

Classification Algorithms System

V0.1

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

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Data	8
FeatureSelection	19
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Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Classifier	7
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Data	
Wrapper for the dataset data	8
DualClassifier	19
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Kernel	
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Class with methods for statistical computations	37
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Class of methods for the validation of ML algorithms	42
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Chapter 3

File Index

3.1 File List

Here is a list of all documented files with brief descriptions:

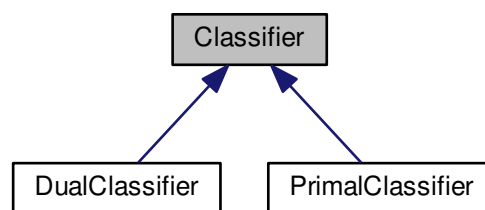
includes/ Classifier.hpp	??
includes/ CrossValidation.hpp	??
includes/ Data.hpp	??
includes/ DualClassifier.hpp	??
includes/ FeatureSelection.hpp	??
includes/ gnuplot_i.hpp	??
includes/ Kernel.hpp	??
includes/ MLToolkit.hpp	??
includes/ Point.hpp	??
includes/ PrimalClassifier.hpp	??
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Chapter 4

Class Documentation

4.1 Classifier Class Reference

Inheritance diagram for Classifier:



Public Member Functions

- virtual void **train** ()=0
Function that execute the training phase of a classification algorithm.
- virtual int **evaluate** (**Point** x)=0
Returns the class of a feature point based on the trained classifier.

4.1.1 Member Function Documentation

4.1.1.1 evaluate()

```
virtual int Classifier::evaluate (  
    Point x ) [pure virtual]
```

Returns the class of a feature point based on the trained classifier.

Parameters

Point	x (???) Features point to be evaluated.
-----------------------	---

Returns

int

4.1.1.2 train()

```
virtual void Classifier::train ( ) [pure virtual]
```

Function that execute the training phase of a classification algorithm.

Returns

void

The documentation for this class was generated from the following file:

- includes/Classifier.hpp

4.2 CrossValidation Class Reference

Public Member Functions

- **CrossValidation** ([Data](#) sample, [Classifier](#) classifier)
- double **kFold** (int fold, int seed)
- void **validation** (int fold, int qtde)
- [Data](#) **getTestSample** ()
- [Data](#) **getTrainSample** ()

The documentation for this class was generated from the following file:

- includes/CrossValidation.hpp

4.3 Data Class Reference

Wrapper for the dataset data.

```
#include <Data.hpp>
```


Public Member Functions

- [Data](#) (const char *pos_class="1", const char *neg_class="-1")
Constructor for empty data.
- [Data](#) (std::string dataset, const char *pos_class="1", const char *neg_class="-1")
Data constructor to load a dataset from a file.
- int [getSize](#) ()
Returns the size of the dataset.
- int [getDim](#) ()
Returns the dimension of the dataset.
- [Point](#) [getPoint](#) (int index)
Returns the point with the given index.
- void [setPoint](#) (int index, [Point](#) p)
- std::vector< [Point](#) > [getPoints](#) ()
Returns the vector of Points of the sample.
- std::vector< int > [getFeaturesNames](#) ()
Returns the features names.
- [Statistics](#) [getStatistics](#) ()
Returns a class with the statistics info of the sample.
- std::vector< int > [getIndex](#) ()
Returns the vector of indexes.
- int [getNumberPositivePoints](#) ()
Return the number of positive points.
- int [getNumberNegativePoints](#) ()
Return the number of negative points.
- void [setClasses](#) (std::string pos, std::string neg)
setClasses Set the classes of the dataset.
- bool [isEmpty](#) ()
Returns if there's a dataset loaded.
- bool [isNormalized](#) ()
Returns if the dataset is normalized.
- bool [load](#) (std::string file)
Load a dataset from a file.
- [Data](#) [copy](#) ()
Returns a copy of the data.
- [Data](#) [copyZero](#) ()
Returns a copy of the data with zero points.
- void [join](#) ([Data](#) data)
Merge one dataset with another.
- bool [insertPoint](#) ([Data](#) sample, int id)
Insert a point to the data from another sample.
- bool [insertPoint](#) ([Point](#) p)
Insert a point to the end of vector points.
- std::vector< bool > [removePoints](#) (std::vector< int > ids)
Remove several points from the sample.
- bool [removePoint](#) (int pid)
Remove a point from the data.
- bool [removeFeatures](#) (std::vector< int > feats)
Remove several features from the sample.
- void [changeXVector](#) (std::vector< int > index)
Change the x vector of a sample.
- void [normalize](#) (double p=2)
normalize Normalize the dataset using a Lp-norm.
- void [operator=](#) (const [Data](#) &)

Static Public Member Functions

- static void [normalize](#) (std::vector< double > &p, double q)
normalize Normalize a vector using a Lp-norm.

Friends

- std::ostream & **operator**<< (std::ostream &output, const [Data](#) &data)

4.3.1 Detailed Description

Wrapper for the dataset data.

4.3.2 Constructor & Destructor Documentation

4.3.2.1 [Data\(\)](#) [1/2]

```
Data::Data (
    const char * pos_class = "1",
    const char * neg_class = "-1" )
```

Constructor for empty data.

Parameters

<i>pos_class</i>	String representing the positive class on the dataset.
<i>neg_class</i>	String representing the negative class on the dataset.

4.3.2.2 [Data\(\)](#) [2/2]

```
Data::Data (
    std::string dataset,
    const char * pos_class = "1",
    const char * neg_class = "-1" )
```

[Data](#) constructor to load a dataset from a file.

