

# MACHINE LEARNING DOCUMENTATION



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Name	ML_Core
Version	3.2.2
Description	Common definitions for Machine Learning
License	<a href="#">See LICENSE.TXT</a>
Copyright	Copyright (C) 2019 HPCC Systems
Authors	HPCCSystems
Platform	6.2.0

## OVERVIEW

### ML\_Core

Core ECL Machine Learning library

Definitions for common types and data manipulation utilities.

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# Analysis

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## IMPORTS

```
__versions.ML_Core.V3_2_2.ML_Core.Types |  
__versions.ML_Core.V3_2_2.ML_Core.Math |
```

## DESCRIPTIONS

### **ANALYSIS** Analysis

	Analysis
--	----------

Analyze and assess the effectiveness of a Machine Learning model.

Sub-modules provide support for both Classification and Regression.

Each of the functions in this module support multi-work-item (i.e. Myriad interface) data, as well as multi-variate data (supported by some ML bundles). The number field, which is usually = 1 for uni-variate data is used to distinguish multiple regressors in the case of multi-variate models.

### Children

1. [Classification](#) : This sub-module provides functions for analyzing and assessing the effectiveness of an ML Classification model
2. [Regression](#) : This sub-module provides functions for analyzing and assessing the effectiveness of an ML Regression model
3. [FeatureSelection](#) : This sub module provides functions for assessing the features of a dataset, to perform feature selection

4. [Clustering](#) : This sub module provides various tests that help evaluate the effectiveness of clustering algorithms

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## **CLASSIFICATION** Classification

[Analysis](#) \

	<b>Classification</b>
--	-----------------------

This sub-module provides functions for analyzing and assessing the effectiveness of an ML Classification model. It can be used with any ML Bundle that supports classification.

### Children

1. [ClassStats](#) : Given a set of expected dependent values, assess the number and percentage of records that were of each class
2. [ConfusionMatrix](#) : Returns the Confusion Matrix, counting the number of cases for each combination of predicted Class and actual Class
3. [Accuracy](#) : Assess the overall accuracy of the classification predictions
4. [AccuracyByClass](#) : Provides per class accuracy / relevance statistics (e.g
5. [AUC](#) : AUC Area under the Receiver Operating Characteristics (ROC) curve, is a measure of how well a classifier is able to distinguish between classes

---

## **CLASSSTATS** ClassStats

[Analysis](#) \ [Classification](#) \

<b>DATASET(Class_Stats)</b>	<b>ClassStats</b>
<b>(DATASET(DiscreteField) actual)</b>	

Given a set of expected dependent values, assess the number and percentage of records that were of each class.

**PARAMETER** **actual** ||| TABLE ( DiscreteField ) — The set of training-data or test-data dependent values in DATASET(DiscreteField) format.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , INTEGER4 classCount , REAL8 classPct } ) — DATASET(Class\_Stats), one record per work-item, per classifier (i.e. number field) per class.

**SEE** ML\_Core.Types.Class\_Stats

---

## CONFUSIONMATRIX ConfusionMatrix

[Analysis \ Classification \](#)

DATASET(Confusion_Detail)	ConfusionMatrix
(DATASET(DiscreteField) predicted, DATASET(DiscreteField) actual)	

Returns the Confusion Matrix, counting the number of cases for each combination of predicted Class and actual Class.

**PARAMETER** **predicted** ||| TABLE ( DiscreteField ) — The predicted values for each id in DATASET(DiscreteField) format.

**PARAMETER** **actual** ||| TABLE ( DiscreteField ) — The actual (i.e. expected) values for each id in DATASET(DiscreteField) format.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 actual\_class , INTEGER4 predict\_class , UNSIGNED4 occurs , BOOLEAN correct , REAL8 pctActual , REAL8 pctPred } ) — DATASET(Confusion\_Detail). One record for each combination of work-item, number (i.e. classifier), predicted class, and actual class.

**SEE** ML\_Core.Types.Confusion\_Detail

---

## ACCURACY Accuracy

[Analysis \ Classification \](#)

<b>DATASET(Classification_Accuracy)</b>	<b>Accuracy</b>
(DATASET(DiscreteField) predicted, DATASET(DiscreteField) actual)	

Assess the overall accuracy of the classification predictions.

ML\_Core.Types.Classification\_Accuracy provides a detailed description of the return values.

**PARAMETER** **predicted** ||| TABLE ( DiscreteField ) — The predicted values for each id in DATASET(DiscreteField) format.

**PARAMETER** **actual** ||| TABLE ( DiscreteField ) — The actual (i.e. expected) values for each id in DATASET(DiscreteField) format.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , UNSIGNED8 recCnt , UNSIGNED8 errCnt , REAL8 Raw\_Accuracy , REAL8 PoD , REAL8 PoDE , REAL8 Hamming\_Loss } ) — DATASET(Classification\_Accuracy). One record for each combination of work-item, and number (i.e. classifier).

**SEE** ML\_Core.Types.Classification\_Accuracy

---

## ACCURACYBYCLASS AccuracyByClass

Analysis \ Classification \

<b>DATASET(Class_Accuracy)</b>	<b>AccuracyByClass</b>
(DATASET(DiscreteField) predicted, DATASET(DiscreteField) actual)	

Provides per class accuracy / relevance statistics (e.g. Precision / Recall, False-positive Rate).

ML\_Core.Types.Class\_Accuracy provides a detailed description of the return values.

**PARAMETER** **predicted** ||| TABLE ( DiscreteField ) — The predicted values for each id in DATASET(DiscreteField) format.

**PARAMETER** **actual** ||| TABLE ( DiscreteField ) — The actual (i.e. expected) values for each id in DATASET(DiscreteField) format.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , REAL8 precision , REAL8 recall , REAL8 FPR , REAL8 f\_score } ) — DATASET(Class\_Accuracy). One record for each combination of work-item, number (i.e. classifier), and class.

**SEE** ML\_Core.Types.Class\_Accuracy

---

## AUC AUC

[Analysis \ Classification \](#)

<b>DATASET(AUC_Result)</b>	<b>AUC</b>
(DATASET(Classification_Scores) scores, DATASET(DiscreteField) actual)	

AUC Area under the Receiver Operating Characteristics (ROC) curve, is a measure of how well a classifier is able to distinguish between classes. The ROC curve is a plot of the true positive rate vs. the false positive rate with varying threshold values. The value of this metric ranges from 0 to 1. Higher values are an indication of better classifiers.

**PARAMETER** scores ||| TABLE ( Classification\_Scores ) — The probability or confidence per class that a sample belongs to that class in DATASET(Classification\_Scores) format

**PARAMETER** actual ||| TABLE ( DiscreteField ) — The actual class to which a sample belongs in DATASET(DiscreteField) format

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , REAL8 auc } ) — DATASET(AUC\_Result) The AUC score, per class, per classifier, per work item

**SEE** ML\_Core.Types.AUC\_Result, ML\_Core.Types.Classification\_Score

---

## REGRESSION Regression

[Analysis \](#)

## Regression

This sub-module provides functions for analyzing and assessing the effectiveness of an ML Regression model. It can be used with any ML Bundle that supports regression.

### Children

1. [Accuracy](#) : Assess the overall accuracy of the regression predictions

---

## ACCURACY Accuracy

[Analysis](#) \ [Regression](#) \

<code>DATASET(Regression_Accuracy)</code>	Accuracy
<code>(DATASET(NumericField) predicted, DATASET(NumericField) actual)</code>	

Assess the overall accuracy of the regression predictions.

`ML_Core.Types.Regression_Accuracy` provides a detailed description of the return values.

**PARAMETER** `predicted` ||| `TABLE ( NumericField )` — The predicted values for each id in `DATASET(NumericField)` format.

**PARAMETER** `actual` ||| `TABLE ( NumericField )` — The actual (i.e. expected) values for each id in `DATASET(NumericField)` format.

**RETURN** `TABLE ( { UNSIGNED2 wi , UNSIGNED4 regressor , REAL8 R2 , REAL8 MSE , REAL8 RMSE } )` — `DATASET(Regression_Accuracy)`. One record for each combination of work-item, and number (i.e. regressor).

**SEE** `ML_Core.Types.Regression_Accuracy`

---

## FEATURESELECTION FeatureSelection

[Analysis](#) \



This sub module provides functions for assessing the features of a dataset, to perform feature selection.

## Children

1. [Contingency](#) : Contingency Provides the contingency table for each combination of feature and sample (classifier)
2. [Chi2](#) : Chi2 Provides Chi2 coefficient and number of degrees of freedom for each combination of feature and classifier

## CONTINGENCY Contingency

[Analysis](#) \ [FeatureSelection](#) \

<code>DATASET(Contingency_Table)</code>	<b>Contingency</b>
<code>(DATASET(DiscreteField) samples, DATASET(DiscreteField) features)</code>	

Contingency Provides the contingency table for each combination of feature and sample (classifier). The contingency table represents the number of samples present in the data for each combination of sample category and feature category. Can only be used when both classifier and feature are discrete. The sets provided need not be sample / feature sets. They can be any two discrete fields whose contingency table is needed.

**PARAMETER** samples ||| TABLE ( DiscreteField ) — The samples or dependent values in DATASET(DiscreteField) format

**PARAMETER** features ||| TABLE ( DiscreteField ) — The features or independent values in DATASET(DiscreteField) format

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 fnumber , UNSIGNED4 snumber , INTEGER4 fclass , INTEGER4 sclass , INTEGER8 cnt } ) —  
DATASET(Contingency\_Table) The contingency table for each combination of sample (classifier) and feature, per work item

**SEE** ML\_Core.Types.Contingency\_Table

## CHI2 Chi2

[Analysis \ FeatureSelection \](#)

<b>DATASET(Chi2_Result)</b>	<b>Chi2</b>
(DATASET(DiscreteField) features, DATASET(DiscreteField) samples)	

Chi2 Provides Chi2 coefficient and number of degrees of freedom for each combination of feature and classifier. Chi squared test is a statistical measure that helps establish the dependence of two categorical variables. In machine learning, it can be used to determine whether a classifier is dependent on a certain feature, and thus helps in feature selection. This test can only be used when both variables are categorical.

**PARAMETER** **samples** ||| TABLE ( DiscreteField ) — The samples or dependent values in DATASET(DiscreteField) format

**PARAMETER** **features** ||| TABLE ( DiscreteField ) — The features or independent values in DATASET(DiscreteField) format

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 fnumber , UNSIGNED4 snumber , INTEGER8 dof , REAL8 x2 , REAL8 p } ) — DATASET(Chi2\_Result) Chi square values and degrees of freedom for each combination of feature and classifier, per work item.

**SEE** ML\_Core.Types.Chi2\_Result

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## CLUSTERING Clustering

[Analysis \](#)

<b>Clustering</b>
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This sub module provides various tests that help evaluate the effectiveness of clustering algorithms.

### Children

1. [ARI](#) : ARI The Rand index is a measure of the similarity between two data clusterings
2. [SampleSilhouetteScore](#) : SampleSilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters

3. **SilhouetteScore** : Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters

## ARI ARI

Analysis \ Clustering \

<b>DATASET(ARI_Result)</b>	<b>ARI</b>
(DATASET(ClusterLabels) predicted, DATASET(ClusterLabels) actual)	

ARI The Rand index is a measure of the similarity between two data clusterings. Adjusted Rand Index (ARI) is a version of rand index which is corrected for chance. This measure assumes values between -1 and 1. It produces values close to zero for random clusterings, values close to 1 for good clusterings and values close to -1 for clusterings that are worse than random guesses.

**PARAMETER** **predicted** ||| TABLE ( ClusterLabels ) — The labels predicted by the model in DATASET(ClusteringLabels) Format

**PARAMETER** **actual** ||| TABLE ( ClusterLabels ) — The actual labels, or the 'Ground Truth' in DATASET(ClusteringLabels) Format

**RETURN** TABLE ( { UNSIGNED2 wi , REAL8 value } ) — DATASET(ARI\_Result) The adjusted rand index per work item

**SEE** ML\_Core.Types.ClusterLabels, ML\_Core.Types.ARI\_Result

## SAMPLESILHOUETTESCORE SampleSilhouetteScore

Analysis \ Clustering \

<b>DATASET(SampleSilhouette_Result)</b>	<b>SampleSilhouetteScore</b>
(DATASET(NumericField) samples, DATASET(ClusterLabels) labels)	

SampleSilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters. It provides an easy way of finding the optimum value for k during k-means clustering. Silhouette values lie in the range of (-1, 1). A value of +1 indicates that the sample point is far away from its neighboring cluster and very close to the cluster to which it is assigned. The euclidian distance metric is used to measure the distances between points.

**PARAMETER** samples ||| TABLE ( NumericField ) — The datapoints / independent data in DATASET(NumericField) format

**PARAMETER** labels ||| TABLE ( ClusterLabels ) — The labels assigned to these datapoints in DATASET(ClusterLabels) format

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , REAL8 value } ) —

**RESULT** DATASET(SampleSilhouette\_Result) The silhouette coefficient per sample, per work item

**SEE** ML\_Core.Types.SampleSilhouette\_Result

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## SILHOUETTESCORE SilhouetteScore

[Analysis](#) \ [Clustering](#) \

<b>DATASET(Silhouette_Result)</b>	<b>SilhouetteScore</b>
(DATASET(NumericField) samples, DATASET(ClusterLabels) labels)	

SilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters. It provides an easy way of finding the optimum value for k during k-means clustering. Silhouette values lie in the range of (-1, 1). A value of +1 indicates that the sample point is far away from its neighboring cluster and very close to the cluster to which it is assigned. The euclidian distance metric is used to measure the distances between points. This function produces an average over SampleSilhouetteScore

**PARAMETER** samples ||| TABLE ( NumericField ) — The datapoints/independent data in DATASET(NumericField) format

**PARAMETER** labels ||| TABLE ( ClusterLabels ) — The labels assigned to these datapoints in DATASET(ClusterLabels) format

**RETURN** TABLE ( { UNSIGNED2 wi , REAL8 score } ) —

**RESULT** DATASET(Silhouette\_Result) The silhouette coefficient per work item

**SEE** ML\_Core.Types.SampleSilhouette\_Result, ML\_Core.Analysis.SampleSilhouetteScore

---

# AppendID

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## DESCRIPTIONS

### **APPENDID** AppendID

<b>/ EXPORT</b>	AppendID
(dIn,idfield,dOut)	

Macro takes any structured dataset, and appends a unique 1-based record ID column to it. Values will not be sequential and values will not be dense because of data skew. Gaps will appear when data ends on each node. If dense and sequential values are required, use AppendSeqID.

Note that, as a macro, nothing is returned, but attribute named in dOut will be defined to contain the resulting dataset.

Example:

```
ML\_Core.AppendID(dOrig, recID, dOrigWithId);
```

**PARAMETER** dIn ||| INTEGER8 — The name of the input dataset.

**PARAMETER** idfield ||| INTEGER8 — The name of the field to be appended containing the id for each row.

**PARAMETER** dOut ||| INTEGER8 — The name of the resulting dataset.

**RETURN** —

---

# AppendSeqID

---

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## DESCRIPTIONS

### **APPENDSEQID** AppendSeqID

- <b>EXPORT</b>	AppendSeqID
(dIn,idfield,dOut)	

Macro takes any structured dataset, and appends a unique 1-based record ID column to it. Values will be in data sequence. Note: implemented as a count project, each node processes the data in series instead of parallel. For better cluster performance, use AppendID as long as dense, sequential ids are not needed.

Note that, as a macro, nothing is returned, but attribute named in dOut will be defined to contain the resulting dataset.

Example:

```
ML\_Core.AppendSeqID(dOrig, recID, dOrigWithId);
```

**PARAMETER** dIn ||| INTEGER8 — The name of the input dataset.

**PARAMETER** idfield ||| INTEGER8 — The name of the field to be appended containing the id for each row.

**PARAMETER** dOut ||| INTEGER8 — The name of the resulting dataset.

**RETURN** —

# Config

---

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## DESCRIPTIONS

### **CONFIG** Config

	Config
--	--------

Global configuration constants that can be modified if needed.

#### Children

1. [MaxLookup](#) : The maximum amount of data to use in a LOOKUP JOIN
  2. [Discrete](#) : The default number of groups to use when discretizing data
  3. [RoundingError](#) : The tolerance for rounding error
- 

### **MAXLOOKUP** MaxLookup

[Config](#) \

	MaxLookup
--	-----------

The maximum amount of data to use in a LOOKUP JOIN.

**RETURN** INTEGER8 —

---



## **DISCRETE** Discrete

[Config \](#)

	<b>Discrete</b>
--	-----------------

The default number of groups to use when discretizing data.

**RETURN** INTEGER8 —

---

## **ROUNDINGERROR** RoundingError

[Config \](#)

	<b>RoundingError</b>
--	----------------------

The tolerance for rounding error.

**RETURN** REAL8 —

---

# Constants

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## DESCRIPTIONS

**CONSTANTS**

 Constants

	Constants
--	-----------

Useful constants used in ML.

### Children

- 1. [Pi](#) : Constant PI
- 2. [Root\\_2](#) : Constant square root of 2

---

**PI** Pi

[Constants \](#)

	Pi
--	----

Constant PI

**RETURN**

 REAL8 —

## ROOT\_2 Root\_2

Constants \

	Root_2
--	--------

Constant square root of 2

RETURN REAL8 —

---

# CrossValidation

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## IMPORTS

```
__versions.ML_Core.V3_2_2.ML_Core |  
__versions.ML_Core.V3_2_2.ML_Core.Types |
```

## DESCRIPTIONS

### **CROSSVALIDATION** CrossValidation

	CrossValidation
--	-----------------

This module is a container for any cross-validation methods

#### Children

1. [NFoldCV](#) :

N-Fold Cross Validation is a way to validate the effectiveness of a regression or classification without having to segregate test data from training data

---

### **NFOLD CV** NFoldCV

[CrossValidation](#) \

<b>NFoldCV</b>
(LearnerName, IndepDS, DepDS, NumFolds)

N-Fold Cross Validation is a way to validate the effectiveness of a regression or classification without having to segregate test data from training data.

