Classification Algorithms System

V0.1

Generated by Doxygen 1.8.13

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1.1 Class Hierarchy

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

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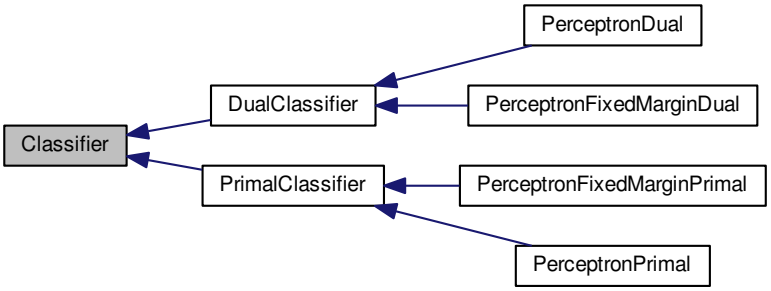
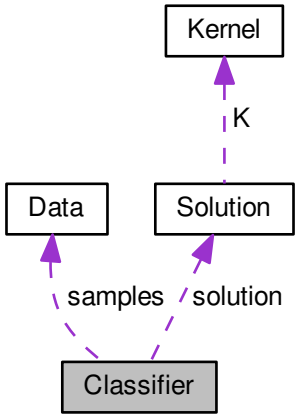
Class Documentation

4.1 Classifier Class Reference

Inheritance diagram for Classifier:



Collaboration diagram for Classifier:



Public Member Functions

- virtual bool train ()=0

  Function that execute the training phase of a classification algorithm.
- virtual double evaluate (Point p)=0

  Returns the class of a feature point based on the trained classifier.
- virtual void setSamples (Data *samples)

  setSamples Set the samples used in the classifier.
- void **setStartTime** (double start_time)
- void **setMaxTime** (double max_time)
- void **setEPS** (double EPS)
- void **setMaxIterations** (int MAX_IT)
- void **setMaxUpdates** (int MAX_UP)
- int getSteps ()

  getSteps Returns the number of steps through the data by the classifier.
- int getUpdates ()

  getUpdates Returns the number of updates needed to get to the the solution.

Protected Attributes

- Data * **samples**
- std::vector< Point > svs

  Support vectors points.
- Solution solution

  Classifier solution.
- double rate = 0.5

  Learning rate.
- double start_time = 0

  Initial time.

- double max_time = 200

  Maximum time of training.
- int steps = 0

  Number of steps in the data.
- int ctot = 0

  Number of updates of the weights.
- double EPS = 1E-9

  Max precision.
- int **MAX_IT** = 1E9
- int **MAX_UP** = 1E9

4.1.1 Member Function Documentation

4.1.1.1 evaluate()

```
virtual double Classifier::evaluate (
            Point p )  [pure virtual]
```

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

Parameters

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

Returns

int

Implemented in PerceptronFixedMarginDual, PerceptronDual, PerceptronFixedMarginPrimal, and Perceptron↩ Primal.

4.1.1.2 getSteps()

```
int Classifier::getSteps ( )
```

getSteps Returns the number of steps through the data by the classifier.

Returns

int

4.1.1.3 getUpdates()

```
int Classifier::getUpdates ( )
```

getUpdates Returns the number of updates needed to get to the the solution.

Returns

int

4.1.1.4 setSamples()

```
void Classifier::setSamples (
            Data * samples )  [virtual]
```

setSamples Set the samples used in the classifier.

Parameters

samples	Samples to be used.

4.1.1.5 train()

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

Function that execute the training phase of a classification algorithm.

Returns

void

Implemented in PerceptronFixedMarginDual, PerceptronDual, PerceptronFixedMarginPrimal, and Perceptron↩ Primal.

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

- includes/Classifier.hpp
- src/Classifier.cpp

4.2 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.
- void write (std::string fname, std::string ext)
  write Write the data to a file with the given extention.
- int getSize ()
  Returns the size of the dataset.
- int getDim ()
  Returns the dimension of the dataset.
- void setDim (int dim)
  setDim Set the dimension of the points.
- Point getPoint (int index)
  Returns the point with the given index.
- void setPoint (int index, Point p)
  setPoint Set the point in a position of the data.
- std::vector< Point > getPoints ()
  Returns the vector of Points of the sample.
- std::vector< int > getFeaturesNames ()
  Returns the features names.
- void setFeaturesNames (std::vector< int > fnames)
  setFeaturesNames Set the name of the features of the data.
- 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.
- void clear ()
  clear Clear the data.
- 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.
- Data insertFeatures (std::vector< int > ins_feat)

  insertFeatures Returns Data object with only features in array.
- 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)

4.2.1 Detailed Description

Wrapper for the dataset data.

4.2.2 Constructor & Destructor Documentation

4.2.2.1 Data() [1/2]

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

Constructor for empty data.