Parameters

<i>dataset</i>	(???) Path to the dataset to be loaded.
<i>pos_class</i>	String representing the positive class on the dataset.
<i>neg_class</i>	String representing the negative class on the dataset.

4.3.3 Member Function Documentation

4.3.3.1 `changeXVector()`

```
void Data::changeXVector (
    std::vector< int > index )
```

Change the x vector of a sample.

Parameters

<i>index</i>	(???) Indexes of the change to be made.
--------------	---

Returns

void

4.3.3.2 `copy()`

```
Data Data::copy ( )
```

Returns a copy of the data.

Returns

Data

4.3.3.3 `copyZero()`

```
Data Data::copyZero ( )
```

Returns a copy of the data with zero points.

Returns

Data

4.3.3.4 getDim()

```
int Data::getDim ( )
```

Returns the dimension of the dataset.

Returns

int

4.3.3.5 getFeaturesNames()

```
vector< int > Data::getFeaturesNames ( )
```

Returns the features names.

Returns

std::vector<int>

4.3.3.6 getIndex()

```
vector< int > Data::getIndex ( )
```

Returns the vector of indexes.

Returns

std::vector<int>

4.3.3.7 getNumberNegativePoints()

```
int Data::getNumberNegativePoints ( )
```

Return the number of negative points.

Returns

int

4.3.3.8 `getNumberPositivePoints()`

```
int Data::getNumberPositivePoints ( )
```

Return the number of positive points.

Returns

int

4.3.3.9 `getPoint()`

```
Point Data::getPoint (
    int index )
```

Returns the point with the given index.

Parameters

<i>index</i>	Position of a point in the points array.
--------------	--

Returns

`std::vector<Points>`

4.3.3.10 `getPoints()`

```
vector< Point > Data::getPoints ( )
```

Returns the vector of Points of the sample.

Returns

`std::vector<Points>`

4.3.3.11 `getSize()`

```
int Data::getSize ( )
```

Returns the size of the dataset.

Returns

`int`

4.3.3.12 `getStatistics()`

```
Statistics Data::getStatistics ( )
```

Returns a class with the statistics info of the sample.

Returns

[Statistics](#)

4.3.3.13 `insertPoint()` [1/2]

```
bool Data::insertPoint (
    Data sample,
    int id )
```

Insert a point to the data from another sample.

Parameters

<i>sample</i>	(???) Sample with the point to be added.
<i>id</i>	(???) Index of the point to be added.

Returns

bool

4.3.3.14 insertPoint() [2/2]

```
bool Data::insertPoint (
    Point p )
```

Insert a point to the end of vector points.

Parameters

<i>p</i>	(???) Point to be inserted.
----------	---

Returns

bool

4.3.3.15 isEmpty()

```
bool Data::isEmpty ( )
```

Returns if there's a dataset loaded.

Returns

bool

4.3.3.16 isNormalized()

```
bool Data::isNormalized ( )
```

Returns if the dataset is normalized.

Returns

bool

4.3.3.17 join()

```
void Data::join (
    Data data )
```

Merge one dataset with another.

Parameters

<i>data</i>	(???) Dataset to be joined.
-------------	-----------------------------

Returns

bool

4.3.3.18 load()

```
bool Data::load (
    std::string file )
```

Load a dataset from a file.

Parameters

<i>file</i>	(???) Path to dataset file.
-------------	-----------------------------

Returns

bool

4.3.3.19 normalize() [1/2]

```
void Data::normalize (
    double p = 2 )
```

normalize Normalize the dataset using a Lp-norm.

Parameters

<i>p</i>	Norm to be utilized.
----------	----------------------

4.3.3.20 `normalize()` [2/2]

```
static void Data::normalize (
    std::vector< double > & p,
    double q ) [static]
```

`normalize` Normalize a vector using a Lp-norm.

Parameters

<i>p</i>	Norm to be utilized.
----------	----------------------

4.3.3.21 `removeFeatures()`

```
bool Data::removeFeatures (
    std::vector< int > feats )
```

Remove several features from the sample.

Parameters

<i>feats</i>	(???) Names of the features to be removed (must be sorted).
--------------	---

Returns

boolean informing if all features were succesfully removed.

4.3.3.22 `removePoint()`

```
bool Data::removePoint (
    int pid )
```

Remove a point from the data.

Parameters

<i>pid</i>	(???) Index of the point to be removed.
------------	---

Returns

bool

4.3.3.23 removePoints()

```
vector< bool > Data::removePoints (
    std::vector< int > ids )
```

Remove several points from the sample.

Parameters

<i>ids</i>	(???) Ids of the points to be removed (must be sorted).
------------	---

Returns

booleans informing which points were removed succesfully.

4.3.3.24 setClasses()

```
void Data::setClasses (
    std::string pos,
    std::string neg )
```

setClasses Set the classes of the dataset.

Parameters

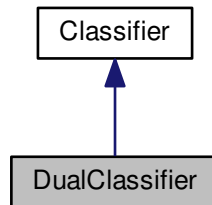
<i>pos</i>	Positive class.
<i>neg</i>	Negative class.