The results of the N-Fold Cross Validation approximate the expected result of training on all of the data samples and testing those results on other data from the same distribution.

This allows a model that is built on all available labeled data to be effectively assessed. Note that this process does not produce the target model, but only estimates the 'out-of-sample' error statistics that such a model would produce.

The method is as follows:

- Randomly split independent and dependent data into N (e.g. 10) 'folds'.
- Train N separate models, using N-1 of the folds as training data (e.g. 9).
- Test each model using the 1 fold that was not in the training set.
- Aggregate the test results across the N tests.

Any of the HPCC Machine Learning methods may be used with N-Fold Cross Validation The ML module to be used is passed as a parameter.

N-Fold Cross Validation can be used for regression or classification. If the dependent data is in NumericField format, it is treated as a regression and regression analytics are returned. If it is in DiscreteField format, then it is treated as a Classification, and Classification analytics are return.

Using the wrong dependent data type for the given learner will result in un- handled errors.

The returned MODULE exports the following attributes:

For Classification:

- ClassStats - Assesses Classes Contained in the Training Data (see Types.Class\_Stats).
- Accuracy Overall Accuracy of the classification (see Types.Classification\_Accuracy).
- AccuracyByClass Precision and Recall for each class (see Types.Class\_Accuracy).
- ConfusionMatrix Frequency of predicted / actual class pairings (see Types.Consusion\_Detail).

For Regression:

- Accuracy (see Types.Regression\_Accuracy).

**PARAMETER** LearnerName ||| INTEGER8 — The attribute that holds the instantiated ML module.

**PARAMETER** IndepDS ||| INTEGER8 — The independent data to be used for training and testing.

**PARAMETER** DepDS ||| INTEGER8 — The dependent data to be used for training and testing.

**PARAMETER** NumFolds ||| INTEGER8 — The number of folds to use. Ten is typically considered adequate.

**RETURN** **BOOLEAN** — Result **MODULE** with attributes for assessing the strength of the model.

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# Discretize

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## IMPORTS

`__versions.ML_Core.V3_2_2.ML_Core.Types |`

## DESCRIPTIONS

### **DISCRETIZE** Discretize

	Discretize
--	------------

This module is used to turn a dataset of NumericFields into a dataset of DiscreteFields. This is not quite as trivial as it seems as there are a number of different ways to make the underlying data discrete; and even within one method there may be different parameters. Further - it is quite probable that different methods are going to be desired for each field.

There are two methods of interfacing:

- Call a discretization method directly to apply to all fields.
- Build a set of instructions on how to discretize each field and then call 'Do'.

The record format 'r\_Method is used to build the set of instructions in the latter case.

For each discretization method (e.g. ByRounding), there is a corresponding attribute preceded by 'i\_' that is used to build the r\_Method instruction for using that method (e.g. i\_ByRounding).

Three methods are currently provided:

- ByRounding – Numerically round the number to the nearest integer.

- ByBucketing – Split the range of each variable into a number of evenly spaced buckets.
- ByTiling – Splits the datapoints into an ordered set of equal-sized groups.

## Children

1. [c\\_Method](#) : Enumerate the available discretization methods
2. [r\\_Method](#) : This format is used to construct an 'instruction stream' to allow a dataset to be discretized according to a set of instructions which are in (meta)data
3. [i\\_ByRounding](#) : Construct an instruction (rMethod) that will cause certain fields to be discretized by rounding
4. [ByRounding](#) : Round the values passed in to create a discrete element Scale is applied (by multiplication) first and can be used to bring the data into a desired range (rParam1), Delta is applied (by addition) second and can be used to re-base a range OR to cause truncation or roundup as required (rParam2)
5. [i\\_ByBucketing](#) : Construct an instruction (rMethod) that will cause certain fields to be discretized by bucketing
6. [ByBucketing](#) : Allocates a continuous variable into one of N buckets based upon an equal division of the RANGE of the variable
7. [i\\_ByTiling](#) : Construct an instruction (rMethod) that will cause certain fields to be discretized by tiling
8. [ByTiling](#) : Allocate a continuous variable into one of N groups such that each group (tile) contains roughly the same number of entries and that all of the elements of group 2 have a higher value than group 1, etc
9. [Do](#) : Execute a set of discretization instructions in order to discretize all of the fields of the dataset using the appropriate methods

---

## **C\_METHOD** c\_Method

Discretize \

c_Method
----------

Enumerate the available discretization methods.

**RETURN** UNSIGNED4 —



**VALUE** Rounding = 1

**VALUE** Bucketing = 2

**VALUE** Tiling = 3

---

## R\_METHOD r\_Method

Discretize \

r_Method
----------

This format is used to construct an 'instruction stream' to allow a dataset to be discretized according to a set of instructions which are in (meta)data. It can be created directly, though the preferred method is to call `i_ByRounding(...)`, `i_ByBucketing(...)`, or `i_ByTiling(...)` to create each record.

**FIELD** method ||| UNSIGNED4 — Indicator of the method to use (see `c_method`).

**FIELD** iParam1 ||| INTEGER8 — The first integer parameter to the discretization method.

**FIELD** rParam1 ||| REAL8 — The first real parameter.

**FIELD** rParam2 ||| REAL8 — The second real parameter.

**FIELD** fields ||| SET ( UNSIGNED4 ) — No Doc

---

## I\_BYROUNDING i\_ByRounding

Discretize \

i_ByRounding
--------------

(SET OF Types.t_FieldNumber f, REAL Scale=1.0,REAL Delta=0.0)
---

Construct an instruction (`rMethod`) that will cause certain fields to be discretized by rounding. See `ByRounding` below.

**PARAMETER** f ||| SET ( UNSIGNED4 ) — A set of field numbers to which to apply this method.

**PARAMETER** Scale ||| REAL8 — (Optional) A number by which to multiply each field before rounding.

**PARAMETER** Delta ||| REAL8 — (Optional) An offset that is applied after scaling but before rounding.

**RETURN** TABLE ( r\_Method ) — DATASET(r\_Method) containing one record.

---

## BYROUNDING ByRounding

Discretize \

ByRounding
(DATASET(Types.NumericField) d, REAL Scale=1.0, REAL Delta=0.0)

Round the values passed in to create a discrete element Scale is applied (by multiplication) first and can be used to bring the data into a desired range (rParam1), Delta is applied (by addition) second and can be used to re-base a range OR to cause truncation or roundup as required (rParam2).

**PARAMETER** d ||| TABLE ( NumericField ) — The NumericField dataset to be discretized.

**PARAMETER** Scale ||| REAL8 — (Optional) A number by which to multiply each field before rounding.

**PARAMETER** Delta ||| REAL8 — (Optional) An offset that is applied after scaling but before rounding.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value } ) — DATASET(DiscreteField) containing the discretized dataset.

---

## I\_BYBUCKETING i\_ByBucketing

Discretize \

i_ByBucketing
(SET OF Types.t_FieldNumber f, Types.t_Discrete N=ML_Core.Config.Discrete)

Construct an instruction (rMethod) that will cause certain fields to be discretized by bucketing. See ByBucketing below.

**PARAMETER** f ||| SET ( UNSIGNED4 ) — A set of field numbers to which to apply this method.

**PARAMETER** N ||| INTEGER4 — (Optional) The number of buckets into which to split the range. The default is to use the ML\_Core. Config.Discrete configuration parameter.

**RETURN** TABLE ( r\_Method ) — DATASET(r\_Method) containing one record.

---

## BYBUCKETING ByBucketing

Discretize \

	<b>ByBucketing</b>
	(DATASET(Types.NumericField) d, Types.t_Discrete N=ML_Core.Config.Discrete)

Allocates a continuous variable into one of N buckets based upon an equal division of the RANGE of the variable.

The buckets will NOT have an even number of elements unless the underlying distribution of the variable is uniform.

**PARAMETER** d ||| TABLE ( NumericField ) — The NumericField dataset to be discretized.

**PARAMETER** N ||| INTEGER4 — (Optional) The number of buckets into which to split the range. The default is to use the ML\_Core. Config.Discrete configuration parameter.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value } ) — DATASET(DiscreteField) containing the discretized dataset.

---

## I\_BYTILING i\_ByTiling

Discretize \

<b>i_ByTiling</b>
(SET OF Types.t_FieldNumber f, Types.t_Discrete N=ML_Core.Config.Discrete)

Construct an instruction (rMethod) that will cause certain fields to be discretized by tiling. See ByTiling below.

**PARAMETER** **f** ||| SET ( UNSIGNED4 ) — A set of field numbers to which to apply this method.

**PARAMETER** **N** ||| INTEGER4 — (Optional) The number of tiles into which to split the data. The default is to use the ML\_Core. Config.Discrete configuration parameter.

**RETURN** TABLE ( r\_Method ) — DATASET(r\_Method) containing one record.

## BYTILING ByTiling

Discretize \

<b>ByTiling</b>
(DATASET(Types.NumericField) d, Types.t_Discrete N=ML_Core.Config.Discrete)

Allocate a continuous variable into one of N groups such that each group (tile) contains roughly the same number of entries and that all of the elements of group 2 have a higher value than group 1, etc.

**PARAMETER** **d** ||| TABLE ( NumericField ) — The NumericField dataset to be discretized.

**PARAMETER** **N** ||| INTEGER4 — (Optional) The number of tiles to create. The default is to use the ML\_Core. Config.Discrete configuration parameter.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value } ) — DATASET(DiscreteField) containing the discretized dataset.

## DO Do

Discretize \

<b>Do</b>
<code>(DATASET(Types.NumericField) d, DATASET(r_Method) to_do)</code>

Execute a set of discretization instructions in order to discretize all of the fields of the dataset using the appropriate methods.

Note that the file `d` is read once for each instruction - so it is much better to combine the instructions for multiple fields into one (provided the parameters and method are the same).

**PARAMETER** `d` ||| TABLE ( NumericField ) — The NumericField dataset to be discretized.

**PARAMETER** `to_do` ||| TABLE ( r\_Method ) — The DATASET(`r_Method`) that contains the discretization instructions.

**RETURN** TABLE ( DiscreteField ) — DATASET(DiscreteField) containing the discretized dataset.

---

# FieldAggregates

---

[Go Up](#)

## IMPORTS

```
__versions.ML__Core.V3__2__2.ML__Core.Types |  
__versions.ML__Core.V3__2__2.ML__Core.Utills | std.system.ThorLib |
```

## DESCRIPTIONS

### **FIELDAGGREGATES** FieldAggregates

FieldAggregates
(DATASET(Types.NumericField) d)

Calculate various statistical aggregations of the fields in a NumericField dataset.

**PARAMETER** **d** ||| TABLE ( NumericField ) — The dataset to be aggregated.

### Children

1. [Simple](#) : Calculate basic statistics about each field
2. [SimpleRanked](#) : Calculate the rank (order) of each cell for each field
3. [Medians](#) : Calculate the median value of each field
4. [MinMedNext](#) : No Documentation Found
5. [Buckets](#) : Bucketize the datapoints into N buckets for each field
6. [BucketRanges](#) : Return the ranges associated with each of N buckets as computed by 'Buckets' above

7. [Modes](#) : Calculate the mode (i.e
8. [Cardinality](#) : Returns the cardinality of each field
9. [RankedInput](#) : No Documentation Found
10. [NTiles](#) : Calculate the N-tile of each datapoint within its field
11. [NTileRanges](#) : Return the ranges associated with each of N-tiles as computed by 'Ntiles' above
12. [HistBins](#) : No Documentation Found
13. [HistBinRanges](#) : No Documentation Found
14. [PearsonCorr](#) : No Documentation Found
15. [SpearmanCorr](#) : No Documentation Found
16. [KendallCorr](#) : No Documentation Found
17. [GenSpearman2Corr](#) : No Documentation Found

---

## **SIMPLE** Simple

[FieldAggregates](#) \

	<b>Simple</b>
--	---------------

Calculate basic statistics about each field.

Calculates: min, max, sum, count, mean, variance, and standard deviation for each field.

There are no parameters.

Example:

```
myAggs := FieldAggregates(myDS).simple;
```

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , REAL8 minval , REAL8 maxval , REAL8 sumval , REAL8 countval , REAL8 mean , REAL8 var , REAL8 sd } ) —

---

## **SIMPLERANKED** SimpleRanked

[FieldAggregates](#) \

<b>SimpleRanked</b>
---------------------

Calculate the rank (order) of each cell for each field.

The returned data adds a 'Pos' field to each cell, indicating its rank within it's field number.

There are no parameters.

Example:

```
myRankedDS := FieldAggregates(myDS).SimpleRanked;
```

---

## **MEDIANS** Medians

[FieldAggregates](#) \

<b>Medians</b>
----------------

Calculate the median value of each field.

There are no parameters.

**RETURN** **TABLE** ( { **UNSIGNED2** wi , **UNSIGNED4** number , **REAL8** median } ) —  
DATASET({wi, number, median}), one record per work-item and field number. <p>Example:  
</p><pre>myFieldMedians := FieldAggregates(myDS).Medians;</pre>

---

## **MINMEDNEXT** MinMedNext

[FieldAggregates](#) \

<b>MinMedNext</b>
-------------------



**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , REAL8 median , REAL8 nextval , REAL8 minval , REAL8 maxval , REAL8 sumval , REAL8 countval , REAL8 mean , REAL8 var , REAL8 sd } ) —

## BUCKETS Buckets

FieldAggregates \

	<b>Buckets</b>
	(Types.t_Discrete n)

Bucketize the datapoints into N buckets for each field.

Bucketization splits the range of the data into N equal size range buckets. The data will not normally be evenly split among buckets unless it is uniformly distributed. Contrast this with N-tile, where the data is split nearly evenly.

**PARAMETER** n ||| INTEGER4 — The number of buckets to use.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , UNSIGNED8 Pos , INTEGER4 bucket } ) — DATASET OF {wi, id, number, value, pos, bucket}, where pos is the rank within each field, and bucket is the bucket number.

## BUCKETRANGES BucketRanges

FieldAggregates \

	<b>BucketRanges</b>
	(Types.t_Discrete n)

Return the ranges associated with each of N buckets as computed by 'Buckets' above.

**PARAMETER** n ||| INTEGER4 — The number of buckets.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , INTEGER4 bucket , REAL8 Min , REAL8 Max , UNSIGNED8 cnt } ) — DATASET OF {wi, number, bucket, Min, and Max}, one for each bucket for each field.

---

## **MODES** Modes

[FieldAggregates](#) \

	Modes
--	-------

Calculate the mode (i.e. the most common value) for each field

There are no parameters.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , REAL8 mode , UNSIGNED8 cnt } ) — DATASET OF {wi, number, mode, cnt}, one per field. 'cnt' is the number of times the mode value occurred.

---

## **CARDINALITY** Cardinality

[FieldAggregates](#) \

	Cardinality
--	-------------

Returns the cardinality of each field. That is the number of different values occurring in each field.

There are no parameters.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , UNSIGNED8 cardinality } ) — DATASET OF {wi, number, cardinality}, one per field.

---

## RANKEDINPUT RankedInput

[FieldAggregates](#) \

	RankedInput
--	-------------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , REAL8 Pos } ) —

---

## NTILES NTiles

[FieldAggregates](#) \

	NTiles
(Types.t_Discrete n)	

Calculate the N-tile of each datapoint within its field. For example, if N is 100, we calculate percentiles.

**PARAMETER** n ||| INTEGER4 — The number of groups into which to balance the data

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , REAL8 Pos , INTEGER4 ntile } ) — DATASET OF {wi, id, number, value, pos, ntile}, where pos is the rank within each field.

---

## NTILERANGES NTileRanges

[FieldAggregates](#) \

	NTileRanges
(Types.t_Discrete n)	

Return the ranges associated with each of N-tiles as computed by 'Ntiles' above.

**PARAMETER** n ||| INTEGER4 — The number of N-tile groups.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , INTEGER4 ntile ,  
REAL8 Min , REAL8 Max , UNSIGNED8 cnt } ) — DATASET OF {wi, number, bucket,  
Min, and Max}, one for each N-tile group for each field.

---

## HISTBINS HistBins

[FieldAggregates](#) \

HistBins
(Types.t_Discrete n)

No Documentation Found

**PARAMETER** n ||| INTEGER4 — No Doc

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8  
value , INTEGER4 hbin } ) —

---

## HISTBINRANGES HistBinRanges

[FieldAggregates](#) \

HistBinRanges
(Types.t_Discrete n)

No Documentation Found

**PARAMETER** n ||| INTEGER4 — No Doc

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 number , INTEGER4 hbin ,  
REAL8 Min , REAL8 Max , UNSIGNED8 cnt } ) —

---

## PEARSONCORR PearsonCorr

[FieldAggregates](#) \

	PearsonCorr
--	-------------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 ,  
REAL8 Correl } ) —

---

## SPEARMANCORR SpearmanCorr

[FieldAggregates](#) \

	SpearmanCorr
--	--------------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 ,  
REAL8 Correl } ) —

---

## KENDALLCORR KendallCorr

[FieldAggregates](#) \

	KendallCorr
--	-------------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 ,  
REAL8 Correl } ) —

---

## GENSPEARMAN2CORR GenSpearman2Corr

[FieldAggregates](#) \

	GenSpearman2Corr
(dep = 1)	

No Documentation Found

**PARAMETER** dep ||| INTEGER8 — No Doc

**RETURN** TABLE ( { UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 ,  
REAL8 Correl } ) —

---

# FromField

---

[Go Up](#)

## DESCRIPTIONS

### **FROMFIELD** FromField

<a href="#">/ EXPORT</a>	FromField
(dIn,lOut,dOut,dMap=)	

Macro to convert a NumericField formatted, cell-based dataset to a Record formatted dataset. Typically used to return converted NumericField data back to its original layout.