Parameters

pos_class	String representing the positive class on the dataset.
neg_class	String representing the negative class on the dataset.

4.2.2.2 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

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

4.2.3 Member Function Documentation

4.2.3.1 changeXVector()

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

Change the x vector of a sample.

Parameters

index	(???) Indexes of the change to be made.

Returns

void

4.2.3.2 copy()

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

Returns a copy of the data.

Returns

Data

4.2.3.3 copyZero()

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

Returns a copy of the data with zero points.

Returns

Data

4.2.3.4 getDim()

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

Returns the dimension of the dataset.

Returns

int

4.2.3.5 getFeaturesNames()

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

Returns the features names.

Returns

std::vector<int>

4.2.3.6 getIndex()

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

Returns the vector of indexes.

Returns

std::vector<int>

4.2.3.7 getNumberNegativePoints()

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

Return the number of negative points.

Returns

int

4.2.3.8 getNumberPositivePoints()

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

Return the number of positive points.

Returns

int

4.2.3.9 getPoint()

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

Returns the point with the given index.

Parameters

index	Position of a point in the points array.

Returns

std::vector<Points>

4.2.3.10 getPoints()

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

Returns the vector of Points of the sample.

Returns

std::vector<Points>

4.2.3.11 getSize()

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

Returns the size of the dataset.

Returns

int

4.2.3.12 getStatistics()

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

Returns a class with the statistics info of the sample.

Returns

Statistics

4.2.3.13 insertFeatures()

```
Data Data::insertFeatures (
            std::vector< int > ins_feat )
```

insertFeatures Returns Data object with only features in array.

Parameters

ins_feat	(???) Array with features that will be in the Data object.

Returns

Data If the object is empty something wrong happened.

4.2.3.14 insertPoint() [1/2]

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

Insert a point to the data from another sample.

Parameters

sample	(???) Sample with the point to be added.
id	(???) Index of the point to be added.

Returns

bool

4.2.3.15 insertPoint() [2/2]

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

Insert a point to the end of vector points.

Parameters

p	(???) Point to be inserted.

Returns

bool

4.2.3.16 isEmpty()

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

Returns if there's a dataset loaded.

Returns

bool

4.2.3.17 isNormalized()

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

Returns if the dataset is normalized.

Returns

bool

4.2.3.18 join()

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

Merge one dataset with another.

Parameters

data	(???) Dataset to be joined.

Returns

bool

4.2.3.19 load()

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

Load a dataset from a file.

Parameters

file	(???) Path to dataset file.

Returns

bool

4.2.3.20 normalize() [1/2]

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

normalize Normalize the dataset using a Lp-norm.

Parameters

p	Norm to be utilized.

4.2.3.21 normalize() [2/2]

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

normalize Normalize a vector using a Lp-norm.

Parameters

q	Norm to be utilized.
p	Vector to be normalized.

4.2.3.22 removeFeatures()

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

Remove several features from the sample.

Parameters

feats	(???) Names of the features to be removed (must be sorted).

Returns

boolean informing if all features were succesfully removed.

4.2.3.23 removePoint()

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

Remove a point from the data.

Parameters

pid	(???) Index of the point to be removed.

Returns

bool

4.2.3.24 removePoints()

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

Remove several points from the sample.

Parameters

ids	(???) Ids of the points to be removed (must be sorted).

Returns

booleans informing which points were removed succesfully.

4.2.3.25 setClasses()

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

setClasses Set the classes of the dataset.

Parameters

pos	Positive class.
neg	Negative class.

4.2.3.26 setDim()

```
void Data::setDim (
            int dim )
```

setDim Set the dimension of the points.

Parameters

dim	(???) Dimension to be set.

4.2.3.27 setFeaturesNames()

```
void Data::setFeaturesNames (
            std::vector< int > fnames )
```

setFeaturesNames Set the name of the features of the data.

Parameters

fnames	(???) Name of the features.

4.2.3.28 setPoint()

```
void Data::setPoint (
            int index,
            Point p )
```

setPoint Set the point in a position of the data.

Parameters

index	(???) Index of the point that will be set.
p	(???) Point to be set.

4.2.3.29 write()

```
void Data::write (
            std::string fname,
            std::string ext )
```

write Write the data to a file with the given extention.

Parameters

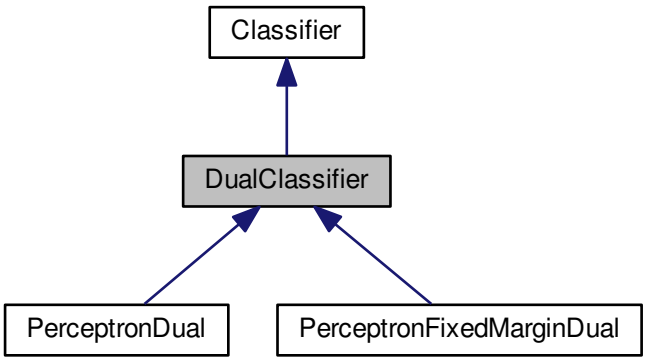
fname	Name of the file.
ext	Extention of the file.