The documentation for this class was generated from the following files:

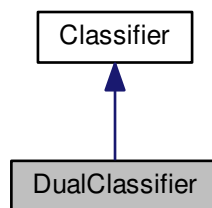
- includes/Data.hpp
- src/[Data.cpp](#)

4.4 DualClassifier Class Reference

Inheritance diagram for DualClassifier:



Collaboration diagram for DualClassifier:



Additional Inherited Members

The documentation for this class was generated from the following file:

- includes/DualClassifier.hpp

4.5 FeatureSelection Class Reference

The documentation for this class was generated from the following file:

- includes/FeatureSelection.hpp

4.6 Gnuplot Class Reference

Public Member Functions

- [Gnuplot](#) (const std::string &style="points")
set a style during construction
- [Gnuplot](#) (const std::vector< double > &x, const std::string &title="", const std::string &style="points", const std::string &labelx="x", const std::string &labely="y")
plot a single std::vector at one go
- [Gnuplot](#) (const std::vector< double > &x, const std::vector< double > &y, const std::string &title="", const std::string &style="points", const std::string &labelx="x", const std::string &labely="y")
plot pairs std::vector at one go
- [Gnuplot](#) (const std::vector< double > &x, const std::vector< double > &y, const std::vector< double > &z, const std::string &title="", const std::string &style="points", const std::string &labelx="x", const std::string &labely="y", const std::string &labelz="z")
plot triples std::vector at one go
- [~Gnuplot](#) ()
destructor: needed to delete temporary files
- [Gnuplot & cmd](#) (const std::string &cmdstr)
send a command to gnuplot
- [Gnuplot & operator<<](#) (const std::string &cmdstr)
Sends a command to an active gnuplot session, identical to [cmd\(\)](#) send a command to gnuplot using the << operator.
- [Gnuplot & showonscreen](#) ()
sets terminal type to terminal_std
- [Gnuplot & savetops](#) (const std::string &filename="gnuplot_output")
saves a gnuplot session to a postscript file, filename without extension
- [Gnuplot & set_style](#) (const std::string &stylestr="points")
- [Gnuplot & set_smooth](#) (const std::string &stylestr="csplines")
- [Gnuplot & unset_smooth](#) ()
unset smooth attention: smooth is not set by default
- [Gnuplot & set_pointsize](#) (const double pointsize=1.0)
scales the size of the points used in plots
- [Gnuplot & set_grid](#) ()
turns grid on/off
- [Gnuplot & unset_grid](#) ()
grid is not set by default
- [Gnuplot & set_multiplot](#) ()
- [Gnuplot & unset_multiplot](#) ()
- [Gnuplot & set_samples](#) (const int samples=100)
set sampling rate of functions, or for interpolating data
- [Gnuplot & set_isosamples](#) (const int isolines=10)
set isoline density (grid) for plotting functions as surfaces (for 3d plots)
- [Gnuplot & set_hidden3d](#) ()
- [Gnuplot & unset_hidden3d](#) ()
- [Gnuplot & set_contour](#) (const std::string &position="base")
- [Gnuplot & unset_contour](#) ()
- [Gnuplot & set_surface](#) ()
- [Gnuplot & unset_surface](#) ()
- [Gnuplot & set_legend](#) (const std::string &position="default")
- [Gnuplot & unset_legend](#) ()
Switches legend off attention: legend is set by default.
- [Gnuplot & set_title](#) (const std::string &title="")

- sets and clears the title of a gnuplot session*
- [Gnuplot & unset_title](#) ()
 - Clears the title of a gnuplot session The title is not set by default.*
- [Gnuplot & set_ylabel](#) (const std::string &label="x")
 - set x axis label*
- [Gnuplot & set_xlabel](#) (const std::string &label="y")
 - set y axis label*
- [Gnuplot & set_zlabel](#) (const std::string &label="z")
 - set z axis label*
- [Gnuplot & set_xrange](#) (const double iFrom, const double iTo)
 - set axis - ranges*
- [Gnuplot & set_yrange](#) (const double iFrom, const double iTo)
 - set y-axis - ranges*
- [Gnuplot & set_zrange](#) (const double iFrom, const double iTo)
 - set z-axis - ranges*
- [Gnuplot & set_xautoscale](#) ()
- [Gnuplot & set_yautoscale](#) ()
- [Gnuplot & set_zautoscale](#) ()
- [Gnuplot & set_xlogscale](#) (const double base=10)
 - turns on/off log scaling for the specified xaxis (logscale is not set by default)*
- [Gnuplot & set_ylogscale](#) (const double base=10)
 - turns on/off log scaling for the specified yaxis (logscale is not set by default)*
- [Gnuplot & set_zlogscale](#) (const double base=10)
 - turns on/off log scaling for the specified zaxis (logscale is not set by default)*
- [Gnuplot & unset_xlogscale](#) ()
- [Gnuplot & unset_ylogscale](#) ()
- [Gnuplot & unset_zlogscale](#) ()
- [Gnuplot & set_cbrange](#) (const double iFrom, const double iTo)
 - set palette range (autoscale by default)*
- [Gnuplot & plotfile_x](#) (const std::string &filename, const unsigned int column=1, const std::string &title="")
- `template<typename X >`
[Gnuplot & plot_x](#) (const X &x, const std::string &title="")
 - from std::vector*
- [Gnuplot & plotfile_xy](#) (const std::string &filename, const unsigned int column_x=1, const unsigned int column_y=2, const std::string &title="")
- `template<typename X , typename Y >`
[Gnuplot & plot_xy](#) (const X &x, const Y &y, const std::string &title="")
 - from data*
- [Gnuplot & plotfile_xy_err](#) (const std::string &filename, const unsigned int column_x=1, const unsigned int column_y=2, const unsigned int column_dy=3, const std::string &title="")
- `template<typename X , typename Y , typename E >`
[Gnuplot & plot_xy_err](#) (const X &x, const Y &y, const E &dy, const std::string &title="")
 - from data*
- [Gnuplot & plotfile_xyz](#) (const std::string &filename, const unsigned int column_x=1, const unsigned int column_y=2, const unsigned int column_z=3, const std::string &title="")
- `template<typename X , typename Y , typename Z >`
[Gnuplot & plot_xyz](#) (const X &x, const Y &y, const Z &z, const std::string &title="")
 - from std::vector*
- [Gnuplot & plot_slope](#) (const double a, const double b, const std::string &title="")
 - plot an equation of the form: $y = ax + b$, you supply a and b*
- [Gnuplot & plot_equation](#) (const std::string &equation, const std::string &title="")
- [Gnuplot & plot_equation3d](#) (const std::string &equation, const std::string &title="")