Note that as a Macro, nothing is returned, but new attributes are created in-line for use in subsequent definitions.

In the simplest case, the assumption is that the field order of the resulting table is in line with the field number in the input dataset, with the ID field as the first field.

For example:

```
myRec := RECORD
  UNSIGNED recordId;
  REAL height;
  REAL weight;
END;
Value of NumericField records with field number = 1 would go to height.
Value of NumericField records with field number = 2 would go to weight.
The id field of the NumericField record would be mapped to the recordId
field of the result.
```

If the field orders have been changed (e.g. by customizing the ToField process, a field-mapping should be specified (See dMap below). Usage Examples:

```
ML.FromField(myNFData, myRecordLayout, myRecordData);  
// Datamap to reorder the weight and height fields in the example above  
dataMap := DATASET([\{'weight', '1'\},  
                    \{'height', '2'\}], Types.Field\_Mapping);  
ML.FromField(nyNFData, myRecordLayout, myRecordData, dataMap);
```

**PARAMETER** dIn ||| INTEGER8 — The name of the input dataset in NumericField format.

**PARAMETER** lOut ||| INTEGER8 — The name of the layout record defining the records of the result dataset.

**PARAMETER** dOut ||| INTEGER8 — The name of the result dataset.

**PARAMETER** dMap ||| INTEGER8 — [OPTIONAL] A Field\\_Mapping dataset as produced by ToField that describes the mapping between field name and field number. The format of this map is defined by Types.Field\\_Mapping.

**RETURN** — Nothing. The MACRO creates new attributes in-line as described above.

**SEE** Types.NumericField

**SEE** Types.Field\\_Mapping

**SEE** ToField



# Generate

---

[Go Up](#)

## IMPORTS

`__versions.ML_Core.V3_2_2.ML_Core.Types |`

## DESCRIPTIONS

### **GENERATE** Generate

	Generate
--	----------

Increase dimensionality by adding polynomial transforms of the data to create new feature columns. This can be useful, for example, when building a linear model against data that may not have linear relationships.

#### Children

1. [tp\\_Method](#) : Enumeration of polynomial methods
2. [MethodName](#) : Convert a column number into a descriptive label
3. [ToPoly](#) : Generate up to seven, successively higher order, features from a single given feature

---

### **TP\_METHOD** [tp\\_Method](#)

[Generate](#) \

	<code>tp_Method</code>
--	------------------------

Enumeration of polynomial methods.

**RETURN** **UNSIGNED1** —

**VALUE**  $\text{LogX} = 1$

**VALUE**  $X = 2$

**VALUE**  $X\text{LogX} = 3$

**VALUE**  $XX = 4 - X \text{ squared}$

**VALUE**  $XX\text{LogX} = 5$

**VALUE**  $XXX = 6 - X \text{ cubed}$

**VALUE**  $XXX\text{LogX} = 7$

**METHODNAME** **MethodName**

Generate \

	<code>MethodName</code>
	<code>(tp_Method x)</code>

Convert a column number into a descriptive label.

**PARAMETER** **x** ||| **UNSIGNED1** — The column number to describe.

**RETURN** **STRING7** — The descriptive label.

## TOPOLY ToPoly

Generate \

	<b>ToPoly</b>
	<code>(DATASET(Types.NumericField) seedCol, UNSIGNED maxN=7)</code>

Generate up to seven, successively higher order, features from a single given feature.

The generated features are:

1. LogX (logs are base 10)
2. X
3. XLogX
4. X<sup>2</sup>
5. X<sup>2</sup>LogX
6. X<sup>3</sup>
7. X<sup>3</sup>LogX

Note that the returned fields will be numbered 1-7, as above.

**PARAMETER** seedCol ||| TABLE ( NumericField ) — A single column of NumericField data. The number field is ignored.

**PARAMETER** maxN ||| UNSIGNED8 — (Optional) The number of new columns to generate. For example: If 1, then one feature, LogX is generated. If 3, then LogX, X, and X<sup>2</sup> features are generated. The default is 7, in which case, all features are generated.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — DATASET(NumericField) with numOriginalRecs \* maxN records.

**SEE** Types.NumericField

# ModelOps2

---

[Go Up](#)

## IMPORTS

`__versions.ML_Core.V3_2_2.ML_Core.Types |`

## DESCRIPTIONS

### **MODELOPS2** ModelOps2

	ModelOps2
--	-----------

This module provides a set of operations to provide manipulation of machine learning models (version 2) in the `Types.Layout_Model2` format.

`Layout_Model2` defines a flexible structure that allows storage of model information for any Machine Learning algorithm.

The model is based on a "Naming Tree" paradigm.

The naming tree is a data structure that allows a hierarchical name (e.g. object-id) to be attached to each data-cell. Examples of naming-trees are OID trees such as those used in various network identifiers such as MIBs.

This structure is used within ML to store model information. It is a useful format for several reasons:

- It has the flexibility to store complex sets of data in a generic way.
- It easily stores scalar as well as matrix oriented data.
- It allows a model to contain data elements within scopes that are defined at different level. For example, part of the model may be defined globally, another may be common for a bundle, while another section is specific to a given module.

- It readily allows composite models to be created by encapsulating entire complex models (or sets of models) within branches of another model. The individual models can then be extracted from the composite model, and passed to the modules that created them.

## Theory of Operation

The naming tree (NT) is conceptually simple. Each cell is identified by a hierarchical numbering scheme of arbitrary depth. Take, for example, the following NT:

```

1
  1.1
    1.1.1
    1.1.2
  1.2
    1.2.1
    1.2.2
2

```

This tree defines the following leaf (scalar) elements: 1.1.1, 1.1.2, 1.2.1, 1.2.2, 2.

Note that the deepest node on any branch is considered a leaf, and branches can be of variable depth. Note also that there is no explicit creation of branch nodes. The branches are implicitly defined by the ids of the leafs.

In this example, node 1.1 can be thought as representing an array, though it could also be thought of as a structure of two distinct scalars, depending on whether the user expects a variable length list under 1.1 (i.e. 1.1.1 - 1.1.N) or a fixed set of cells.

Likewise node 1 can be thought of as a matrix (1.r.c, where r is the row index and c is the column index), in cases where r and c are of variable size.

This naming tree also supports the myriad interface, allowing multiple independent work-items to be represented, each of which may duplicate the same structure.

The id is represented by an ECL SET of Unsigned identifiers (e.g. [1,2,1] represents the OID 1.2.1).

Each cell is defined by three fields: wi (work-item-id), value (the cell contents) and indexes (the id).

A naming tree can be constructed as an inline dataset. For example, the following creates the tree in the example above:

```

DATASET([\{1, 3.2, [1,1,1]\},
        \{1, .0297, [1,1,2]\},
        \{1, 2.0, [1,2,1]\},
        \{1, 1550, [1,2,2]\},

```

```
\{1, 8.1, [2]\}], Layout\_Model2);
```

There are attributes in this module to assist with manipulation of naming trees:

- Creating a NT from a NumericField matrix.
- Extracting a NumericField matrix from an NT branch.
- Inserting an NT onto a branch of another NT.
- Extracting an NT from a branch of an NT.

**SEE** `Types.Layout_Model2`

## Children

1. [Extract](#) : Extract an inner sub-tree from an existing model
2. [ExtendIndices](#) : Extend the indices of a model to fit within a deeper model
3. [Insert](#) : Insert a model into a sub-tree of an existing model
4. [ToNumericField](#) : Convert a two-level model or model sub-tree into a NumericField dataset
5. [FromNumericField](#) : Convert a NumericField dataset to a 2 level model (or model subtree)
6. [GetItem](#) : Get a single record (cell) from a model by index
7. [SetItem](#) : Add a single record (cell) to an model at a given set of coordinates

---

## **EXTRACT** Extract

[ModelOps2](#) \

<code>DATASET(Layout_Model2)</code>	<b>Extract</b>
<code>(DATASET(Layout_Model2) mod, t_indexes fromIndx, t_work_item fromWi=0)</code>	

Extract an inner sub-tree from an existing model.

Work-item = 0 (default) will extract all work-items

This is the opposite of Insert. For example:

If I have a tree:

```
1
2
3
  3.1
  3.2
```

and I extract from index 3, it will return the Naming Tree:

```
1
2
```

containing the two sub-cells of the original index 3

- PARAMETER** mod ||| TABLE ( Layout\_Model2 ) — The model from which to extract the sub-tree.
- PARAMETER** fromIndx ||| SET ( UNSIGNED4 ) — The index from which to extract the subtree.
- PARAMETER** fromWi ||| UNSIGNED2 — The work-item to extract or 0 to extract the same sub-tree from all work-items.

**RETURN** TABLE ( { UNSIGNED2 wi , REAL8 value , SET ( UNSIGNED4 ) indexes } )  
 — A model containing all of the sub-cells below fromIndx with the indexes adjusted to the top of the tree.

## EXTENDINDICES ExtendIndices

ModelOps2 \

<b>DATASET(Layout_Model2)</b>	<b>ExtendIndices</b>
(DATASET(Layout_Model2) mod, t_indexes atIndex)	

Extend the indices of a model to fit within a deeper model.

For example, a cell with index [1,2] could be moved to index [1,2,3,1,2] by using atIndex := [1,2,3].

- PARAMETER** mod ||| TABLE ( Layout\_Model2 ) — The model whose indexes are to be extended.

**PARAMETER** atIndex ||| SET ( UNSIGNED4 ) — The prefix indexes to be prepended to the indexes of each cell in mod.

**RETURN** TABLE ( { UNSIGNED2 wi , REAL8 value , SET ( UNSIGNED4 ) indexes } )  
— A model with extended indexes.

---

## **INSERT** Insert

ModelOps2 \

<code>DATASET(Layout_Model2)</code>	Insert
<code>(DATASET(Layout_Model2) mod1, DATASET(Layout_Model2) mod2, t_indexes atIndex)</code>	

Insert a model into a sub-tree of an existing model.

Extends the indexes of the provided model to fit onto a branch of another model, and concatenates the two models. This is the opposite of extract. For example:

If I have a model:

1  
2

and a second model:

1  
2  
3

That I would like to insert into the first tree at index 3, I would end up with the tree:

1  
2  
3  
  3.1  
  3.2  
  3.3

Example code:

```
mod3 := Insert(mod1, mod2, [3]);
```



**PARAMETER** mod1 ||| TABLE ( Layout\_Model2 ) — The first (base) model.

**PARAMETER** mod2 ||| TABLE ( Layout\_Model2 ) — The sub-model that is to be inserted into mod1.

**PARAMETER** atIndx ||| SET ( UNSIGNED4 ) — The index prefix (in mod1) that will contain the cells from mod2.

**RETURN** TABLE ( Layout\_Model2 ) — a new model containing the cells from both models.

---

## TONUMERICFIELD ToNumericField

ModelOps2 \

<b>DATASET(NumericField)</b>	<b>ToNumericField</b>
(DATASET(Layout_Model2) mod, t_indexes fromIndx = [])	

Convert a two-level model or model sub-tree into a NumericField dataset.

The last two indexes of the model subtree are used as the indexes for the NumericField matrix. The second to last index corresponds to the NF's id field and the last index corresponds to the NF's number field.

**PARAMETER** mod ||| TABLE ( Layout\_Model2 ) — The model from which to extract the NumericField matrix.

**PARAMETER** fromIndx ||| SET ( UNSIGNED4 ) — The index from which to extract the matrix. Example: [3,1,5]. The default is from the top of the tree i.e. [].

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — NumericField matrix in DATASET(NumericField) format.

---

## FROMNUMERICFIELD FromNumericField

ModelOps2 \

<b>DATASET(Layout_Model2)</b>	<b>FromNumericField</b>
(DATASET(NumericField) nf, t_indexes atIndex=[])	

Convert a NumericField dataset to a 2 level model (or model subtree).

A two level model is created and appended to atIndex.

The first new index will contain the value of the NumericField's id field, and the second will contain the value of the NumericField's number field.

Example: If I have a NumericField with id=1 and number=3, and I use atIndex = [3,1,5], it will create a Naming Tree cell with indexes: [3,1,5,1,3].

**PARAMETER** nf ||| TABLE ( NumericField ) — A NumericField dataset to be converted.

**PARAMETER** atIndex ||| SET ( UNSIGNED4 ) — The index at which to place the new subtree e.g., [3,1,5].

**RETURN** TABLE ( { UNSIGNED2 wi , REAL8 value , SET ( UNSIGNED4 ) indexes } )  
— DATASET(ntNumeric) Naming Tree.

## GETITEM GetItem

ModelOps2 \

<b>Layout_Model2</b>	<b>GetItem</b>
(DATASET(Layout_Model2) mod, t_indexes indxs, wi_num=1)	

Get a single record (cell) from a model by index.

**PARAMETER** mod ||| TABLE ( Layout\_Model2 ) — The model (DATASET(layout\_model2)) from which to extract the cell.

**PARAMETER** indxs ||| SET ( UNSIGNED4 ) — The id of the cell to extract (e.g. [3,1,5]).

**PARAMETER** wi\_num ||| INTEGER8 — The work-item number to extract the cell from, default = 1.

**RETURN** ROW ( Layout\_Model2 ) — The model cell (Layout\_Model2) or an empty cell (wi=0) if not found.

## SETITEM SetItem

ModelOps2 \

<b>DATASET(Layout_Model2)</b>	<b>SetItem</b>
(DATASET(Layout_Model2) mod, t_work_item wi, t_indexes indexes, t_fieldReal value)	

Add a single record (cell) to an model at a given set of coordinates.

**PARAMETER** mod ||| TABLE ( Layout\_Model2 ) — The model to which to add a cell.

**PARAMETER** wi ||| UNSIGNED2 — The work-item associated with the cell.

**PARAMETER** indexes ||| SET ( UNSIGNED4 ) — The indices for the cell.

**PARAMETER** value ||| REAL8 — The value of the cell.

**RETURN** TABLE ( Layout\_Model2 ) — Model with the added cell.

---

# ToField

---

[Go Up](#)

## DESCRIPTIONS

### **TOFIELD** ToField

<b>/ EXPORT</b>	<b>ToField</b>
<code>(dIn, dOut, idfield=", wifield=", wivalue=", datafields=)</code>	

Convert a record-oriented dataset to a cell-oriented NumericField dataset for use with Machine Learning mechanisms.

ToField Macro takes a record-oriented dataset, with each row containing an ID and one or more numeric fields, and expands it into the NumericField format used by ML.

Note that as a Macro, nothing is returned, but new attributes are created in-line for use in subsequent definitions.

Along with creating the NumericField table, this macro produces two simple functions to assist the user in mapping the field names to their corresponding numbers. These are "STRING dOut\_ToName(UNSIGNED)" and "UNSIGNED dOut\_ToNumber(STRING)", where the "dOut" portion of the function name is the name passed into that parameter of the macro.

The macro also produces a mapping table named "dOut\_Map", again where "dOut" refers to the parameter, that contains a table of the field mappings. See Types.Field\_Mapping for the layout of this mapping dataset. Examples:

```
ML.ToField(dOrig,dMatrix);
ML.ToField(dOrig,dMatrix,myid,'field5,field7,field10');
dMatrix\_ToName(2);    // returns 'field7'
dMatrix\_ToNumber('field10'); // returns 3
dMatrix\_Map;  // returns the mapping table of field name to number see
               // Types.Field\_Mapping
```

**PARAMETER** dIn ||| INTEGER8 — The name of the input dataset.

**PARAMETER** dOut ||| INTEGER8 — The name of the resulting dataset.

**PARAMETER** idfield ||| INTEGER8 — [OPTIONAL] The name of the field that contains the UID for each row. If omitted, it is assumed to be the first field.

**PARAMETER** wifield ||| INTEGER8 — [OPTIONAL] The name of the field that contains the work item value. A constant is used if the field name is not supplied (as provided by wivalue below).

**PARAMETER** wivalue ||| INTEGER8 — [OPTIONAL] The constant value to use for work item. The value 1 is used if not supplied.

**PARAMETER** datafields ||| INTEGER8 — [OPTIONAL] A STRING containing a comma-delimited list of the fields to be treated as axes. If omitted, all numeric fields that are not the idfield or wifield will be treated as axes. NOTE: idfield defaults to the first field in the table, so if that field is specified as an axis field, then the user should be sure to specify a value in the idfield param.

