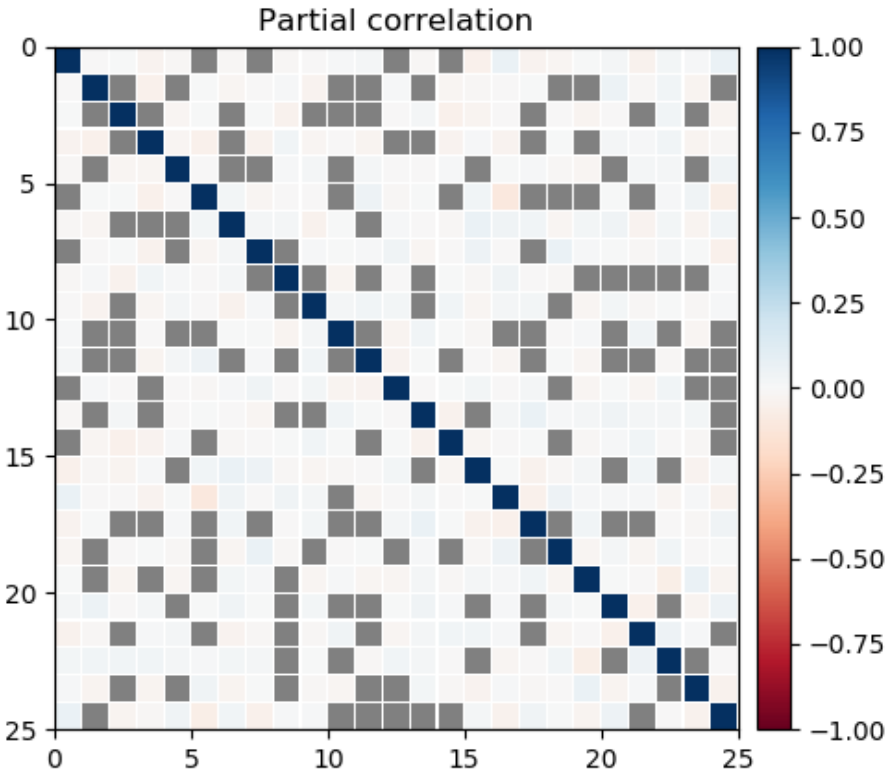
Parameters

- **partial_corrcoef** (*array-like of shape (n_features, n_features)*) – Partial correlation coefficient matrix.
- **ax** (*matplotlib Axes, default None*) – Target axes instance.
- **cbar** (*bool, default True.*) – Whether to draw a colorbar.
- **figsize** (*tuple, default None*) – Tuple denoting figure size of the plot.
- **filename** (*str, default None*) – If provided, save the current figure.
- **title** (*string, default 'Partial correlation'*) – Axes title. To disable, pass None.
- ****kwargs** (*dict*) – Other keywords passed to *ax.pcolormesh*.

Returns **ax** – Axes on which the plot was drawn.

Return type matplotlib Axes

Examples



1.3 Module contents

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