- [Gnuplot](#) & [plot_image](#) (const unsigned char *ucPicBuf, const unsigned int iWidth, const unsigned int iHeight, const std::string &title="")
plot image
- [Gnuplot](#) & [replot](#) (void)
replot repeats the last plot or splot command. this can be useful for viewing a plot with different set options, or when generating the same plot for several devices (showonscreen, savetops)
- [Gnuplot](#) & [reset_plot](#) ()
resets a gnuplot session (next plot will erase previous ones)
- [Gnuplot](#) & [reset_all](#) ()
resets a gnuplot session and sets all variables to default
- void [remove_tmpfiles](#) ()
deletes temporary files
- bool [is_valid](#) ()
Is the gnuplot session valid ??

Static Public Member Functions

- static bool [set_GNUPlotPath](#) (const std::string &path)
optional function: set [Gnuplot](#) path manual attention: for windows: path with slash '/' not backslash '\'
- static void [set_terminal_std](#) (const std::string &type)

4.6.1 Member Function Documentation

4.6.1.1 is_valid()

```
bool Gnuplot::is_valid ( ) [inline]
```

Is the gnuplot session valid ??

Parameters

—	
---	--

Returns

true if valid, false if not

4.6.1.2 operator<<()

```
Gnuplot& Gnuplot::operator<< (
    const std::string & cmdstr ) [inline]
```

Sends a command to an active gnuplot session, identical to [cmd\(\)](#) send a command to gnuplot using the << operator.

Parameters

<i>cmdstr</i>	→ the command string
---------------	----------------------

Returns

← a reference to the gnuplot object

4.6.1.3 plot_equation()

```
Gnuplot & Gnuplot::plot_equation (
    const std::string & equation,
    const std::string & title = "" )
```

plot an equation supplied as a std::string y=f(x), write only the function f(x) not y= the independent variable has to be x binary operators: ** exponentiation, * multiply, / divide, + add, - subtract, % modulo unary operators: - minus, ! factorial elementary functions: rand(x), abs(x), sgn(x), ceil(x), floor(x), int(x), imag(x), real(x), arg(x), sqrt(x), exp(x), log(x), log10(x), sin(x), cos(x), tan(x), asin(x), acos(x), atan(x), atan2(y,x), sinh(x), cosh(x), tanh(x), asinh(x), acosh(x), atanh(x) special functions: erf(x), erfc(x), inverf(x), gamma(x), igamma(a,x), lgamma(x), ibeta(p,q,x), besj0(x), besj1(x), besy0(x), besy1(x), lambertw(x) statistical fuctions: norm(x), invnorm(x)

4.6.1.4 plot_equation3d()

```
Gnuplot & Gnuplot::plot_equation3d (
    const std::string & equation,
    const std::string & title = "" )
```

plot an equation supplied as a std::string z=f(x,y), write only the function f(x,y) not z= the independent variables have to be x and y

4.6.1.5 plot_image()

```
Gnuplot & Gnuplot::plot_image (
    const unsigned char * ucPicBuf,
    const unsigned int iWidth,
    const unsigned int iHeight,
    const std::string & title = "" )
```

plot image

- note that this function is not valid for versions of GNUPlot below 4.2

4.6.1.6 plot_x()

```
template<typename X >
Gnuplot & Gnuplot::plot_x (
    const X & x,
    const std::string & title = "" )
```

from std::vector

Plots a 2d graph from a list of doubles: x.

4.6.1.7 plot_xy()

```
template<typename X , typename Y >
Gnuplot & Gnuplot::plot_xy (
    const X & x,
    const Y & y,
    const std::string & title = "" )
```

from data

Plots a 2d graph from a list of doubles: x y.

4.6.1.8 plot_xy_err()

```
template<typename X , typename Y , typename E >
Gnuplot & Gnuplot::plot_xy_err (
    const X & x,
    const Y & y,
    const E & dy,
    const std::string & title = "" )
```

from data

plot x,y pairs with dy errorbars

4.6.1.9 plotfile_x()

```
Gnuplot & Gnuplot::plotfile_x (
    const std::string & filename,
    const unsigned int column = 1,
    const std::string & title = "" )
```

plot a single std::vector: x from file

4.6.1.10 plotfile_xy()

```
Gnuplot & Gnuplot::plotfile_xy (
    const std::string & filename,
    const unsigned int column_x = 1,
    const unsigned int column_y = 2,
    const std::string & title = "" )
```

plot x,y pairs: x y from file

4.6.1.11 `plotfile_xy_err()`

```
Gnuplot & Gnuplot::plotfile_xy_err (
    const std::string & filename,
    const unsigned int column_x = 1,
    const unsigned int column_y = 2,
    const unsigned int column_dy = 3,
    const std::string & title = "" )
```

plot x,y pairs with dy errorbars: x y dy from file

4.6.1.12 `plotfile_xyz()`

```
Gnuplot & Gnuplot::plotfile_xyz (
    const std::string & filename,
    const unsigned int column_x = 1,
    const unsigned int column_y = 2,
    const unsigned int column_z = 3,
    const std::string & title = "" )
```

plot x,y,z triples: x y z from file

4.6.1.13 `replot()`

```
Gnuplot& Gnuplot::replot (
    void ) [inline]
```

replot repeats the last plot or splot command. this can be useful for viewing a plot with different set options, or when generating the same plot for several devices (showonscreen, savetops)