**RETURN** — Nothing. The MACRO creates new attributes in-line as described above.

**SEE** Types.NumericField

**SEE** Types.Field\_Mapping

# Types

---

[Go Up](#)

## DESCRIPTIONS

### **TYPES** Types

	Types
--	-------

This module provides the major data type definitions for use with the various ML Bundles

#### Children

1. [t\\_RecordID](#) : No Documentation Found
2. [t\\_FieldNumber](#) : No Documentation Found
3. [t\\_FieldReal](#) : No Documentation Found
4. [t\\_FieldSign](#) : No Documentation Found
5. [t\\_Discrete](#) : No Documentation Found
6. [t\\_Item](#) : No Documentation Found
7. [t\\_Count](#) : No Documentation Found
8. [t\\_Work\\_Item](#) : No Documentation Found
9. [t\\_index](#) : No Documentation Found
10. [t\\_indexes](#) : No Documentation Found
11. [AnyField](#) : No Documentation Found
12. [NumericField](#) : The NumericField layout defines a matrix of Real valued data-points
13. [DiscreteField](#) : The Discrete Field layout defines a matrix of Integer valued data-points
14. [Layout\\_Model2](#) : Layout for Model dataset (version 2) Generic Layout describing the model 'learned' by a Machine Learning algorithm

15. [Layout\\_Model](#) : No Documentation Found
  16. [Classify\\_Result](#) : No Documentation Found
  17. [l\\_result](#) : No Documentation Found
  18. [Class\\_Stats](#) : Class\_Stats
  19. [Confusion\\_Detail](#) : Confusion\_Detail
  20. [Classification\\_Accuracy](#) : Classification\_Accuracy
  21. [Class\\_Accuracy](#) : Class\_Accuracy Results layout for Analysis.Classification.AccuracyByClass See [https://en.wikipedia.org/wiki/Precision\\_and\\_recall](https://en.wikipedia.org/wiki/Precision_and_recall) for a more detailed explanation
  22. [AUC\\_Result](#) : AUC\_Result Result layout for Analysis.Classification.AUC
  23. [Regression\\_Accuracy](#) : Regression\_Accuracy
  24. [Contingency\\_Table](#) : Contingency\_Table Contains the contingency table for every combination of feature and classifier
  25. [Chi2\\_Result](#) : Chi2\_Result Result layout for Analysis.FeatureSelection.Chi2 Contains chi2 value for every combination of feature and classifier per work item, and its corresponding p value
  26. [ARI\\_Result](#) : ARI\_Result Result layout for Analysis.Clustering.ARI Contains the Adjusted Rand Index for each work item
  27. [SampleSilhouette\\_Result](#) : SampleSilhouette\_Result Result layout for Analysis.Clustering.SampleSilhouetteScore Contains the silhouette score for each sample datapoint
  28. [Silhouette\\_Result](#) : Silhouette\_Result Result layout for Analysis.Clustering.SilhouetteScore Contains the silhouette score for each work item
  29. [ClusterLabels](#) : ClusterLabels format defines the distance space where each cluster defined by a center and its closest samples
  30. [Data\\_Diagnostic](#) : No Documentation Found
  31. [Field\\_Mapping](#) : Field\_Mapping is the format produced by ToField for field-name mapping
  32. [LUCI\\_Rec](#) : LUCI Record – A dataset of lines each containing a string This is the DATASET format in which ML algorithm export LUCI files
  33. [Classification\\_Scores](#) : Classification\_Scores The probability or confidence, per class, that a sample belongs to that class
-

## **T\_RECORDID** t\_RecordID

Types \

	t_RecordID
--	------------

No Documentation Found

**RETURN** UNSIGNED8 —

---

## **T\_FIELDNUMBER** t\_FieldNumber

Types \

	t_FieldNumber
--	---------------

No Documentation Found

**RETURN** UNSIGNED4 —

---

## **T\_FIELDREAL** t\_FieldReal

Types \

	t_FieldReal
--	-------------

No Documentation Found

**RETURN** REAL8 —

---



## **T\_FIELDSIGN** t\_FieldSign

Types \

	t_FieldSign
--	-------------

No Documentation Found

**RETURN** INTEGER1 —

---

## **T\_DISCRETE** t\_Discrete

Types \

	t_Discrete
--	------------

No Documentation Found

**RETURN** INTEGER4 —

---

## **T\_ITEM** t\_Item

Types \

	t_Item
--	--------

No Documentation Found

**RETURN** UNSIGNED4 —

---

## **T\_COUNT** t\_Count

Types \

	t_Count
--	---------

No Documentation Found

**RETURN** UNSIGNED8 —

---

## **T\_WORK\_ITEM** t\_Work\_Item

Types \

	t_Work_Item
--	-------------

No Documentation Found

**RETURN** UNSIGNED2 —

---

## **T\_INDEX** t\_index

Types \

	t_index
--	---------

No Documentation Found

**RETURN** UNSIGNED4 —

---

## T\_INDEXES t\_indexes

Types \

	t_indexes
--	-----------

No Documentation Found

**RETURN** SET ( UNSIGNED4 ) —

---

## ANYFIELD AnyField

Types \

	AnyField
--	----------

No Documentation Found

**FIELD** wi ||| UNSIGNED2 — No Doc

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** number ||| UNSIGNED4 — No Doc

---

## NUMERICFIELD NumericField

Types \

	NumericField
--	--------------

The NumericField layout defines a matrix of Real valued data-points. It acts as the primary Dataset layout for interacting with most ML Functions. Each record represents a single cell in a matrix. It is most often used to represent a set of data-samples or observations, with the 'id' field representing the data-sample or observation, and the 'number' field representing the various fields within the observation.

**FIELD** wi ||| UNSIGNED2 — The work-item id, supporting the Myriad style interface. This allows multiple independent matrixes to be contained within a single dataset, supporting independent ML activities to be processed in parallel.

**FIELD** id ||| UNSIGNED8 — This field represents the row-number of this cell of the matrix. It is also considered the record-id for observations / data-samples.

**FIELD** number ||| UNSIGNED4 — This field represents the matrix column number for this cell. It is also considered the field number of the observation

**FIELD** value ||| REAL8 — The value of this cell in the matrix.

---

## DISCRETEFIELD DiscreteField

Types \

	DiscreteField
--	---------------

The Discrete Field layout defines a matrix of Integer valued data-points. It is similar to the NumericField layout above, except for only containing discrete (integer) values. It is typically used to convey the class-labels for classification algorithms.

**FIELD** wi ||| UNSIGNED2 — The work-item id, supporting the Myriad style interface. This allows multiple independent matrixes to be contained within a single dataset, supporting independent ML activities to be processed in parallel.

**FIELD** id ||| UNSIGNED8 — This field represents the row-number of this cell of the matrix. It is also considered the record-id for observations / data-samples.

**FIELD** number ||| UNSIGNED4 — This field represents the matrix column number for this cell. It is also considered the field number of the observation

**FIELD** value ||| INTEGER4 — The value of this cell in the matrix.

---

## LAYOUT\_MODEL2 Layout\_Model2

Types \

	Layout_Model2
--	---------------

Layout for Model dataset (version 2) Generic Layout describing the model 'learned' by a Machine Learning algorithm. Models for all new ML bundles are stored in this format. Some older bundles may still use the Layout\_Model (version 1) layout. Models are thought of as opaque data structures. They are not designed to be understandable except to the bundle that produced them. Most bundles contain mechanisms to extract useful information from the model. This version of the model is based on a Naming-Tree paradigm. This provides a flexible generic mechanism for storage and manipulation of models. For bundle developers (or the curious), the file modelOps2 provides a detailed description of the theory and usage of this model layout as well as a set of functions to manipulate models for use by bundle developers.

- FIELD** wi ||| UNSIGNED2 — The work-item-id
- FIELD** value ||| REAL8 — The value of the cell
- FIELD** indexes ||| SET ( UNSIGNED4 ) — The identifier for the cell – a set of unsigned integers e.g., [1,2,1,3]

---

## LAYOUT\_MODEL Layout\_Model

Types \

	Layout_Model
--	--------------

No Documentation Found

- FIELD** wi ||| UNSIGNED2 — No Doc
- FIELD** id ||| UNSIGNED8 — No Doc
- FIELD** number ||| UNSIGNED4 — No Doc
- FIELD** value ||| REAL8 — No Doc

---

## CLASSIFY\_RESULT Classify\_Result

Types \

	Classify_Result
--	-----------------

No Documentation Found

**FIELD** wi ||| UNSIGNED2 — No Doc

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** number ||| UNSIGNED4 — No Doc

**FIELD** value ||| INTEGER4 — No Doc

**FIELD** conf ||| REAL8 — No Doc

---

## **L\_RESULT** l\_result

Types \

<u>l_result</u>
-----------------

No Documentation Found

---

## **CLASS\_STATS** Class\_Stats

Types \

<u>Class_Stats</u>
--------------------

Class\_Stats Layout for data returned from Analysis.Regression.ClassStats

**FIELD** wi ||| UNSIGNED2 — Work-item identifier

**FIELD** classifier ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate classification. Otherwise 1.

**FIELD** class ||| INTEGER4 — The class label associated with this record

**FIELD** classCount ||| INTEGER4 — The number of times the class was seen in the data

**FIELD** classPct ||| REAL8 — The percent of records with this class.

## CONFUSION\_DETAIL Confusion\_Detail

Types \

	Confusion_Detail
--	------------------

Confusion\_Detail Layout for storage of the confusion matrix for ML Classifiers Each row represents a pairing of a predicted class and an actual class

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** classifier ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

**FIELD** actual\_class ||| INTEGER4 — The target class number – the expected result.

**FIELD** predict\_class ||| INTEGER4 — The class number predicted by the ML algorithm

**FIELD** occurs ||| UNSIGNED4 — The number of times this pairing of (actual / predicted) classes occurred

**FIELD** correct ||| BOOLEAN — Boolean indicating if this represents a correct prediction (i.e. predicted = actual)

**FIELD** pctActual ||| REAL8 — The percent of items that were actually of <actual\_class> that were predicted as <predict\_class>.</predict\_class></actual\_class>

**FIELD** pctPred ||| REAL8 — Indicates the percent of items that were predicted as <predict\_class> that were actually of <actual\_class>.</actual\_class></predict\_class>

---

## CLASSIFICATION\_ACCURACY Classification\_Accuracy

Types \

	Classification_Accuracy
--	-------------------------

Classification\_Accuracy Results layout for Analysis.Classification/Accuracy

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** classifier ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

**FIELD** errCnt ||| UNSIGNED8 — The number of errors (i.e. predicted &lt;&gt; actual)

**FIELD** recCnt ||| UNSIGNED8 — The total number or records in the test set

**FIELD** Raw\_Accuracy ||| REAL8 — The percentage of samples properly classified (0.0 - 1.0)

**FIELD** PoD ||| REAL8 — Power of Discrimination. Indicates how this classification performed relative to a random guess of class. Zero or negative indicates that the classification was no better than a random guess. 1.0 indicates a perfect classification. For example if there are two equi-probable classes, then a random guess would be right about 50% of the time. If this classification had a Raw Accuracy of 75%, then its PoD would be .5 (half way between a random guess and perfection).

**FIELD** PoDE ||| REAL8 — Power of Discrimination Extended. Indicates how this classification performed relative to guessing the most frequent class (i.e. the trivial solution). Zero or negative indicates that this classification is no better than the trivial solution. 1.0 indicates perfect classification. For example, if 95% of the samples were of class 1, then the trivial solution would be right 95% of the time. If this classification had a raw accuracy of 97.5%, its PoDE would be .5 (i.e. half way between trivial solution and perfection).

**FIELD** Hamming\_Loss ||| REAL8 — Hamming loss. The percentage of records misclassified. Useful for multilabel classification. It is equal to 1 - Raw\_Accuracy.

---

## **CLASS\_ACCURACY** **Class\_Accuracy**

Types \

<b>Class_Accuracy</b>
-----------------------

Class\_Accuracy Results layout for Analysis.Classification.AccuracyByClass See [https://en.wikipedia.org/wiki/Precision\\_and\\_recall](https://en.wikipedia.org/wiki/Precision_and_recall) for a more detailed explanation.

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** classifier ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

**FIELD** class ||| INTEGER4 — The class to which the analytics apply

**FIELD** precision ||| REAL8 — The precision of the classification for this class (i.e. True Positives / (True Positives + FalsePositives)). What percentage of the items that we predicted as being in this class are actually of this class?

**FIELD** recall ||| REAL8 — The completeness of recall for this class (i.e. True Positives / (True Positives + False Negatives)) What percentage of the items that are actually in this class did we correctly predict as this class?



**FIELD** **FPR** ||| REAL8 — The false positive rate for this class (i.e. False Positives / (False Positives + True Negatives)) What percentage of the items not in this class did we falsely predict as this class?

**FIELD** **f\_score** ||| REAL8 — The balanced F-score for this class (i.e.  $2 * (\text{precision} * \text{recall}) / (\text{precision} + \text{recall})$ ) The harmonic mean of precision and recall. Higher values are better.

---

## **AUC\_RESULT** **AUC\_Result**

Types \

	<b>AUC_Result</b>
--	-------------------

AUC\_Result Result layout for Analysis.Classification.AUC. Provides the area under the Receiver Operating Characteristic curve for the given data. This area is a measure of the classifier's ability to distinguish between classes.

**FIELD** **wi** ||| UNSIGNED2 — Work item identifier

**FIELD** **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

**FIELD** **class** ||| INTEGER4 — The class to which the analytics apply.

**FIELD** **AUC** ||| REAL8 — The value of the Area Under the Receiver Operating Characteristic curve for this class. This value ranges between 0 and 1. A higher value is an indication of a better classifier.

---

## **REGRESSION\_ACCURACY** **Regression\_Accuracy**

Types \

	<b>Regression_Accuracy</b>
--	----------------------------

Regression\_Accuracy Results layout for Analysis.Reggression.Accuracy

**FIELD** **wi** ||| UNSIGNED2 — Work item identifier

**FIELD** regressor ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

**FIELD** R2 ||| REAL8 — The R-Squared value (Coefficient of Determination) for the regression. R-squared of zero or negative indicates that the regression has no predictive value. R2 of 1 would indicate a perfect regression.

**FIELD** MSE ||| REAL8 — Mean Squared Error =  $\text{SUM}((\text{predicted} - \text{actual})^2) / N$  (number of datapoints)

**FIELD** RMSE ||| REAL8 — Root Mean Squared Error =  $\text{MSE}^{.5}$  (Square root of MSE)

---

## CONTINGENCY\_TABLE Contingency\_Table

Types \

Contingency_Table
-------------------

Contingency\_Table Contains the contingency table for every combination of feature and classifier. Result layout for Analysis.FeatureSelection.Contingency

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** fnumber ||| UNSIGNED4 — The feature number

**FIELD** snumber ||| UNSIGNED4 — The sample number or the classifier number

**FIELD** fclass ||| INTEGER4 — The feature label / class

**FIELD** sclass ||| INTEGER4 — The sample (classifier) label / class

**FIELD** cnt ||| INTEGER8 — The number of samples with feature label fclass and classifier label sclass  
Does not contain entries for combinations with no members.

---

## CHI2\_RESULT Chi2\_Result

Types \

Chi2_Result
-------------

Chi2\_Result Result layout for Analysis.FeatureSelection.Chi2 Contains chi2 value for every combination of feature and classifier per work item, and its corresponding p value.

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** fnumber ||| UNSIGNED4 — Feature number

**FIELD** snumber ||| UNSIGNED4 — Sample number / number of classifier

**FIELD** dof ||| INTEGER8 — The number of degrees of freedom

**FIELD** x2 ||| REAL8 — The chi2 value for this combination. Higher values indicate more closely related variables

**FIELD** p ||| REAL8 — The p-value, which is the area under the chi-square probability density function curve to the right of the specified x2 value. The probability that the variables are not closely related

---

## ARI\_RESULT ARI\_Result

Types \

	ARI_Result
--	------------

ARI\_Result Result layout for Analysis.Clustering.ARI Contains the Adjusted Rand Index for each work item.

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** value ||| REAL8 — The ARI for the model

---

## SAMPLESILHOUETTE\_RESULT SampleSilhouette\_Result

Types \

	SampleSilhouette_Result
--	-------------------------

SampleSilhouette\_Result Result layout for Analysis.Clustering.SampleSilhouetteScore Contains the silhouette score for each sample datapoint.

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** id ||| UNSIGNED8 — Sample datapoint identifier

**FIELD** value ||| REAL8 — Silhouette score

---

## **SILHOUETTE\_RESULT** Silhouette\_Result

Types \

	<b>Silhouette_Result</b>
--	--------------------------

Silhouette\_Result Result layout for Analysis.Clustering.SilhouetteScore Contains the silhouette score for each work item.

**FIELD** wi ||| UNSIGNED2 — Work item identifier

**FIELD** score ||| REAL8 — Silhouette score

---

## **CLUSTERLABELS** ClusterLabels

Types \

	<b>ClusterLabels</b>
--	----------------------

ClusterLabels format defines the distance space where each cluster defined by a center and its closest samples. It is the same as KMeans.Types.KMeans\_Model.Labels.

**FIELD** wi ||| UNSIGNED2 — The model identifier.

**FIELD** id ||| UNSIGNED8 — The sample identifier.

**FIELD** label ||| UNSIGNED8 — The identifier of the closest center to the sample.

---

## DATA\_DIAGNOSTIC Data\_Diagnostic

Types \

	Data_Diagnostic
--	-----------------

No Documentation Found

**FIELD** wi ||| UNSIGNED2 — No Doc

**FIELD** valid ||| BOOLEAN — No Doc

**FIELD** message\_text ||| SET ( VARSTRING ) — No Doc

---

## FIELD\_MAPPING Field\_Mapping

Types \

	Field_Mapping
--	---------------

Field\_Mapping is the format produced by ToField for field-name mapping.

**FIELD** orig\_name ||| STRING — The name of the field in the original layout

**FIELD** assigned\_name ||| STRING — The integer field number used in the ML algorithm stored as a STRING

---

## LUCI\_REC LUCI\_Rec

Types \

	LUCI_Rec
--	----------

LUCI Record – A dataset of lines each containing a string This is the DATASET format in which ML algorithm export LUCI files.

**FIELD** line ||| STRING — A single line in the LUCI csv file

---

## **CLASSIFICATION\_SCORES** Classification\_Scores

Types \

	Classification_Scores
--	-----------------------

Classification\_Scores The probability or confidence, per class, that a sample belongs to that class.

**FIELD** wi ||| UNSIGNED2 — The work-item identifier.

**FIELD** id ||| UNSIGNED8 — The record-id of the sample.

**FIELD** classifier ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

**FIELD** class ||| INTEGER4 — The class label.

**FIELD** prob ||| REAL8 — The percentage of trees that assigned this class label, which is a rough stand-in for the probability that the label is correct.