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

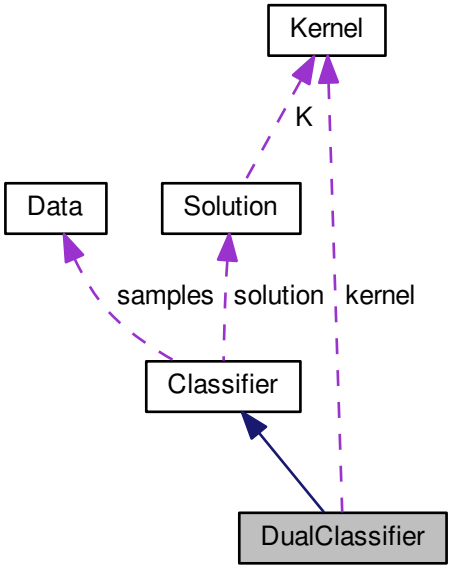
- includes/Data.hpp
- src/Data.cpp

4.3 DualClassifier Class Reference

Inheritance diagram for DualClassifier:



Collaboration diagram for DualClassifier:



Public Member Functions

- void setKernel (Kernel K)

setKernel Set the kernel used by the dual classifier.

- Solution getSolution ()

  getSolution Returns the solution of the primal classifier.

Protected Attributes

- std::vector< double > alpha

  Alphas vector.

- Kernel kernel

  Object for kernel computations.

4.3.1 Member Function Documentation

4.3.1.1 getSolution()

```
Solution DualClassifier::getSolution ( )
```

getSolution Returns the solution of the primal classifier.

Returns

Solution

4.3.1.2 setKernel()

```
void DualClassifier::setKernel (
            Kernel K )
```

setKernel Set the kernel used by the dual classifier.

Parameters

q	Norm that will be used by the classifier.

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

- includes/DualClassifier.hpp
- src/DualClassifier.cpp

4.4 FeatureSelection Class Reference

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

- includes/FeatureSelection.hpp

4.5 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)

4.5.1 Member Function Documentation

4.5.1.1 is_valid()

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

Is the gnuplot session valid ??

Parameters

—	

Returns

true if valid, false if not

4.5.1.2 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

cmdstr	–> the command string

Returns

<– a reference to the gnuplot object

4.5.1.3 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, - substract, % 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)

4.5.1.4 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

4.5.1.5 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

4.5.1.6 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.

4.5.1.7 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.

4.5.1.8 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

4.5.1.9 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

4.5.1.10 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

4.5.1.11 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

4.5.1.12 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

4.5.1.13 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

—

4.5.1.14 set_contour()

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

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

4.5.1.15 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

path	–> the gnuplot path

Returns

true on success, false otherwise

4.5.1.16 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

4.5.1.17 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

4.5.1.18 set_multiplot()

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

set the mulitplot mode

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.19 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 effekt on data plotting)

4.5.1.20 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

4.5.1.21 set_surface()

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

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

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.22 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

type	–> the terminal type

Returns

—

4.5.1.23 set_title()

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

sets and clears the title of a gnuplot session

Parameters

title	–> the title of the plot [optional, default == ""]

Returns

<– reference to the gnuplot object

4.5.1.24 set_xautoscale()

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

autoscale axis (set by default) of xaxis

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.25 set_yautoscale()

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

autoscale axis (set by default) of yaxis

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.26 set_zautoscale()

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

autoscale axis (set by default) of zaxis

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.27 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

4.5.1.28 unset_hidden3d()

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

hidden3d is not set by default

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.29 unset_legend()

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

Switches legend off attention:legend is set by default.

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.30 unset_multiplot()

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

unsets the mulitplot mode

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.31 unset_smooth()

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

unset smooth attention: smooth is not set by default

Parameters

—	

Returns

<– a reference to a gnuplot object

4.5.1.32 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

4.5.1.33 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

4.5.1.34 unset_xlogscale()

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

turns off log scaling for the x axis

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.35 unset_ylogscale()

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

turns off log scaling for the y axis

Parameters

—	

Returns

<– reference to the gnuplot object

4.5.1.36 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 files:

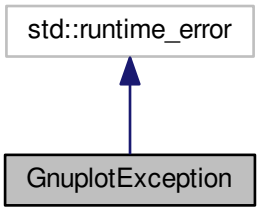
- includes/gnuplot_i.hpp
- src/gnuplot_i.cpp

4.6 GnuplotException Class Reference

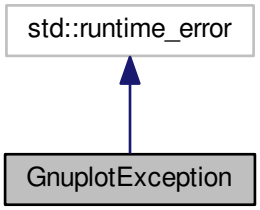
A C++ interface to gnuplot.