Parameters

—	
---	--

Returns

—

4.6.1.14 `set_contour()`

```
Gnuplot & Gnuplot::set_contour (
    const std::string & position = "base" )
```

enables/disables contour drawing for surfaces (for 3d plot) base, surface, both

4.6.1.15 `set_GNUPlotPath()`

```
bool Gnuplot::set_GNUPlotPath (
    const std::string & path ) [static]
```

optional function: set [Gnuplot](#) path manual attention: for windows: path with slash '/' not backslash '\'

Parameters

<i>path</i>	→ the gnuplot path
-------------	--------------------

Returns

true on success, false otherwise

4.6.1.16 set_hidden3d()

```
Gnuplot& Gnuplot::set_hidden3d ( ) [inline]
```

enables/disables hidden line removal for surface plotting (for 3d plot)

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.17 set_legend()

```
Gnuplot & Gnuplot::set_legend (
    const std::string & position = "default" )
```

switches legend on/off position: inside/outside, left/center/right, top/center/bottom, nobox/box

4.6.1.18 set_multiplot()

```
Gnuplot& Gnuplot::set_multiplot ( ) [inline]
```

set the mulitplot mode

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.19 `set_smooth()`

```
Gnuplot & Gnuplot::set_smooth (
    const std::string & stylestr = "csplines" )
```

interpolation and approximation of data, arguments: csplines, bezier, acsplines (for data values > 0), sbezier, unique, frequency (works only with plot_x, plot_xy, plotfile_x, plotfile_xy (if smooth is set, set_style has no effect on data plotting)

4.6.1.20 `set_style()`

```
Gnuplot & Gnuplot::set_style (
    const std::string & stylestr = "points" )
```

set line style (some of these styles require additional information): lines, points, linespoints, impulses, dots, steps, fsteps, histeps, boxes, histograms, filledcurves

4.6.1.21 `set_surface()`

```
Gnuplot & Gnuplot::set_surface ( ) [inline]
```

enables/disables the display of surfaces (for 3d plot)

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.22 `set_terminal_std()`

```
void Gnuplot::set_terminal_std (
    const std::string & type ) [static]
```

optional: set standart terminal, used by showonscreen defaults: Windows - win, Linux - x11, Mac - aqua

Parameters

<i>type</i>	→ the terminal type
-------------	---------------------

Returns

—

4.6.1.23 `set_title()`

```
Gnuplot& Gnuplot::set_title (
    const std::string & title = "" ) [inline]
```

sets and clears the title of a gnuplot session

Parameters

<i>title</i>	→ the title of the plot [optional, default == ""]
--------------	---

Returns

← reference to the gnuplot object

4.6.1.24 `set_xautoscale()`

```
Gnuplot& Gnuplot::set_xautoscale ( ) [inline]
```

autoscale axis (set by default) of xaxis

Parameters

—	
---	--

Returns

← reference to the gnuplot object

4.6.1.25 `set_yautoscale()`

```
Gnuplot& Gnuplot::set_yautoscale ( ) [inline]
```

autoscale axis (set by default) of yaxis

Parameters

—	
---	--

Returns

← reference to the gnuplot object

4.6.1.26 set_zautoscale()

```
Gnuplot& Gnuplot::set_zautoscale ( ) [inline]
```

autoscale axis (set by default) of zaxis

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.27 unset_contour()

```
Gnuplot& Gnuplot::unset_contour ( ) [inline]
```

contour is not set by default, it disables contour drawing for surfaces

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.28 unset_hidden3d()

```
Gnuplot& Gnuplot::unset_hidden3d ( ) [inline]
```

hidden3d is not set by default

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.29 unset_legend()

`Gnuplot& Gnuplot::unset_legend () [inline]`

Switches legend off attention: legend is set by default.

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.30 unset_multiplot()

`Gnuplot& Gnuplot::unset_multiplot () [inline]`

unsets the mulitplot mode

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.31 unset_smooth()

`Gnuplot& Gnuplot::unset_smooth () [inline]`

unset smooth attention: smooth is not set by default

Parameters

—	
---	--

Returns

<— a reference to a gnuplot object

4.6.1.32 unset_surface()

`Gnuplot`& `Gnuplot::unset_surface ()` [inline]

surface is set by default, it disables the display of surfaces (for 3d plot)

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.33 unset_title()

`Gnuplot`& `Gnuplot::unset_title ()` [inline]

Clears the title of a gnuplot session The title is not set by default.

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.34 unset_xlogscale()

`Gnuplot`& `Gnuplot::unset_xlogscale ()` [inline]

turns off log scaling for the x axis

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.35 unset_ylogscale()

`Gnuplot& Gnuplot::unset_ylogscale () [inline]`

turns off log scaling for the y axis

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

4.6.1.36 unset_zlogscale()

`Gnuplot& Gnuplot::unset_zlogscale () [inline]`

turns off log scaling for the z axis

Parameters

—	
---	--

Returns

<— reference to the gnuplot object

The documentation for this class was generated from the following file:

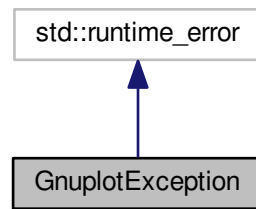
- includes/gnuplot_i.hpp

4.7 GnuplotException Class Reference

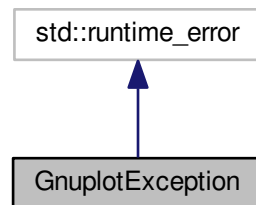
A C++ interface to gnuplot.

```
#include <gnuplot_i.hpp>
```


Inheritance diagram for GnuplotException:



Collaboration diagram for GnuplotException:



Public Member Functions

- **GnuplotException** (const std::string &msg)

4.7.1 Detailed Description

A C++ interface to gnuplot.