---

# Interfaces

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*DEPRECATED*** Interface Definition for Classification Modules (version 1)
<a href="#">IClassify2.ecl</a>
Interface definition for Classification (Version 2)
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*DEPRECATED*** Interface Definition for Regression Modules (version 1)
<a href="#">IRegression2.ecl</a>
Interface Definition for Regression Modules (Version 2)

## Interfaces/ IClassify

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### IMPORTS

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### DESCRIPTIONS

#### **ICLASSIFY** IClassify

	IClassify
--	-----------

\*\*\*DEPRECATED\*\*\* Interface Definition for Classification Modules (version 1). This interface is being deprecated and should not be used for new bundles or bundles undergoing substantial revision. Please use IClassify2 going forward. Interface definition for Classification. Actual implementation modules will probably take parameters.

#### Children

1. [GetModel](#) : Calculate the model to fit the observation data to the observed classes
  2. [Classify](#) : Classify the observations using a model
  3. [Report](#) : Report the confusion matrix for the classifier and training data
-



## GETMODEL GetModel

IClassify \

<code>DATASET(Types.Layout_Model)</code>	<b>GetModel</b>
<code>(DATASET(Types.NumericField) observations, DATASET(Types.DiscreteField) classifications)</code>	

Calculate the model to fit the observation data to the observed classes.

**PARAMETER** observations ||| TABLE ( NumericField ) — the observed explanatory values.

**PARAMETER** classifications ||| TABLE ( DiscreteField ) — the observed classification used to build.  
the model

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8  
value } ) — the encoded model

---

## CLASSIFY Classify

IClassify \

<code>DATASET(Types.Classify_Result)</code>	<b>Classify</b>
<code>(DATASET(Types.Layout_Model) model, DATASET(Types.NumericField) new_observations)</code>	

Classify the observations using a model.

**PARAMETER** model ||| TABLE ( Layout\_Model ) — The model, which must be produced by a  
corresponding getModel function.

**PARAMETER** new\_observations ||| TABLE ( NumericField ) — observations to be classified.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number ,  
INTEGER4 value , REAL8 conf } ) — Classification with a confidence value.

---

## REPORT Report

IClassify \

<code>DATASET(Types.Confusion_Detail)</code>	Report
<code>(DATASET(Types.Layout_Model) model, DATASET(Types.NumericField) observations, DATASET(Types.DiscreteField) classifications)</code>	

Report the confusion matrix for the classifier and training data.

**PARAMETER** model ||| TABLE ( Layout\_Model ) — the encoded model.

**PARAMETER** observations ||| TABLE ( NumericField ) — the explanatory values.

**PARAMETER** classifications ||| TABLE ( DiscreteField ) — the classifications associated with the observations.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 actual\_class , INTEGER4 predict\_class , UNSIGNED4 occurs , BOOLEAN correct , REAL8 pctActual , REAL8 pctPred } ) — the confusion matrix showing correct and incorrect results.

---

## Interfaces/ IClassify2

---

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### IMPORTS

`__versions.ML_Core.V3_2_2.ML_Core.Types |`

### DESCRIPTIONS

#### **ICLASSIFY2** IClassify2

IClassify2
------------

Interface definition for Classification (Version 2). Classification learns a function that maps a set of input data to one or more output class-label (i.e. Discrete) variables. The resulting learned function is known as the model. That model can then be used repetitively to predict the class(es) for each sample when presented with new input data. Actual implementation modules will probably take configuration parameters to control the classification process. The Classification modules also expose attributes for assessing the effectiveness of the classification.

#### Children

1. [GetModel](#) : Calculate the model to fit the independent data to the observed classes (i.e
2. [Classify](#) : Classify the observations using a model
3. [Accuracy](#) : Return accuracy metrics for the given set of test data  
This is equivalent to calling Predict followed by Analysis.Classification.Accuracy(...)
4. [AccuracyByClass](#) : Return class-level accuracy by class metrics for the given set of test data
5. [ConfusionMatrix](#) : Return the confusion matrix for a set of test data

---

## GETMODEL GetModel

[IClassify2 \](#)

<b>DATASET(Layout_Model2)</b>	<b>GetModel</b>
(DATASET(NumericField) <u>independents</u> , DATASET(DiscreteField) <u>dependents</u> )	

Calculate the model to fit the independent data to the observed classes (i.e. dependent data).

**PARAMETER** independents ||| — The observed independent (explanatory) values.

**PARAMETER** dependents ||| TABLE ( DiscreteField ) — The observed dependent(class label) values.

**PARAMETER** independents ||| TABLE ( NumericField ) — No Doc

**RETURN** TABLE ( { UNSIGNED2 wi , REAL8 value , SET ( UNSIGNED4 ) indexes } )  
— The encoded model.

**SEE** Types.Layout\_Model2

**SEE** Types.NumericField

**SEE** Types.DiscreteField

---

## CLASSIFY Classify

[IClassify2 \](#)

<b>DATASET(DiscreteField)</b>	<b>Classify</b>
(DATASET(Layout_Model2) <u>model</u> , DATASET(NumericField) <u>observations</u> )	

Classify the observations using a model.

**PARAMETER** model ||| TABLE ( Layout\_Model2 ) — The model, which must be produced by a corresponding getModel function.

**PARAMETER** observations ||| TABLE ( NumericField ) — New observations (independent data) to be classified.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value } ) — Predicted class values.

---

## ACCURACY Accuracy

IClassify2 \

<code>DATASET(Classification_Accuracy)</code>	Accuracy
<code>(DATASET(Layout_Model2) model, DATASET(DiscreteField) actuals, DATASET(NumericField) observations )</code>	

Return accuracy metrics for the given set of test data

This is equivalent to calling Predict followed by Analysis.Classification.Accuracy(...).

Provides accuracy statistics as follows:

- `errCount` – The number of misclassified samples.
- `errPct` – The percentage of samples that were misclassified (0.0 - 1.0).
- `RawAccuracy` – The percentage of samples properly classified (0.0 - 1.0).
- `PoD` – Power of Discrimination. Indicates how this classification performed relative to a random guess of class. Zero or negative indicates that the classification was no better than a random guess. 1.0 indicates a perfect classification. For example if there are two equiprobable classes, then a random guess would be right about 50% of the time. If this classification had a Raw Accuracy of 75%, then its PoD would be .5 (half way between a random guess and perfection).
- `PoDE` – Power of Discrimination Extended. Indicates how this classification performed relative to guessing the most frequent class (i.e. the trivial solution). Zero or negative indicates that this classification is no better than the trivial solution. 1.0 indicates perfect classification. For example, if 95% of the samples were of class 1, then the trivial solution would be right 95% of the time. If this classification had a raw accuracy of 97.5%, its PoDE would be .5 (i.e. half way between trivial solution and perfection).

Normally, this should be called using data samples that were not included in the training set. In that case, these statistics are considered Out-of-Sample error statistics. If it is called with the X and Y from the training set, it provides In-Sample error statistics, which should never be used to rate the classification model.

**PARAMETER** model ||| TABLE ( Layout\_Model2 ) — The encoded model as returned from GetModel.

**PARAMETER** actuals ||| TABLE ( DiscreteField ) — The actual class values associated with the observations.

**PARAMETER** observations ||| TABLE ( NumericField ) — The independent (explanatory) values on which to base the test.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , UNSIGNED8 recCnt , UNSIGNED8 errCnt , REAL8 Raw\_Accuracy , REAL8 PoD , REAL8 PoDE , REAL8 Hamming\_Loss } ) — DATASET(Classification\_Accuracy), one record per work-item.

**SEE** Types.Classification\_Accuracy

---

## ACCURACYBYCLASS AccuracyByClass

IClassify2 \

DATASET(Class_Accuracy)	AccuracyByClass
(DATASET(Layout_Model2) model, DATASET(DiscreteField) actuals, DATASET(NumericField) observations )	

Return class-level accuracy by class metrics for the given set of test data.

This is equivalent to calling Predict followed by Analysis.Classification.AccuracyByClass(...).

**PARAMETER** model ||| TABLE ( Layout\_Model2 ) — The encoded model as returned from GetModel.

**PARAMETER** actuals ||| TABLE ( DiscreteField ) — The actual class values associated with the observations.

**PARAMETER** observations ||| TABLE ( NumericField ) — The independent (explanatory) values on which to base the test

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , REAL8 precision , REAL8 recall , REAL8 FPR , REAL8 f\_score } ) — DATASET(Class\_Accuracy), one record per work-item per class.

**SEE** Types.Class\_Accuracy.

## CONFUSIONMATRIX ConfusionMatrix

IClassify2 \

<code>DATASET(Confusion_Detail)</code>	<code>ConfusionMatrix</code>
<code>(DATASET(Layout_Model2) model, DATASET(DiscreteField) actuals, DATASET(NumericField) observations )</code>	

Return the confusion matrix for a set of test data. This is equivalent to calling Predict followed by Analysis.Classification.ConfusionMatrix(...).

The confusion matrix indicates the number of datapoints that were classified correctly or incorrectly for each class label.

The matrix is provided as a matrix of size numClasses x numClasses with fields as follows:

- 'wi' – The work item id
- 'pred' – the predicted class label (from Classify).
- 'actual' – the actual (target) class label.
- 'samples' – the count of samples that were predicted as 'pred', but should have been 'actual'.
- 'totSamples' – the total number of samples that were predicted as 'pred'.
- 'pctSamples' – the percentage of all samples that were predicted as 'pred', that should have been 'actual' (i.e. samples / totSamples)

This is a useful tool for understanding how the algorithm achieved the overall accuracy. For example: were the common classes mostly correct, while less common classes often misclassified? Which classes were most often confused? This should be called with test data that is independent of the training data in order to understand the out-of-sample (i.e. generalization) performance.

**PARAMETER** model ||| TABLE ( Layout\_Model2 ) — The encoded model as returned from GetModel.

**PARAMETER** actuals ||| TABLE ( DiscreteField ) — The actual class values.

**PARAMETER** observations ||| TABLE ( NumericField ) — The independent (explanatory) values.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 actual\_class , INTEGER4 predict\_class , UNSIGNED4 occurs , BOOLEAN correct , REAL8 pctActual , REAL8 pctPred } ) — DATASET(Confusion\_Detail), one record per cell of the confusion matrix.

**SEE** Types.Confusion\_Detail.

# Interfaces/ IRegression

---

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## IMPORTS

Types |

## DESCRIPTIONS

### **IRegression** IRegression

<a href="#">/ EXPORT</a>	IRegression
(DATASET(NumericField) X=empty_data, DATASET(NumericField) Y=empty_data)	

\*\*\*DEPRECATED\*\*\* Interface Definition for Regression Modules (version 1). This interface is being deprecated and should not be used for new bundles or bundles undergoing substantial revision. Please use IRegression2 going forward. Regression learns a function that maps a set of input data to one or more output variables. The resulting learned function is known as the model. That model can then be used repetitively to predict (i.e. estimate) the output value(s) based on new input data.

**PARAMETER** X ||| TABLE ( NumericField ) — The independent data in DATASET(NumericField) format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

**PARAMETER** Y ||| TABLE ( NumericField ) — The dependent variable(s) in DATASET(NumericField) format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

Children



1. [GetModel](#) : Calculate and return the 'learned' model
2. [Predict](#) : Predict the output variable(s) based on a previously learned model

---

## **GETMODEL** **GetModel**

[IRegression](#) \

<a href="#">DATASET(Layout_Model)</a>	<b>GetModel</b>
---------------------------------------	-----------------

Calculate and return the 'learned' model. The model may be persisted and later used to make predictions using 'Predict' below.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — DATASET(LayoutModel) describing the learned model parameters.

---

## **PREDICT** **Predict**

[IRegression](#) \

<a href="#">DATASET(NumericField)</a>	<b>Predict</b>
<a href="#">(DATASET(NumericField) newX, DATASET(Layout_Model) model)</a>	

Predict the output variable(s) based on a previously learned model.

**PARAMETER** newX ||| TABLE ( NumericField ) — DATASET(NumericField) containing the X values to b predicted.

**PARAMETER** model ||| TABLE ( Layout\_Model ) — No Doc

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — DATASET(NumericField) containing one entry per observation (i.e. id) in newX. This represents the predicted values for Y.

## Interfaces/ IRegression2

---

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### IMPORTS

`__versions.ML_Core.V3_2_2.ML_Core.Types |`

### DESCRIPTIONS

#### **IRegression2** IRegression2

IRegression2
--------------

Interface Definition for Regression Modules (Version 2). Regression learns a function that maps a set of input data to one or more continuous output variables. The resulting learned function is known as the model. That model can then be used repetitively to predict (i.e. estimate) the output value(s) based on new input data. Actual implementation modules will probably take configuration parameters to control the regression process. The regression modules also expose attributes for assessing the effectiveness of the regression.

#### Children

1. [GetModel](#) : Calculate and return the 'learned' model
  2. [Predict](#) : Predict the output variable(s) based on a previously learned model
  3. [Accuracy](#) : Assess the accuracy of a set of predictions
-

## GETMODEL GetModel

IRegression2 \

<code>DATASET(Layout_Model2)</code>	GetModel
<code>(DATASET(NumericField) independents, DATASET(NumericField) dependents)</code>	

Calculate and return the 'learned' model.

The model may be persisted and later used to make predictions using 'Predict' below.

**PARAMETER** **`independents`** ||| `TABLE ( NumericField )` — The independent data in `DATASET(NumericField)` format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

**PARAMETER** **`dependents`** ||| `TABLE ( NumericField )` — The dependent variable(s) in `DATASET(NumericField)` format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

**RETURN** `TABLE ( { UNSIGNED2 wi , REAL8 value , SET ( UNSIGNED4 ) indexes } )`  
— The encoded model.

**SEE** `Types.NumericField`

**SEE** `Types.Layout_Model2`

---

## PREDICT Predict

IRegression2 \

<code>DATASET(NumericField)</code>	Predict
<code>(DATASET(Layout_Model2) model, DATASET(NumericField) observations)</code>	

Predict the output variable(s) based on a previously learned model

**PARAMETER** **`independents`** ||| — the observations upon which to predict.

**PARAMETER** model ||| TABLE ( Layout\_Model2 ) — No Doc

**PARAMETER** observations ||| TABLE ( NumericField ) — No Doc

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — one entry per observation (i.e. id) in observations. This represents the predicted values for the dependent variable(s).

---

## ACCURACY Accuracy

IRegression2 \

<code>DATASET(Regression_Accuracy)</code>	Accuracy
<code>(DATASET(Layout_Model2) model, DATASET(NumericField) actuals, DATASET(NumericField) observations)</code>	

Assess the accuracy of a set of predictions. This is equivalent to calling predict and then Analysis.Regression.Accuracy.

**PARAMETER** model ||| TABLE ( Layout\_Model2 ) — The model as returned from GetModel

**PARAMETER** actuals ||| TABLE ( NumericField ) — The actual values of the dependent variable to compare with the predictions.

**PARAMETER** observations ||| TABLE ( NumericField ) — The independent data upon which the accuracy assessment is to be based.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED4 regressor , REAL8 R2 , REAL8 MSE , REAL8 RMSE } ) — Accuracy statistics (see Types.Regression\_Accuracy for details)

---

# Math

---

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Compute the upper incomplete gamma value of two real numbers, x and y

# Math/ Beta

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## IMPORTS

Math |

## DESCRIPTIONS

### **BETA** Beta

<b>/ EXPORT</b>	<b>Beta</b>
(REAL8 x, REAL8 y)	

Compute the beta value of two positive real numbers, x and y.

**PARAMETER** x ||| REAL8 — the value of the first number

**PARAMETER** y ||| REAL8 — the value of the second number

**RETURN** REAL8 — the beta value

---

# Math/ Distributions

---

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## IMPORTS

Constants | Math |

## DESCRIPTIONS

### **DISTRIBUTIONS** Distributions

	Distributions
--	---------------

Compute PDF, CDF, and PPF values for various Probability Distributions.

The Probability Density Function(PDF(x)) of a distribution is the relative likelihood of a sample drawn from that distribution being of value x.

The Cumulative Distribution Function (CDF(x)) of a distribution is the probability of a sample drawn from that distribution to be less than or equal to x.

The Percentage Point Function (PPF(x)) of a distribution is the inverse of the CDF. Given a probability, it returns the value at which the probability of occurrence is less than or equal to the given probability.

### Children

1. [Normal\\_CDF](#) : Cumulative Distribution Function (CDF) of the standard normal distribution
2. [Normal\\_PPF](#) : Percentage Point Function (PPF) for the Normal Distribution
3. [T\\_CDF](#) : Cumulative Distribution Function (CDF) for Students t distribution

4. [T\\_PPF](#) : Percentage point function (PPF) for the T distribution
5. [Chi2\\_CDF](#) : The Cumulative Distribution Function (CDF) for the Chi Square distribution for the specified degrees of freedom
6. [Chi2\\_PPF](#) : Probability Point Function (PPF) for the Chi Squared distribution

## **NORMAL\_CDF** Normal\_CDF

[Distributions](#) \

<b>REAL8</b>	<b>Normal_CDF</b>
(REAL8 x)	

Cumulative Distribution Function (CDF) of the standard normal distribution. The probability that a normal random variable will be smaller than or equal to x standard deviations above or below the mean.

Taken from C/C++ Mathematical Algorithms for Scientists and Engineers, n. Shamma, McGraw-Hill, 1995.

**PARAMETER** x ||| REAL8 — the number of standard deviations.

**RETURN** REAL8 — probability of exceeding x.

## **NORMAL\_PPF** Normal\_PPF

[Distributions](#) \

<b>REAL8</b>	<b>Normal_PPF</b>
(REAL8 x)	

Percentage Point Function (PPF) for the Normal Distribution.

Translated from C/C++ Mathematical Algorithms for Scientists and Engineers, N. Shamma, McGraw-Hill, 1995.



**PARAMETER** x ||| REAL8 — probability.

**RETURN** REAL8 — number of standard deviations from the mean.

---

## T\_CDF T\_CDF

[Distributions \](#)

REAL8	T_CDF
(REAL8 x, REAL8 df)	

Cumulative Distribution Function (CDF) for Students t distribution.

The integral evaluated between negative infinity and x.

Translated from NIST SEL DATAPAC Fortran TCDF.f source.

**PARAMETER** x ||| REAL8 — value of the evaluation.

**PARAMETER** df ||| REAL8 — degrees of freedom.

**RETURN** REAL8 — the probability that a value will be less than or equal to the specified value.

---

## T\_PPF T\_PPF

[Distributions \](#)

REAL8	T_PPF
(REAL8 x, REAL8 df)	

Percentage point function (PPF) for the T distribution.

Translated from NIST SEL DATAPAC Fortran TPPF.f source.

**PARAMETER** x ||| REAL8 — the probability.

**PARAMETER** df ||| REAL8 — degrees of freedom of the distribution.

**RETURN** REAL8 — the value with that probability.

---

## CHI2\_CDF Chi2\_CDF

[Distributions \](#)

REAL8	Chi2_CDF
(REAL8 x, REAL8 df)	

The Cumulative Distribution Function (CDF) for the Chi Square distribution for the specified degrees of freedom.

Translated from the NIST SEL DATAPAC Fortran subroutine CHSCDF.

**PARAMETER** x ||| REAL8 — the value at which to compute.

**PARAMETER** df ||| REAL8 — the degrees of freedom of the distribution.

**RETURN** REAL8 — the cumulative probability.

---

## CHI2\_PPF Chi2\_PPF

[Distributions \](#)

REAL8	Chi2_PPF
(REAL8 x, REAL8 df)	

Probability Point Function (PPF) for the Chi Squared distribution.

Translated from the NIST SEL DATAPAC Fortran subroutine CHSPPF.

**PARAMETER** x ||| REAL8 — the probability value.

**PARAMETER** df ||| REAL8 — the degrees of freedom of the distribution.

**RETURN** REAL8 — the value with that probability.

---

# Math/ DoubleFac

---

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## DESCRIPTIONS

### **DOUBLEFAC** DoubleFac

<b>/ EXPORT REAL8</b>	DoubleFac
(INTEGER2 i)	

Compute the double factorial. The double factorial is defined for odd  $n$  as the product of all the odd numbers up to and including that number.

For even numbers it is the product of the even numbers up to and including that number.

Thus  $\text{DoubleFac}(8) = 8*6*4*2$ .

IF  $i < 2$ , the value 1 is returned.

**PARAMETER**  $i$  ||| INTEGER2 — the input value.

**RETURN** REAL8 — the numeric result.

---

# Math/ Fac

---

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## DESCRIPTIONS

### **FAC** Fac

/ EXPORT REAL8	Fac
(UNSIGNED2 i)	

Factorial function,  $(i)(i-1)(i-2)\dots(2)$

**PARAMETER** *i* ||| UNSIGNED2 — the input value.

**RETURN** REAL8 — the factorial  $i!$ .

---

# Math/ gamma

---

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## DESCRIPTIONS

### **GAMMA** gamma

<b>/ EXPORT REAL8</b>	gamma
(REAL8 x)	

Compute the value of gamma function of real number x.

This is a wrapper for the standard C tgamma function.

**PARAMETER**  $\underline{x}$  ||| REAL8 — the input value.

**RETURN** REAL8 — the value of GAMMA evaluated at x.

---

# Math/ log\_gamma

---

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## DESCRIPTIONS

**LOG\_GAMMA** log\_gamma

/ EXPORT REAL8	log_gamma
(REAL8 x)	

Compute the value of the log gamma function of the absolute value of X.

This is wrapper for the standard C lgamma function. Avoids the race condition found on some platforms by taking the absolute value of the input argument.

**PARAMETER** x ||| REAL8 — the input x.

**RETURN** REAL8 — the value of the log of the GAMMA evaluated at ABS(x).

---

## Math/ lowerGamma

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### DESCRIPTIONS

#### **LOWERGAMMA** lowerGamma

<b>/ EXPORT REAL8</b>	lowerGamma
(REAL8 x, REAL8 y)	

Compute the lower incomplete gamma value of two real numbers, x and y.

**PARAMETER** x ||| REAL8 — the value of the first number.

**PARAMETER** y ||| REAL8 — the value of the second number.

**RETURN** REAL8 — the lower incomplete gamma value.

---



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## **IMPORTS**

Math |

## **DESCRIPTIONS**

### **NCK** NCK

<b>/</b> <b>EXPORT</b> <b>REAL8</b>	<b>NCK</b>
<b>(INTEGER2 N, INTEGER2 K)</b>	

N Choose K – finds the number of combinations of K elements out of a possible N.

**PARAMETER** N ||| INTEGER2 — the number of items in the population.

**PARAMETER** K ||| INTEGER2 — the number of items to choose.

**RETURN** **REAL8** — the number of combinations.

---

# Math/ Poly

---

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## DESCRIPTIONS

### **POLY** Poly

/ EXPORT REAL8	Poly
(REAL8 x, SET OF REAL8 Coeffs)	

Evaluate a polynomial from a set of coefficients.

Coeffs 1 is assumed to be the HIGH order of the equation.

Thus for  $ax^2+bx+c$  - the set would need to be  $\text{Coef} := [a,b,c]$ ;

**PARAMETER** x ||| REAL8 — the value of x in the polynomial.

**PARAMETER** Coeffs ||| SET ( REAL8 ) — a set of coefficients for the polynomial. The ALL set is considered to be all zero values.

**RETURN** REAL8 — value of the polynomial at x.

---

# Math/ StirlingFormula

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## IMPORTS

Math | Constants |

## DESCRIPTIONS

### **STIRLINGFORMULA** StirlingFormula

<b>/ EXPORT</b>	StirlingFormula
(REAL x)	

Stirling's formula.

**PARAMETER** x ||| REAL8 — the point of evaluation.

**RETURN** REAL8 — evaluation result.

---

# Math/ upperGamma

---

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## DESCRIPTIONS

**UPPERGAMMA** upperGamma

/ EXPORT REAL8	upperGamma
(REAL8 x, REAL8 y)	

Compute the upper incomplete gamma value of two real numbers, x and y.

**PARAMETER** x ||| REAL8 — the value of the first number.

**PARAMETER** y ||| REAL8 — the value of the second number.

**RETURN** REAL8 — the upper incomplete gamma value.

---

# Preprocessing

---

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Record structures for Preprocessing modules
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## Preprocessing/ LabelEncoder

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### DESCRIPTIONS

#### **LABELENCODER** LabelEncoder

LabelEncoder
--------------

Allows to convert categorical values into numeric format. For example: use LabelEncoder to convert below raw data: `raw := DATASET([{'apple'}, {'grape'}], {STRING fruit});` The result is as following: `convertedDs := DATASET([{'0'}, {'1'}], {INTEGER fruit});` Curently does not support Myriad interface

#### Children

1. [GetKey](#) : Builds a mapping between feature names and categories
  2. [GetMapping](#) : Builds a lookup table that maps each category of a feature to a unique number
  3. [Encode](#) : Replaces each categorical value in the data with its index in the key
  4. [Decode](#) : Converts back the categorical values into their original labels
- 

#### **GETKEY** GetKey

[LabelEncoder](#) \

GetKey
--------

<code>(dataForUndefinedCategories, partialKey)</code>
---

Builds a mapping between feature names and categories.

**PARAMETER** dataForUndefinedCategories: ||| INTEGER8 — any record-oriented dataset.  
<p>The data from which the categories are extracted if not predefined in the list of categorical features.</p>

**PARAMETER** partialKey: ||| INTEGER8 — same record structure as the key (see below). <p>Mapping between feature names and categories. Some names are mapped to empty categories such that their categories could be extracted from dataForUndefinedCategories.</p>

**RETURN** **BOOLEAN** — key: DATASET(KeyLayout) <p>The full mapping between categorical feature names and their categories. Its record structure has the following format: </p><p></p><pre><name of="" categorical="" feature="">; SET OF STRING <name of="" categorical="" feature="">; ...SET OF STRING <name of="" categorical="" feature="" n="">; END; </name></name></name><br/> KeyLayout := RECORD<br/> SET OF STRING </pre>

---

## GETMAPPING GetMapping

LabelEncoder \

	GetMapping
(key)	

Builds a lookup table that maps each category of a feature to a unique number. Each category is assigned its index in the category set.

**PARAMETER** key: ||| INTEGER8 — DATASET(KeyLayout). <p>Mapping between feature names and categories.</p>

**RETURN** **BOOLEAN** — categoriesMapping: DATASET(MappingLayout). <p>A table with each feature name mapped to its categories and each category mapped to its value. </p><pre><br/> //record mapping a category to its value.<br/> Category := RECORD<br/> STRING categoryName;<br/> INTEGER value;<br/> END;<br/><br/> //record mapping feature names to their categories.<br/> MappingLayout := RECORD<br/> STRING featureName;<br/> DATASET(Category) categories;<br/> END;<br/> </pre>

---

## ENCODE Encode

LabelEncoder \

<b>Encode</b>
<code>(dataToEncode, key)</code>

Replaces each categorical value in the data with its index in the key. Every unknown category (not in the key) is replaced by -1.

**PARAMETER** dataToEncode: ||| INTEGER8 — any dataset. <p> The data to encode.</p>

**PARAMETER** key: ||| INTEGER8 — DATASET(KeyLayout). <p> Mapping between feature names and their categories.</p>

**RETURN** **BOOLEAN** — encodedData: same record structure as dataToEncode with the datatype of all categorical features changed to INTEGER. <p> Data with categorical values replaced by numbers.</p>

## DECODE Decode

[LabelEncoder](#) \

<b>Decode</b>
<code>(dataToDecode, encoderKey)</code>

Converts back the categorical values into their original labels. Every -1 is replaced by an empty string.

**PARAMETER** dataToDecode: ||| INTEGER8 — any dataset. <p> The data to decode.</p>

**PARAMETER** key: ||| — DATASET(KeyLayout). <p> Mapping between feature names and their categories.</p>

**PARAMETER** encoderkey ||| INTEGER8 — No Doc

**RETURN** **BOOLEAN** — decodedData: same record structure as dataToDecode with the datatype of all categorical features changed to STRING. <p> Data with categorical values replaced by their original labels.</p>



# Preprocessing/ MinMaxScaler

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## IMPORTS

std |

## DESCRIPTIONS

### **MINMAXSCALER** MinMaxScaler

<b>/ EXPORT</b>	<b>MinMaxScaler</b>
<pre>(DATASET(NumericField) baseData = DATASET([], NumericField), t_FieldReal lowBound = 0.0, t_FieldReal highBound = 1.0, DATASET(KeyLayout) key = DATASET([], KeyLayout))</pre>	

Scale the input data to a defined range [Min, Max]. Curently does not support Myriad interface

**PARAMETER** **baseData:** ||| TABLE ( NumericField ) — DATASET(NumericField), Default = DATASET([], NumericField). <p> The data from which the minimums and maximums are determined.</p>

**PARAMETER** **low:** ||| — t\_FieldReal, Default = 0.0 <p> The minimum value of the normalized data.</p>

**PARAMETER** **high:** ||| — t\_FieldReal, Default = 1.0 <p> The maximum value of the normalized data.</p>

**PARAMETER** **key:** ||| TABLE ( KeyLayout ) — DATASET(KeyLayout), default = DATASET([], KeyRec). <p> The key to be reused for scaling/unscaling.</p>

**PARAMETER** **lowbound** ||| REAL8 — No Doc

**PARAMETER** highbound ||| REAL8 — No Doc

**SEE** StandardScaler

## Children

1. [GetKey](#) : Computes the key or reuses it if already given
2. [Scale](#) : scales the data using the following formula:
3. [unscale](#) : unscales the data using the following formula

---

## **GETKEY** GetKey

[MinMaxScaler](#) \

	<b>GetKey</b>
<a href="#">()</a>	

Computes the key or reuses it if already given.

**RETURN** TABLE ( { REAL8 lowBound , REAL8 highBound , TABLE ( FeatureMinMax ) minsMaxs } ) — the key: DATASET(KeyLayout).

---

## **SCALE** Scale

[MinMaxScaler](#) \

	<b>Scale</b>
<a href="#">(DATASET(NumericField) dataToScale)</a>	

scales the data using the following formula:  $x' = \min + [(x - x_{\min})(\max - \min)] / (x_{\max} - x_{\min})$

**PARAMETER** dataToScale: ||| TABLE ( NumericField ) — DATASET(NumericField). <p> The data to scale.</p>

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — the scaled data: DATASET(NumericField)

---

## UNSCALE `unscale`

[MinMaxScaler](#) \

<code>unscale</code>
<code>(DATASET(NumericField) dataToUnscale)</code>

unscales the data using the following formula  $x = x\_min + ((x' - min)(x\_max - x\_min))/(max-min)$

**PARAMETER** `dataToUnscale`: ||| TABLE ( NumericField ) — DATASET(NumericField) <p> The data to unscale.</p>

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — the unscaled data: DATASET(NumericField).

---

## Preprocessing/ Normalizer

---

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### IMPORTS

```
__versions.ML_Core.V3_2_2.ML_Core.Types |
```

### DESCRIPTIONS

#### **NORMALIZER** Normalizer

Normalizer
<code>(DATASET(MTypes.NumericField) dataToNormalize, STRING3 norm = 'l2')</code>

Normalizer Normalizes each sample to its unit norm (row-wise normalization) with below options L1 norm.

Given a set of values, the L1 norm is the sum of absolute values. L2 norm.

Given a set of values, the L2 norm is the square root of the sum of squares. L-Infinity norm.

Given a set of values the l-infinity norm is the value with highest absolute value.

**PARAMETER** **dataToNormalize:** ||| TABLE ( NumericField ) — DATASET(Types.NumericField)  
<p> The data to normalize.</p>

**PARAMETER** **norm:** ||| STRING3 — STRING3, Default = 'l2'. <p> The norm based on which the data will be normalized. </p><p> valid values: 'l1', 'l2', 'inf'.</p>

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8

**value } )** — the normalizedData: DATASET(NumericField). Curently does not support Myriad interface.

---

# Preprocessing/ OneHotEncoder

---

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## IMPORTS

Preprocessing.Types |

## DESCRIPTIONS

### **ONEHOTENCODER** OneHotEncoder

<b>/ EXPORT</b>	<b>OneHotEncoder</b>
<pre>(DATASET(NumericField) ds = DATASET([], NumericField), DATASET(1_cFeatures) categoricalFeatures = DATASET([], 1_cFeatures))</pre>	

OneHotEncoder OneHotEncode is used to convert each of the designated categorical features to a binary (absent/present) value (i.e.oneHot) for use by algorithms that don't directly support categorical values. Also can convert back from oneHot encoding to numerical category. Each categorical field will produce additional features according to its cardinality. For example, if there are four possible categories, then the original feature will be replaced by four binary features. Supports Myriad Interface.

**PARAMETER** ds ||| TABLE ( NumericField ) — dataset to be encoded.

**PARAMETER** categoricalFeatures ||| TABLE ( 1\_cFeatures ) — categorical feature IDs for each work item. e.g. to encoded field number 3 for work item 1, below categoricalFeatures can be used:  
DATASET([1, 3], 1\_cFeatures)

### Children

1. [isValidInput](#) : Validates input

2. [getMappings](#) : No Documentation Found
  3. [encode](#) : No Documentation Found
  4. [decode](#) : Revert the encoded data to its original form
- 

## **ISVALIDINPUT** isValidInput

[OneHotEncoder](#) \

	<b>isValidInput</b>
<b>()</b>	

Validates input.

**RETURN** **BOOLEAN** — True when input is valid, False otherwise.

---

## **GETMAPPINGS** getMappings

[OneHotEncoder](#) \

	<b>getMappings</b>
--	--------------------

No Documentation Found

**RETURN** **TABLE** ( { **UNSIGNED2** wi , **UNSIGNED4** number , **REAL8** value ,  
**UNSIGNED4** newNum } ) —

---

## **ENCODE** encode

[OneHotEncoder](#) \

	<b>encode</b>
--	---------------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) —

**DECODE** decode

OneHotEncoder \

	<b>decode</b>
(DATASET(NumericField) encodedDS)	

Revert the encoded data to its original form

**PARAMETER** encodedDS ||| TABLE ( NumericField ) — encoded data

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — decoded decoded data



## Preprocessing/ Split

---

[Go Up](#)

### IMPORTS

Preprocessing | Preprocessing.Types |

### DESCRIPTIONS

#### **SPLIT** Split

Split
<code>(DATASET(NumericField) dataToSplit, REAL4 splitRatio = 0.0, BOOLEAN shuffle = FALSE)</code>

Split input data into training and test sets based on the split ratio. It requires the data has sequential id starting with 1. Curently does not support Myriad interface

**PARAMETER** dataToSplit: ||| TABLE ( NumericField ) — DATASET(Types.NumericField). <p>The data to split.</p>

**PARAMETER** splitRatio: ||| REAL4 — REAL4, DEFAULT = 0.5. <p>The percentage of input data split as training data.</p>

**PARAMETER** shuffle: ||| BOOLEAN — Boolean, DEFAULT = false. <p>if true, the data is shuffled before splitting.</p>

**RETURN** — training and test data Note: currently not support Myraid interface.

Children

1. [trainData](#) : No Documentation Found
2. [testData](#) : No Documentation Found

---

## **TRAINDATA** trainData

[Split](#) \

	trainData
--	-----------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) —

---

## **TESTDATA** testData

[Split](#) \

	testData
--	----------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) —

---

# Preprocessing/ StandardScaler

---

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## IMPORTS

## DESCRIPTIONS

### **STANDARDSCALER** StandardScaler

<a href="#">/ EXPORT</a>	StandardScaler
<pre>(DATASET(NumericField) baseData = DATASET([], NumericField), DATASET(KeyLayout) key = DATASET([], KeyLayout))</pre>	

Standardize the data by mapping to zero mean and standard deviation of 1.0. Curently does not support Myriad interface

**PARAMETER** **baseData:** ||| TABLE ( NumericField ) — DATASET(NumericField), default = DATASET([], Types.NumericField) <p> The data from which the means and standard deviations are determined for each feature.</p>

**PARAMETER** **key:** ||| TABLE ( KeyLayout ) — DATASET(KeyLayout), default = DATASET([], KeyRec) <p> The key to be reused for scaling/unsaling.</p>

### Children

1. [GetKey](#) : Compute the mean and standard deviation per feature or reuses the key if provided
2. [Scale](#) : scale the data using the following formula
3. [unscale](#) : unscale the data using the following formula:

## GETKEY GetKey

StandardScaler \

	GetKey
()	

Compute the mean and standard deviation per feature or reuses the key if provided.