The interface uses pipes and so won't run on a system that doesn't have POSIX pipe support Tested on Windows (MinGW and Visual C++) and Linux (GCC)

Version history: 0. C interface by N. Devillard (27/01/03)

1. C++ interface: direct translation from the C interface by Rajarshi Guha (07/03/03)
2. corrections for Win32 compatibility by V. Chyzhdenka (20/05/03)
3. some member functions added, corrections for Win32 and Linux compatibility by M. Burgis (10/03/08)

Requirements:

- gnuplot has to be installed (<http://www.gnuplot.info/download.html>)
- for Windows: set Path-Variable for **Gnuplot** path (e.g. C:/program files/gnuplot/bin) or set **Gnuplot** path with:
`Gnuplot::set_GNUPlotPath(const std::string &path);`

The documentation for this class was generated from the following file:

- includes/gnuplot_i.hpp

4.8 Kernel Class Reference

Class for the kernel computations.

```
#include <Kernel.hpp>
```

Public Member Functions

- double **norm** (**Data** data)
norm Computes norm in dual variables.

4.8.1 Detailed Description

Class for the kernel computations.

4.8.2 Member Function Documentation

4.8.2.1 norm()

```
double Kernel::norm (
    Data data )
```

norm Computes norm in dual variables.

Parameters

<i>data</i>	Dataset to compute norm.
-------------	--------------------------

Returns

double

The documentation for this class was generated from the following files:

- includes/Kernel.hpp
- src/Kernel.cpp

4.9 Point Class Reference

Class of a [Point](#) of doubles in a space of n dimensions.

```
#include <Point.hpp>
```

Public Member Functions

- **Point** (int dim)
- double [dot](#) (std::vector< double > p)
Computes the dot product with a vector.
- double [norm](#) (int p=2)
Returns the p-norm of the point.

Public Attributes

- std::vector< double > [x](#)
Features values.
- double [y](#) = 0
Point classification.
- double **alpha** = 0.0
- int [id](#) = 0
Point identification.

Friends

- std::ostream & **operator**<< (std::ostream &output, const [Point](#) &p)

4.9.1 Detailed Description

Class of a [Point](#) of doubles in a space of n dimensions.

4.9.2 Member Function Documentation

4.9.2.1 dot()

```
double Point::dot (
    std::vector< double > p )
```

Computes the dot product with a vector.

Parameters

p	(???)
-----	-------

Returns

double

4.9.2.2 norm()

```
double Point::norm (
    int p = 2 )
```

Returns the p-norm of the point.

Parameters

p	(???) p of the norm (euclidean norm is the default).
-----	--

Returns

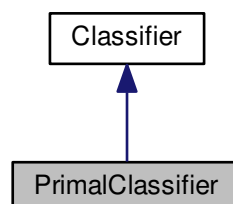
double

The documentation for this class was generated from the following files:

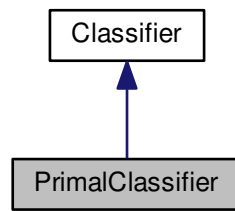
- includes/Point.hpp
- src/[Point.cpp](#)

4.10 PrimalClassifier Class Reference

Inheritance diagram for PrimalClassifier:



Collaboration diagram for PrimalClassifier:



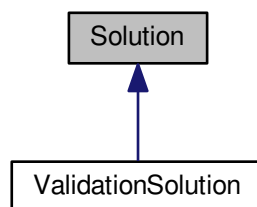
Additional Inherited Members

The documentation for this class was generated from the following file:

- includes/PrimalClassifier.hpp

4.11 Solution Class Reference

Inheritance diagram for Solution:



The documentation for this class was generated from the following file:

- includes/Solution.hpp

4.12 Statistics Class Reference

Class with methods for statistical computations.

```
#include <Statistics.hpp>
```

Static Public Member Functions

- static double [mean](#) (std::vector< double > p)
Compute the mean (average) of a vector.
- static double [getFeatureMean](#) ([Data](#) data, int index)
Computes the mean of a feature in the sample.
- static double [variance](#) (std::vector< double > p)
Compute the variance of a vector.
- static double [variance](#) ([Data](#) data, int index)
Compute the variance of a sample.
- static double [stdev](#) (std::vector< double > p)
Compute the standard deviation of a vector.
- static double [getFeatureStdev](#) ([Data](#) data, int index)
Computes the standard deviation of a feature.
- static double [getRadius](#) ([Data](#) data, int index, double q)
Returns radius of the ball that circ. the data.
- static double [getDistCenters](#) ([Data](#) data, int index)
Returns distance of centers of the classes.
- static double [getDistCentersWithoutFeats](#) ([Data](#) data, std::vector< int > feats, int index)
Returns distance of centers of the classes without given features.

Friends

- class **Data**

4.12.1 Detailed Description

Class with methods for statistical computations.

4.12.2 Member Function Documentation

4.12.2.1 [getDistCenters\(\)](#)

```
double Statistics::getDistCenters (
    Data data,
    int index ) [static]
```

Returns distance of centers of the classes.

Parameters

<i>data</i>	Dataset to compute the distance.
<i>index</i>	Feature to be ignored (-1 uses all features).

Returns

double

4.12.2.2 getDistCentersWithoutFeats()

```
double Statistics::getDistCentersWithoutFeats (
    Data data,
    std::vector< int > feats,
    int index ) [static]
```

Returns distance of centers of the classes without given features.

Parameters

<i>data</i>	Dataset to compute the distance.
<i>feats</i>	Features to be excluded from the computation.
<i>index</i>	Feature to be ignored (-1 uses all features).

Returns

double

4.12.2.3 getFeatureMean()

```
double Statistics::getFeatureMean (
    Data data,
    int index ) [static]
```

Computes the mean of a feature in the sample.

Parameters

<i>data</i>	(???) Sample where the feature is located.
<i>index</i>	(???) Index of the feature to compute the mean.

Returns

double

4.12.2.4 getFeatureStdev()

```
double Statistics::getFeatureStdev (
    Data data,
    int index ) [static]
```

Computes the standard deviation of a feature.

Parameters

<i>data</i>	(???) Sample where the feature is located.
<i>index</i>	(???) Index of teh feature to compute the standard deviation.

Returns

double

4.12.2.5 getRadius()

```
double Statistics::getRadius (
    Data data,
    int index,
    double q ) [static]
```

Returns radius of the ball that circ. the data.

Parameters

<i>data</i>	Dataset to compute the radius.
<i>index</i>	Feature to be ignored (-1 uses all features).
<i>q</i>	Lp-Norm to be used.

Returns

double

4.12.2.6 mean()

```
double Statistics::mean (
    std::vector< double > p ) [static]
```

Compute the mean (average) of a vector.

Parameters

<i>p</i>	(???) Point to compute the mean.
----------	--

Returns

double

4.12.2.7 stdev()

```
double Statistics::stdev (
    std::vector< double > p ) [static]
```

Compute the standard deviation of a vector.

Parameters

<i>p</i>	(???) Point to compute stdev.
----------	---

Returns

double

4.12.2.8 variance() [1/2]

```
static double Statistics::variance (
    std::vector< double > p ) [static]
```

Compute the variance of a vector.

Parameters

<i>p</i>	(???) Vector to compute the variance.
----------	---------------------------------------

Returns

double

4.12.2.9 variance() [2/2]

```
double Statistics::variance (
    Data data,
    int index ) [static]
```

Compute the variance of a sample.

Parameters

<i>data</i>	(???) Sample to compute the variance.
<i>index</i>	(???) Index of the feature to be ignored. (-1 dont ignore any feature)

Returns

double

The documentation for this class was generated from the following files:

- includes/Statistics.hpp
- src/Statistics.cpp

4.13 Validation Class Reference

Class of methods for the validation of ML algorithms.

```
#include <Validation.hpp>
```

Public Member Functions

- **Validation** ([Data](#) sample, [Classifier](#) *classifier=NULL)
- void [partTrainTest](#) (int fold, uint seed)
Divide sample into train and test.
- double **kFold** (int fold, int seed)
- void **validation** (int fold, int qtde)
- [Data](#) **getTestSample** ()
- [Data](#) **getTrainSample** ()

4.13.1 Detailed Description

Class of methods for the validation of ML algorithms.

4.13.2 Member Function Documentation

4.13.2.1 partTrainTest()

```
void Validation::partTrainTest (
    int fold,
    uint seed )
```

Divide sample into train and test.

Parameters

<i>fold</i>	Number of folds.
<i>seed</i>	Seed to feed the pseudo random number generator.

The documentation for this class was generated from the following files:

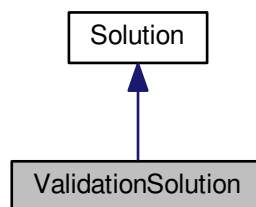
- includes/Validation.hpp
- src/Validation.cpp

4.14 ValidationSolution Class Reference

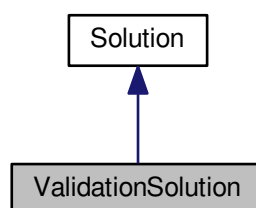
[Solution](#) for the validation of a ML method.

```
#include <ValidationSolution.hpp>
```

Inheritance diagram for ValidationSolution:



Collaboration diagram for ValidationSolution:



4.14.1 Detailed Description

[Solution](#) for the validation of a ML method.

The documentation for this class was generated from the following file:

- includes/ValidationSolution.hpp

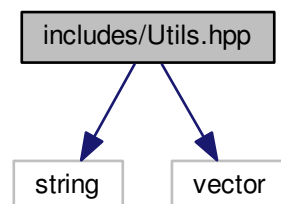
Chapter 5

File Documentation

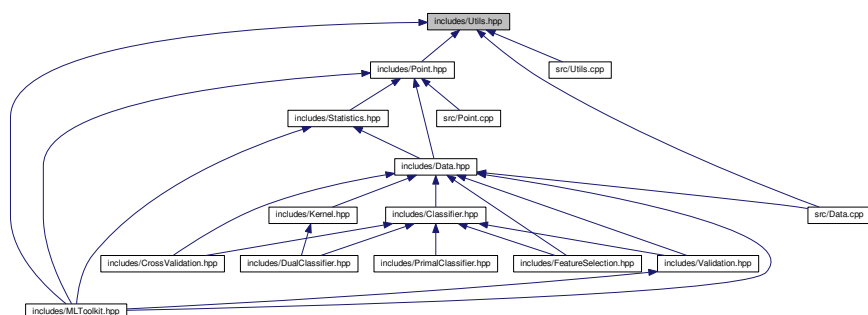
5.1 includes/Utils.hpp File Reference

```
#include <string>
#include <vector>
```

Include dependency graph for Utils.hpp:



This graph shows which files directly or indirectly include this file:



Macros

- `#define INF 1E8`

Typedefs

- `typedef std::vector< std::vector< double > > dMatrix`

Enumerations

- `enum NormType { NORM_LINF = 0, NORM_L1 = 1, NORM_L2 = 2 }`

Functions

- `bool is_number (std::string str)`
Verify if the string is a number.
- `int stoin (std::string str)`
Converts the string to an integer.
- `double stodn (std::string str)`
Converts the string to a double.
- `double maxAbsElement (std::vector< double > x)`
Returns the max absolute element.