**RETURN** TABLE ( { UNSIGNED4 featureId , REAL8 avg , REAL8 stdev } ) — key: DATASET(KeyLayout).

---

## SCALE Scale

StandardScaler \

	Scale
(DATASET(NumericField) dataToScale)	

scale the data using the following formula  $x' = (x - \text{mean})/\text{stdev}$

**PARAMETER** dataToScale: ||| TABLE ( NumericField ) — DATASET(NumericField). <p> The data to scale</p>

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — the scaled data: DATASET(NumericField)

---

## UNSCALE unscale

StandardScaler \

	unscale
(DATASET(NumericField) dataToUnscale)	

unscale the data using the following formula:  $x = (x' * \text{stdev}) + \text{mean}$

**PARAMETER** dataToUnscale: ||| TABLE ( NumericField ) — DATASET(NumericField). <p> The data to unscale.</p>

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — the unscaled data: DATASET(NumericField).

---

## Preprocessing/ StratifiedSplit

---

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### IMPORTS

```
__versions.ML_Core.V3_2_2.ML_Core.Types |
```

### DESCRIPTIONS

#### **STRATIFIEDSPLIT** StratifiedSplit

<b>/ EXPORT</b>	<b>StratifiedSplit</b>
<pre>(DATASET(NumericField) ds, REAL4 trainSize = 0, REAL4 testSize = 0, UNSIGNED labelId = 0, BOOLEAN shuffle = FALSE)</pre>	

Split input data into training and test sets based on the split ratio. The result preserves the percentage of the samples for the specific feature or class. It requires the data has sequential id starting with 1. Curently does not support Myriad interface.

**PARAMETER** **ds:** ||| TABLE ( NumericField ) — DATASET(NumericField). The data to split.

**PARAMETER** **trainSize:** ||| REAL4 — REAL4, Default = 0.0 <p> The training size.</p>

**PARAMETER** **testSize:** ||| REAL4 — REAL4, Default = 0.0 <p> The test size.</p>

**PARAMETER** **labelId:** ||| UNSIGNED8 — UNSIGNED, Default = 0. <p> The number of the field whose proportions has to be maintained.</p>

**PARAMETER** **shuffle** ||| BOOLEAN — No Doc

**RETURN** — the training data, test data as DATASET(NumericField).

## Children

1. [trainData](#) : No Documentation Found
2. [testData](#) : No Documentation Found

---

### **TRAINDATA** trainData

[StratifiedSplit](#) \

	trainData
--	-----------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) —

---

### **TESTDATA** testData

[StratifiedSplit](#) \

	testData
--	----------

No Documentation Found

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) —

---

# Preprocessing/ Types

---

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## IMPORTS

## DESCRIPTIONS

### **TYPES** Types

	Types
--	-------

Record structures for Preprocessing modules.

### Children

1. [valueLayout](#) : No Documentation Found
2. [numberLayout](#) : No Documentation Found
3. [idLayout](#) : No Documentation Found
4. [OneHotEncoder](#) : record structures for OneHotEncoder
5. [StandardScaler](#) : record structures for StandardScaler
6. [MinMaxScaler](#) : record structures for MinMaxScaler
7. [Normaliz](#) : record structures for normalize function

---

### **VALUELAYOUT** valueLayout

[Types \](#)



	<b>valueLayout</b>
--	--------------------

No Documentation Found

**FIELD** value ||| REAL8 — No Doc

---

## NUMBERLAYOUT numberLayout

Types \

	<b>numberLayout</b>
--	---------------------

No Documentation Found

**FIELD** number ||| UNSIGNED4 — No Doc

---

## IDLAYOUT idLayout

Types \

	<b>idLayout</b>
--	-----------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

---

## ONEHOTENCODER OneHotEncoder

Types \

<b>OneHotEncoder</b>
----------------------

record structures for OneHotEncoder.

## Children

1. [cFeatures](#) : No Documentation Found
- 

## CFEATURES cFeatures

[Types](#) \ [OneHotEncoder](#) \

<b>cFeatures</b>
------------------

No Documentation Found

**FIELD** wi ||| UNSIGNED8 — No Doc

**FIELD** number ||| UNSIGNED8 — No Doc

---

## STANDARDSCALER StandardScaler

[Types](#) \

<b>StandardScaler</b>
-----------------------

record structures for StandardScaler.

## Children

1. [KeyLayout](#) : No Documentation Found
-

## KEYLAYOUT KeyLayout

[Types](#) \ [StandardScaler](#) \

	<b>KeyLayout</b>
--	------------------

No Documentation Found

**FIELD** [featureid](#) ||| UNSIGNED4 — No Doc

**FIELD** [avg](#) ||| REAL8 — No Doc

**FIELD** [stdev](#) ||| REAL8 — No Doc

---

## MINMAXSCALER MinMaxScaler

[Types](#) \

	<b>MinMaxScaler</b>
--	---------------------

record structures for MinMaxScaler.

### Children

1. [FeatureMinMax](#) : No Documentation Found
2. [KeyLayout](#) : No Documentation Found

---

## FEATUREMINMAX FeatureMinMax

[Types](#) \ [MinMaxScaler](#) \

	<b>FeatureMinMax</b>
--	----------------------

No Documentation Found

**FIELD** featureid ||| UNSIGNED4 — No Doc

**FIELD** minvalue ||| REAL8 — No Doc

**FIELD** maxvalue ||| REAL8 — No Doc

---

## **KEYLAYOUT** KeyLayout

[Types](#) \ [MinMaxScaler](#) \

	KeyLayout
--	-----------

No Documentation Found

**FIELD** lowbound ||| REAL8 — No Doc

**FIELD** highbound ||| REAL8 — No Doc

**FIELD** minsmxs ||| TABLE ( FeatureMinMax ) — No Doc

---

## **NORMALIZ** Normaliz

[Types](#) \

	Normaliz
--	----------

record structures for normalize function.

### Children

1. [normsLayout](#) : No Documentation Found
-

## NORMSLAYOUT normsLayout

[Types](#) \ [Normaliz](#) \

	<b>normsLayout</b>
--	--------------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** value ||| REAL8 — No Doc

# Test

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<a href="#">Performance</a>
<a href="#">Tutorial</a>

# Functional

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<a href="#">TestMinMaxScaler</a>
<a href="#">TestNormalize</a>
<a href="#">TestOneHotEncoder</a>
<a href="#">TestSplit</a>
<a href="#">TestStandardScaler</a>
<a href="#">TestStratifiedSplit</a>

# TestLabelEncoder

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[TestDataAndTypes.ecl](#)

Data and Record structures used by TestLabelEncoder Modules



# Preprocessing/ Test/ Functional/ TestLabelEncoder/ TestDataAndTypes

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## DESCRIPTIONS

### **TESTDATAANDTYPES** TestDataAndTypes

TestDataAndTypes
------------------

Data and Record structures used by TestLabelEncoder Modules

#### Children

1. [KeyLayout](#) : No Documentation Found
  2. [key](#) : No Documentation Found
  3. [sampleDataLayout](#) : No Documentation Found
  4. [sampleData](#) : No Documentation Found
  5. [sampleData2](#) : No Documentation Found
  6. [EncodedLayout](#) : No Documentation Found
  7. [encodedData1](#) : No Documentation Found
  8. [encodedData2](#) : No Documentation Found
  9. [DecodedLayout](#) : No Documentation Found
  10. [decodedData1](#) : No Documentation Found
  11. [decodedData2](#) : No Documentation Found
-

## KEYLAYOUT KeyLayout

[TestDataAndTypes](#) \

KeyLayout
-----------

No Documentation Found

**FIELD** f1 ||| SET ( STRING ) — No Doc

**FIELD** f3 ||| SET ( STRING ) — No Doc

**FIELD** f4 ||| SET ( STRING ) — No Doc

---

## KEY key

[TestDataAndTypes](#) \

key
-----

No Documentation Found

**RETURN** ROW ( KeyLayout ) —

---

## SAMPLEDATALAYOUT sampleDataLayout

[TestDataAndTypes](#) \

sampleDataLayout
------------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** f1 ||| STRING — No Doc

**FIELD** f2 ||| UNSIGNED8 — No Doc

**FIELD** f3 ||| UNSIGNED8 — No Doc

**FIELD** f4 ||| STRING — No Doc

---

## **SAMPLEDATA** sampleData

[TestDataAndTypes \](#)

	sampleData
--	------------

No Documentation Found

**RETURN** TABLE ( sampleDataLayout ) —

---

## **SAMPLEDATA2** sampleData2

[TestDataAndTypes \](#)

	sampleData2
--	-------------

No Documentation Found

**RETURN** TABLE ( sampleDataLayout ) —

---

## **ENCODEDLAYOUT** EncodedLayout

[TestDataAndTypes \](#)

	EncodedLayout
--	---------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** f1 ||| INTEGER8 — No Doc

**FIELD** f2 ||| UNSIGNED8 — No Doc

**FIELD** f3 ||| INTEGER8 — No Doc

**FIELD** f4 ||| INTEGER8 — No Doc

---

## **ENCODEDDATA1** encodedData1

[TestDataAndTypes \](#)

	<b>encodedData1</b>
--	---------------------

No Documentation Found

**RETURN** TABLE ( EncodedLayout ) —

---

## **ENCODEDDATA2** encodedData2

[TestDataAndTypes \](#)

	<b>encodedData2</b>
--	---------------------

No Documentation Found

**RETURN** TABLE ( EncodedLayout ) —

---

## DECODEDLAYOUT DecodedLayout

[TestDataAndTypes \](#)

DecodedLayout
---------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** f1 ||| STRING — No Doc

**FIELD** f2 ||| UNSIGNED8 — No Doc

**FIELD** f3 ||| STRING — No Doc

**FIELD** f4 ||| STRING — No Doc

---

## DECODEDDATA1 decodedData1

[TestDataAndTypes \](#)

decodedData1
--------------

No Documentation Found

**RETURN** TABLE ( DecodedLayout ) —

---

## DECODEDDATA2 decodedData2

[TestDataAndTypes \](#)

decodedData2
--------------

No Documentation Found

**RETURN** TABLE ( DecodedLayout ) —

---

# TestMinMaxScaler

---

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Test data for testing standardScaler module
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# Preprocessing/ Test/ Functional/ TestMinMaxScaler/ TestData

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## DESCRIPTIONS

### **TESTDATA** TestData

	<b>TestData</b>
--	-----------------

Test data for testing standardScaler module

#### Children

1. [sampleData](#) : No Documentation Found
  2. [key1](#) : No Documentation Found
  3. [key2](#) : No Documentation Found
  4. [scaledData1](#) : No Documentation Found
  5. [scaledData2](#) : No Documentation Found
- 

### **SAMPLEDATA** sampleData

[TestData](#) \

	<b>sampleData</b>
--	-------------------



No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**KEY1** key1

TestData \

key1
------

No Documentation Found

**RETURN** TABLE ( KeyLayout ) —

---

**KEY2** key2

TestData \

key2
------

No Documentation Found

**RETURN** TABLE ( KeyLayout ) —

---

**SCALEDATA1** scaledData1

TestData \

scaledData1
-------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**SCALEDATA2** scaledData2

TestData \

	scaledData2
--	-------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

# TestNormalize

---

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Test data for testing the Normaliz function
---

# Preprocessing/ Test/ Functional/ TestNormalize/ TestData

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## IMPORTS

## DESCRIPTIONS

### **TESTDATA** testData

testData
----------

Test data for testing the Normaliz function

### Children

1. [sampleData](#) : No Documentation Found
2. [l1NormResult](#) : No Documentation Found
3. [l2NormResult](#) : No Documentation Found
4. [lInfNormResult](#) : No Documentation Found

---

### **SAMPLEDATA** sampleData

[testData](#) \

sampleData
------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**L1NORMRESULT** I1NormResult

testData \

I1NormResult
--------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**L2NORMRESULT** I2NormResult

testData \

I2NormResult
--------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**LINFNORMRESULT** IInfNormResult

testData \

IInfNormResult
----------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

# TestOneHotEncoder

---

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Test Data for Testing OneHotEncoder

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## IMPORTS

## DESCRIPTIONS

### **TESTDATA** TestData

TestData
----------

Test Data for Testing OneHotEncoder

#### Children

1. [validFeatureIds](#) : No Documentation Found
  2. [invalidFeatureIds](#) : No Documentation Found
  3. [key](#) : No Documentation Found
  4. [sample1](#) : No Documentation Found
  5. [sample2](#) : No Documentation Found
  6. [encodedSample1](#) : No Documentation Found
  7. [encodedSample2](#) : No Documentation Found
- 

### **VALIDFEATUREIDS** validFeatureIds

[TestData](#) \



	<b>validFeatureIds</b>
--	------------------------

No Documentation Found

**RETURN** SET ( INTEGER8 ) —

**INVALIDFEATUREIDS** invalidFeatureIds

TestData \

	<b>invalidFeatureIds</b>
--	--------------------------

No Documentation Found

**RETURN** SET ( INTEGER8 ) —

**KEY** key

TestData \

	<b>key</b>
--	------------

No Documentation Found

**RETURN** TABLE ( cFeatures ) —

**SAMPLE1** sample1

TestData \

	sample1
--	---------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**SAMPLE2** sample2

TestData \

	sample2
--	---------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**ENCODEDSAMPLE1** encodedSample1

TestData \

	encodedSample1
--	----------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**ENCODEDSAMPLE2** encodedSample2

TestData \

	encodedSample2
--	----------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

# TestSplit

---

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Test data for testing split function
--------------------------------------

# Preprocessing/ Test/ Functional/ TestSplit/ TestData

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## IMPORTS

## DESCRIPTIONS

### **TESTDATA** testData

testData
----------

Test data for testing split function

### Children

1. [sampleData](#) : No Documentation Found
2. [trainData](#) : No Documentation Found
3. [testData](#) : No Documentation Found

---

### **SAMPLEDATA** sampleData

[testData](#) \

sampleData
------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**TRAINDATA** trainData

testData \

	trainData
--	-----------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**TESTDATA** testData

testData \

	testData
--	----------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

# TestStandardScaler

---

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Test data for testing standardScaler module
---

# Preprocessing/ Test/ Functional/ TestStandardScaler/ TestData

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## IMPORTS

## DESCRIPTIONS

### **TESTDATA** TestData

	TestData
--	----------

Test data for testing standardScaler module

### Children

1. [key](#) : No Documentation Found
2. [sampleData](#) : No Documentation Found
3. [scaledData](#) : No Documentation Found

---

### **KEY** key

[TestData](#) \

	key
--	-----

No Documentation Found



**RETURN** TABLE ( KeyLayout ) —

---

**SAMPLEDATA** sampleData

TestData \

	sampleData
--	------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**SCALEDDATA** scaledData

TestData \

	scaledData
--	------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

# TestStratifiedSplit

---

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## **DESCRIPTIONS**

### **TESTDATA** **TestData**

	<b>TestData</b>
--	-----------------

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1. [Layout](#) : No Documentation Found
2. [ds](#) : No Documentation Found
3. [ds4](#) : No Documentation Found
4. [expTrainData](#) : No Documentation Found
5. [expTrainData4](#) : No Documentation Found
6. [expTestData](#) : No Documentation Found
7. [expTestData3](#) : No Documentation Found
8. [expTestData4](#) : No Documentation Found

**LAYOUT** Layout

TestData \

	Layout
--	--------

No Documentation Found

- FIELD id ||| UNSIGNED8 — No Doc
- FIELD f1 ||| UNSIGNED8 — No Doc
- FIELD f2 ||| UNSIGNED8 — No Doc
- FIELD f3 ||| UNSIGNED8 — No Doc
- FIELD f4 ||| UNSIGNED8 — No Doc

**DS** ds

TestData \

	ds
--	----

No Documentation Found

RETURN TABLE ( Layout ) —

**DS4** ds4

TestData \

	ds4
--	-----

No Documentation Found

**RETURN** TABLE ( Layout ) —

---

**EXPTRAINDATA** expTrainData

TestData \

	expTrainData
--	--------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**EXPTRAINDATA4** expTrainData4

TestData \

	expTrainData4
--	---------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**EXPTESTDATA** expTestData

TestData \

	expTestData
--	-------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**EXPTESTDATA3** expTestData3

TestData \

	expTestData3
--	--------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

**EXPTESTDATA4** expTestData4

TestData \

	expTestData4
--	--------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

# Performance

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## **DESCRIPTIONS**

### **FILES** Files

<b>Files</b>
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1. [pathPrefix](#) : No Documentation Found
2. [RawDataRec](#) : No Documentation Found
3. [rawDataPath](#) : No Documentation Found
4. [rawData](#) : No Documentation Found
5. [CleanDataRec](#) : No Documentation Found
6. [cleanDataPath](#) : No Documentation Found
7. [cleanData](#) : No Documentation Found
8. [labelEncodedDataRec](#) : No Documentation Found
9. [labelEncodedDataPath](#) : No Documentation Found
10. [labelEncodedData](#) : No Documentation Found
11. [MLDataPath](#) : No Documentation Found