5.1.1 Detailed Description

Utils functions

Author

Mateus Coutinho Marim

5.1.2 Function Documentation

5.1.2.1 `is_number()`

```
bool is_number (  
    std::string str )
```

Verify if the string is a number.

Parameters

<i>str</i>	String to be tested.
------------	----------------------

Returns

bool

5.1.2.2 maxAbsElement()

```
double maxAbsElement (
    std::vector< double > x )
```

Returns the max absolute element.

Parameters

<i>x</i>	The vector used to obtain the max element.
----------	--

Returns

The max absolute element found.

5.1.2.3 stodn()

```
double stodn (
    std::string str )
```

Converts the string to a double.

Parameters

<i>str</i>	The string to be converted.
------------	-----------------------------

Returns

The double resulted from the conversion.

5.1.2.4 stoin()

```
int stoin (
    std::string str )
```

Converts the string to an integer.

Parameters

<i>str</i>	String to be converted.
------------	-------------------------

Returns

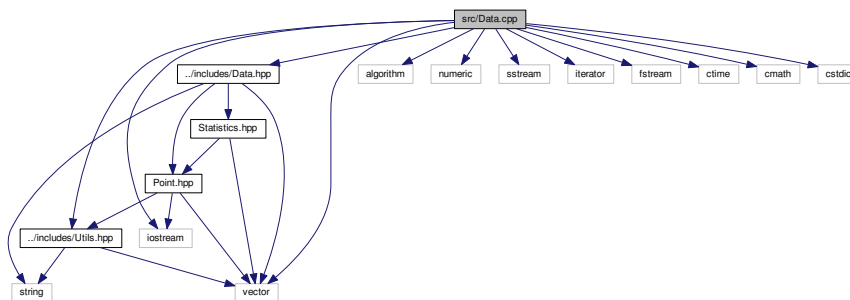
The integer resulted from the conversion.

5.2 src/Data.cpp File Reference

Implementation of the [Data](#) class methods.

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <numeric>
#include <sstream>
#include <iterator>
#include <fstream>
#include <ctime>
#include <cmath>
#include <cstdio>
#include "../includes/Data.hpp"
#include "../includes/Utils.hpp"
```

Include dependency graph for Data.cpp:

**Functions**

- ostream & **operator**<< (ostream &output, const [Data](#) &data)

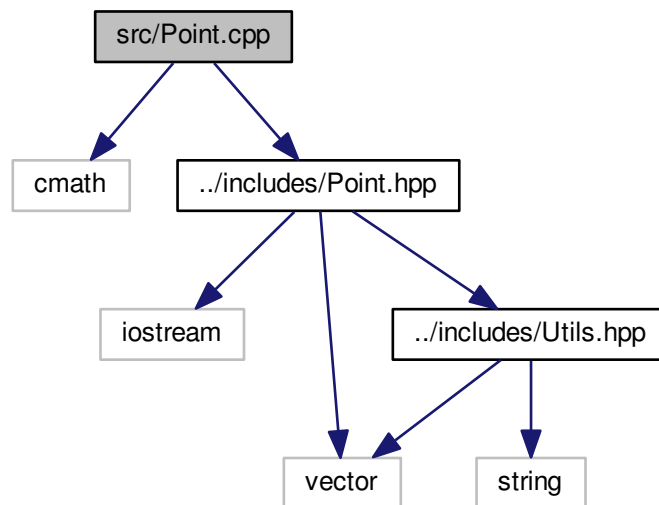
5.2.1 Detailed Description

Implementation of the [Data](#) class methods.

5.3 src/Point.cpp File Reference

Implementation of the [Point](#) class methods.

```
#include <cmath>
#include "../includes/Point.hpp"
Include dependency graph for Point.cpp:
```



Functions

- ostream & **operator**<< (ostream &output, const [Point](#) &p)

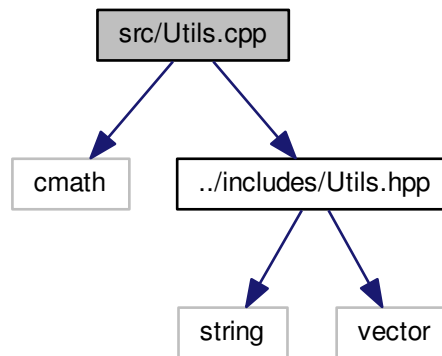
5.3.1 Detailed Description

Implementation of the [Point](#) class methods.

5.4 src/Utils.cpp File Reference

Implementation of methods for general use in the system.

```
#include <cmath>
#include "../includes/Utils.hpp"
Include dependency graph for Utils.cpp:
```



Functions

- bool **is_number** (string str)
- int **stoin** (string str)
- double **stodn** (string str)
- double **maxAbsElement** (vector< double > x)

5.4.1 Detailed Description

Implementation of methods for general use in the system.

Utils functions

Author

Mateus Coutinho Marim

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