12. [MLData](#) : No Documentation Found
13. [xTrainPath](#) : No Documentation Found
14. [xTrain](#) : No Documentation Found
15. [yTrainPath](#) : No Documentation Found
16. [yTrain](#) : No Documentation Found
17. [xTestPath](#) : No Documentation Found
18. [xTest](#) : No Documentation Found
19. [yTestPath](#) : No Documentation Found
20. [yTest](#) : No Documentation Found
21. [cleanXTrainPath](#) : No Documentation Found
22. [cleanXTrain](#) : No Documentation Found
23. [cleanXTestPath](#) : No Documentation Found
24. [cleanXTest](#) : No Documentation Found
25. [PredictionsPath](#) : No Documentation Found

---

## **PATHPREFIX** pathPrefix

[Files](#) \

<b>pathPrefix</b>
-------------------

No Documentation Found

**RETURN** STRING37 —

---

## RAWDATAREC RawDataRec

[Files](#) \

RawDataRec
------------

No Documentation Found

**FIELD** longitude ||| STRING — No Doc

**FIELD** latitude ||| STRING — No Doc

**FIELD** housingmedianage ||| STRING — No Doc

**FIELD** totalrooms ||| STRING — No Doc

**FIELD** totalbedrooms ||| STRING — No Doc

**FIELD** population ||| STRING — No Doc

**FIELD** households ||| STRING — No Doc

**FIELD** medianincome ||| STRING — No Doc

**FIELD** medianhousevalue ||| STRING — No Doc

**FIELD** oceanproximity ||| STRING — No Doc

---

## RAWDATAPATH rawDataPath

[Files](#) \

rawDataPath
-------------

No Documentation Found

**RETURN** STRING44 —

---

## RAWDATA rawData

[Files \](#)

	rawData
--	---------

No Documentation Found

**RETURN** TABLE ( RawDataRec ) —

---

## CLEANDATAREC CleanDataRec

[Files \](#)

	CleanDataRec
--	--------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** longitude ||| REAL4 — No Doc

**FIELD** latitude ||| REAL4 — No Doc

**FIELD** housingmedianage ||| REAL4 — No Doc

**FIELD** totalrooms ||| REAL4 — No Doc

**FIELD** totalbedrooms ||| REAL4 — No Doc

**FIELD** population ||| REAL4 — No Doc

**FIELD** households ||| REAL4 — No Doc

**FIELD** medianincome ||| REAL4 — No Doc

**FIELD** medianhousevalue ||| REAL8 — No Doc

**FIELD** oceanproximity ||| STRING10 — No Doc

---

## CLEANDATAPATH cleanDataPath

[Files](#) \

	cleanDataPath
--	---------------

No Documentation Found

**RETURN** STRING46 —

---

## CLEANDATA cleanData

[Files](#) \

	cleanData
--	-----------

No Documentation Found

**RETURN** TABLE ( CleanDataRec ) —

---

## LABELENCODEDDATAREC labelEncodedDataRec

[Files](#) \

	labelEncodedDataRec
--	---------------------

No Documentation Found

**FIELD** id ||| UNSIGNED8 — No Doc

**FIELD** longitude ||| REAL4 — No Doc

**FIELD** latitude ||| REAL4 — No Doc

**FIELD** housingmedianage ||| REAL4 — No Doc

**FIELD** totalrooms ||| REAL4 — No Doc

**FIELD** totalbedrooms ||| REAL4 — No Doc

**FIELD** population ||| REAL4 — No Doc

**FIELD** households ||| REAL4 — No Doc

**FIELD** medianincome ||| REAL4 — No Doc

**FIELD** medianhousevalue ||| REAL8 — No Doc

**FIELD** oceanproximity ||| INTEGER8 — No Doc

---

## **LABELENCODEDdatapath** labelEncodedDataPath

[Files \](#)

	labelEncodedDataPath
--	----------------------

No Documentation Found

**RETURN** STRING53 —

---

## **LABELENCODEDdata** labelEncodedData

[Files \](#)

	labelEncodedData
--	------------------

No Documentation Found

**RETURN** TABLE ( labelEncodedDataRec ) —

## MLDATAPATH MLDataPath

[Files](#) \

	MLDataPath
--	------------

No Documentation Found

**RETURN** STRING43 —

---

## MLDATA MLData

[Files](#) \

	MLData
--	--------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

## XTRAINPATH xTrainPath

[Files](#) \

	xTrainPath
--	------------

No Documentation Found

**RETURN** STRING43 —

---

## XTRAIN xTrain

[Files](#) \

	xTrain
--	--------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

## YTRAINPATH yTrainPath

[Files](#) \

	yTrainPath
--	------------

No Documentation Found

**RETURN** STRING43 —

---

## YTRAIN yTrain

[Files](#) \

	yTrain
--	--------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---



## XTESTPATH xTestPath

[Files](#) \

	xTestPath
--	-----------

No Documentation Found

**RETURN** STRING42 —

---

## XTEST xTest

[Files](#) \

	xTest
--	-------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

## YTESTPATH yTestPath

[Files](#) \

	yTestPath
--	-----------

No Documentation Found

**RETURN** STRING42 —

---

## YTEST yTest

[Files](#) \

	yTest
--	-------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

## CLEANXTRAINPATH cleanXTrainPath

[Files](#) \

	cleanXTrainPath
--	-----------------

No Documentation Found

**RETURN** STRING48 —

---

## CLEANXTRAIN cleanXTrain

[Files](#) \

	cleanXTrain
--	-------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

## **CLEANXTESTPATH** cleanXTestPath

[Files](#) \

cleanXTestPath
----------------

No Documentation Found

**RETURN** STRING47 —

---

## **CLEANXTEST** cleanXTest

[Files](#) \

cleanXTest
------------

No Documentation Found

**RETURN** TABLE ( NumericField ) —

---

## **PREDICTIONSPATH** PredictionsPath

[Files](#) \

PredictionsPath
-----------------

No Documentation Found

**RETURN** STRING48 —

---

# Utils

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<a href="#">GetFeatureNames.ecl</a>
Extracts the feature names from some dataset
<a href="#">ResetID.ecl</a>
resets the id sequence so it starts from 1
<a href="#">Shuffle.ecl</a>
shuffles a numericField dataset
<a href="#">ValidateSplitInput.ecl</a>
validates input for split function
<a href="#">LabelEncoder</a>

## Preprocessing/ Utils/

# AppendNF

---

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## IMPORTS

## DESCRIPTIONS

### **APPENDNF** AppendNF

	AppendNF
	(DATASET(NumericField) ds1, DATASET(NumericField) ds2)

Merge two NumericField datasets ds1 and ds2 by appending ds2 to ds1. For example, merge ds1 and ds2 as following: ds1 := DATASET({[1, 1, 1, 0.5]}, NumericField); ds2 := DATASET({[1, 2, 1, 2.0]}, NumericField); The result after merging is as below: mergedDs := DATASET({[1, 1, 1, 0.5], [1, 2, 2, 2.0]}, NumericField);

**PARAMETER** ds1: ||| TABLE ( NumericField ) — DATASET(NumericField) The dataset to append to

**PARAMETER** ds2: ||| TABLE ( NumericField ) — DATASET(NumericField) The dataset to be appended

**RETURN** TABLE ( NumericField ) — the merged dataset with ds2 following ds1

---

## Preprocessing/ Utils/ GetCategories

---

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### DESCRIPTIONS

#### **GETCATEGORIES** GetCategories

	GetCategories
(source, featureName)	

Allows to extract all the categories of a feature from a given dataset.

**PARAMETER** source: ||| INTEGER8 — ANY. <p> the dataset from which to extract the categories.</p>

**PARAMETER** featureName: ||| INTEGER8 — STRING. <p> the name of the feature for which to extract the categories.</p>

**RETURN** **BOOLEAN** — categories: SET OF STRING. <p> the feature's categories.</p>

---

## Preprocessing/ Utils/ GetFeatureNames

---

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### DESCRIPTIONS

#### **GETFEATURENAMES** GetFeatureNames

	GetFeatureNames
(dta)	

Extracts the feature names from some dataset.

Note: complex record structures with child datasets are not handled.

**PARAMETER** **dta:** ||| INTEGER8 — any dataset. <p> Dataset from which to extract the feature names.</p>

**RETURN** **BOOLEAN** — featureNames: SET OF STRING <p> A set of string holding the feature names.</p>

---

## Preprocessing/ Utils/ ResetID

---

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### IMPORTS

std |

### DESCRIPTIONS

#### **RESETID** ResetID

<a href="#">/ EXPORT</a>	ResetID
(DATASET(NumericField) ds)	

resets the id sequence so it starts from 1.

**PARAMETER** **ds:** ||| TABLE ( NumericField ) — DATASET(NumericField). <p> The dataset with unordered ids.</p>

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — dataset with ordered ids.

---



## Preprocessing/ Utils/ Shuffle

---

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### IMPORTS

### DESCRIPTIONS

#### **SHUFFLE** shuffle

<a href="#">/ EXPORT</a>	shuffle
(DATASET(NumericField) dataToShuffle)	

shuffles a numericField dataset.

**PARAMETER** dataToShuffle: ||| TABLE ( NumericField ) — DATASET(NumericField). <p> the data to shuffle.</p>

**RETURN** TABLE ( NumericField ) — shuffled data: DATASET(NumericField).

---

# Preprocessing/ Utils/ ValidateSplitInput

---

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## IMPORTS

## DESCRIPTIONS

### **VALIDATESPLITINPUT** validateSplitInput

<b>/ EXPORT</b>	<b>validateSplitInput</b>
(DATASET(NumericField) dataToSplit, REAL4 trainSize, REAL4 testSize)	

validates input for split function.

input is valid if data is not empty, train and test sizes are not both zero, sizes are within [0.0, 1.0) with one of them being different from 0 and their sum does not exceed 1.0.

**PARAMETER** dataToSplit: ||| TABLE ( NumericField ) — DATASET(Types.NumericField). <p> The data to split.</p>

**PARAMETER** trainSize: ||| REAL4 — REAL4. <p> The training size.</p>

**PARAMETER** testSize: ||| REAL4 — REAL4. <p> The test size.</p>

**RETURN** **STRING** — 'Data is empty' if dataToSplit is empty, 'Train size and test sizes are both 0.0' if the sizes are equal to zero, 'Invalid size! valid range = [0.0, 1.0)' if one of the sizes is out of range and 'Sizes are too large! trainSize + testSize > 1.0' if the sum of sizes exceeds 1.0.

# LabelEncoder

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Builds a lookup table that maps each category to a unique number
<a href="#">MapCategoriesToValues.ecl</a>
Builds a lookup table that maps each category of a feature to a unique number
<a href="#">Types.ecl</a>
Utility Record Structures for LabelEncoder Module

# Preprocessing/ Utils/ LabelEncoder/ MapAFeatureCategories

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## IMPORTS

Preprocessing.Utils.LabelEncoder.Types |

## DESCRIPTIONS

### **MAPAFEATURECATEGORIES** MapAFeatureCategories

MapAFeatureCategories
(STRING featureName, SET OF STRING unmappedCategories)

Builds a lookup table that maps each category to a unique number. Each category is assigned its index in the category set.

**PARAMETER** featureName: ||| STRING — STRING. <p> The name of the feature.</p>

**PARAMETER** unmappedCategories: ||| SET ( STRING ) — SET OF STRING. <p> The feature's unmapped categories.</p>

**RETURN** TABLE ( mappingLayout ) — categoriesMapping: ROW(MappingLayout). <p> A row the feature name mapped to its categories and each category mapped to its value.</p>

---

# Preprocessing/ Utils/ LabelEncoder/ MapCategoriesToValues

---

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## DESCRIPTIONS

### MAPCATEGORIESTOVALUES MapCategoriesToValues

MapCategoriesToValues
(key)

Builds a lookup table that maps each category of a feature to a unique number. Each category is assigned its index in the category set.

**PARAMETER** **key:** ||| INTEGER8 — DATASET(KeyLayout). <p> Mapping between feature names and categories.</p>

**RETURN** **BOOLEAN** — categoriesMapping: DATASET(MappingLayout). <p> A table with each feature name mapped to its categories and each category mapped to its value. </p><pre><br/> //record mapping a category to its value.<br/> Category := RECORD<br/> STRING<br/> categoryName;<br/> INTEGER value;<br/> END;<br/><br/> //record mapping feature names to their categories.<br/> MappingLayout := RECORD<br/> STRING<br/> featureName;<br/> DATASET(Category) categories;<br/> END;<br/> </pre>

---

# Preprocessing/ Utils/ LabelEncoder/ Types

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## DESCRIPTIONS

### **TYPES** Types

	Types
--	-------

Utility Record Structures for LabelEncoder Module

#### Children

1. [Category](#) : No Documentation Found
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  3. [LabelLayout](#) : No Documentation Found
- 

### **CATEGORY** Category

[Types](#) \

	Category
--	----------

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**FIELD** categoryname ||| STRING — No Doc

**FIELD** value ||| INTEGER8 — No Doc

---

## MAPPINGLAYOUT MappingLayout

[Types](#) \

	MappingLayout
--	---------------

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**FIELD** featurename ||| STRING — No Doc

**FIELD** categories ||| TABLE ( Category ) — No Doc

---

## LABELLAYOUT LabelLayout

[Types](#) \

	LabelLayout
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**FIELD** label ||| STRING — No Doc

# Tests

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<a href="#">generate.ecl</a>
<a href="#">test_appends.ecl</a>
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# Tests/ field\_\_aggregates

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\_\_versions.ML\_\_Core.V3\_\_2\_\_2.ML\_\_Core.Types |

## DESCRIPTIONS

**FIELD\_\_AGGREGATES** field\_\_aggregates

	field__aggregates
--	-------------------

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**RETURN** —

---

## Tests/ generate

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### IMPORTS

### DESCRIPTIONS

**GENERATE** generate

	generate
--	----------

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**RETURN** —

---

# Tests/ test\_\_appends

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## IMPORTS

std.system.thorlib |

## DESCRIPTIONS

**TEST\_APPENDS** test\_\_appends

	test__appends
--	---------------

No Documentation Found

**RETURN** —

---

# Tests/ test\_\_discrete

---

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## IMPORTS

`__versions.ML_Core.V3_2_2.ML_Core.Types |`

## DESCRIPTIONS

**TEST\_DISCRETE** test\_\_discrete

<code>; EXPORT</code>	<code>test__discrete</code>
-----------------------	-----------------------------

No Documentation Found

**RETURN** —

---

# Tests/ to\_from

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## IMPORTS

Types | `_versions.ML_Core.V3_2_2.ML_Core` |

## DESCRIPTIONS

**TO\_FROM** to\_from

	to_from
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**RETURN** —

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# Utils

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<a href="#">FatD.ecl</a>
Make a sparse DiscreteField dataset dense by filling in missing values
<a href="#">Gini.ecl</a>
Create a file of pivot/target pairs with a Gini impurity value
<a href="#">SequenceInField.ecl</a>
Assign sequence numbers within groups for a dataset

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## IMPORTS

Types |

## DESCRIPTIONS

### **FAT** Fat

<code>/ EXPORT DATASET(Types.NumericField)</code>	<b>Fat</b>
<code>(DATASET(Types.NumericField) d0, Types.t_FieldReal v=0)</code>	

Make a sparse NumericField dataset dense by filling in missing values. All empty cells are set to the designated value.

**PARAMETER** d0 ||| TABLE ( NumericField ) — They NumericField dataset to be filled.

**PARAMETER** v ||| REAL8 — The value to assign missing records.

**RETURN** TABLE ( { UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value } ) — A full NumericField dataset with every field populated.

---

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## IMPORTS

Types |

## DESCRIPTIONS

### **FATD** FatD

<code>/ EXPORT DATASET(Types.DiscreteField)</code>	<b>FatD</b>
<code>(DATASET(Types.DiscreteField) d0, Types.t_Discrete v=0)</code>	

Make a sparse DiscreteField dataset dense by filling in missing values. All empty cells are set to the designated value.

**PARAMETER** **d0** ||| TABLE ( DiscreteField ) — The DiscreteField dataset to be filled.

**PARAMETER** **v** ||| INTEGER4 — The value to assign missing records.

**RETURN** TABLE ( { UNSIGNED2 **wi** , UNSIGNED8 **id** , UNSIGNED4 **number** ,  
INTEGER4 **value** } ) — A full DiscreteField dataset with every field populated.

---



## Utils/ Gini

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### DESCRIPTIONS

#### **GINI** Gini

<code>/ EXPORT</code>	Gini
<code>(infile, pivot, target, wi_name='wi')</code>	

Create a file of pivot/target pairs with a Gini impurity value.

**PARAMETER** infile ||| INTEGER8 — the input file, any type with a work item field.

**PARAMETER** pivot ||| INTEGER8 — the name of the pivot field.

**PARAMETER** target ||| INTEGER8 — the name of the field used as the target.

**PARAMETER** wi\_name ||| INTEGER8 — the name of the work item field, default is "wi".

**RETURN** **BOOLEAN** — A table by Work Item and Pivot value giving count and Gini impurity value.

---

## Utils/ SequenceInField

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### DESCRIPTIONS

#### **SEQUENCEINFIELD** SequenceInField

<b>/ EXPORT</b>	SequenceInField
<code>(infile,infield,seq,wi_name='wi')</code>	

Assign sequence numbers within groups for a dataset. Given a file (dataset) which is sorted by the work item identifier and INFIELD (and possibly other values), add sequence numbers within the range of each infield. Slightly elaborate code is to avoid having to partition the data to one value of infield per node and to work with very large numbers of records where a global count project would be inappropriate. This is useful for assigning rank positions with the groupings.

**PARAMETER** infile ||| INTEGER8 — the input file, any type.

**PARAMETER** infield ||| INTEGER8 — field name of grouping field.

**PARAMETER** seq ||| INTEGER8 — name of the field to receive the sequence number.

**PARAMETER** wi\_name ||| INTEGER8 — work item field name, default is wi.

**RETURN** **BOOLEAN** — a file of the same type with sequence numbers applied.

---