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

Inheritance diagram for GnuplotException:



Collaboration diagram for GnuplotException:



Public Member Functions

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

4.6.1 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. Chyzhdzenka (20/05/03)
3. some member functions added, corrections for Win32 and Linux compatibility by M. Burgis (10/03/08)
4. Move function definition into gnuplot_i.cpp by X. BROQUERE (25/10/11)

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

4.7 Kernel Class Reference

Class for the kernel computations.

`#include <Kernel.hpp>`

Public Member Functions

- Kernel ()
  Class constructor.
- Kernel (dMatrix K)
  Class constructor.
- void setType (int type)
  setType Set the kernel type used in the kernel computations.
- void setParam (int param)
  setParam Set the kernel parameter used in the kernel computations.
- void setKernelMatrix (dMatrix K)
  setKernelMatrix Set a pre computed kernel matrix.
- dMatrix getKernelMatrix ()
  getKernelMatrix Get the kernel matrix.
- void compute (Data samples)
  compute Compute the kernel matrix with the given type and parameter.
- double function (Point one, Point two, int dim)
  function Compute the kernel function between two points.
- double norm (Data data)
  norm Computes norm in dual variables.

4.7.1 Detailed Description

Class for the kernel computations.

4.7.2 Constructor & Destructor Documentation

4.7.2.1 Kernel()

```
Kernel::Kernel (
            dMatrix K )
```

Class constructor.

Parameters

K	Kernel matrix to be set in initialization.

4.7.3 Member Function Documentation

4.7.3.1 compute()

```
void Kernel::compute (
            Data samples )
```

compute Compute the kernel matrix with the given type and parameter.

Parameters

samples	Data used to compute the kernel matrix.

4.7.3.2 function()

```
double Kernel::function (
            Point one,
            Point two,
            int dim )
```

function Compute the kernel function between two points.

Parameters

one	first point.
two	second point.
dim	Dimension of the points.

Returns

double

4.7.3.3 getKernelMatrix()

```
dMatrix Kernel::getKernelMatrix ( )
```

getKernelMatrix Get the kernel matrix.

Returns

std::vector<std::vector<double> >

4.7.3.4 norm()

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

norm Computes norm in dual variables.

Parameters

data	Dataset to compute norm.

Returns

double

4.7.3.5 setKernelMatrix()

```
void Kernel::setKernelMatrix (
            dMatrix K )
```

setKernelMatrix Set a pre computed kernel matrix.

Parameters

K	Kernel matrix to be set.

4.7.3.6 setParam()

```
void Kernel::setParam (
            int param )
```

setParam Set the kernel parameter used in the kernel computations.

Parameters

param	parameter to be set.

4.7.3.7 setType()

```
void Kernel::setType (
            int type )
```

setType Set the kernel type used in the kernel computations.

Parameters

type	Kernel type.

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

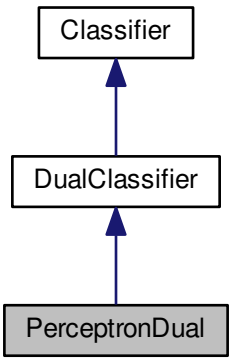
- includes/Kernel.hpp
- src/Kernel.cpp

4.8 PerceptronDual Class Reference

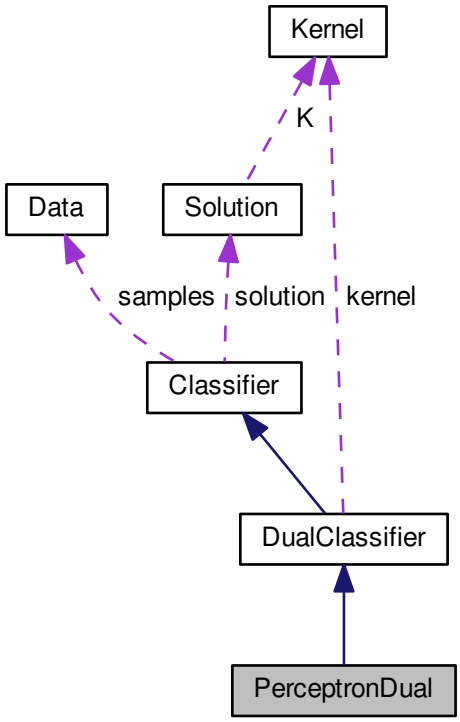
Wrapper for the implementation of the Perceptron dual algorithm.

```
#include <Perceptron.hpp>
```

Inheritance diagram for PerceptronDual:



Collaboration diagram for PerceptronDual:



Public Member Functions

- **PerceptronDual** (Data *samples=NULL, double rate=0.5, Kernel *K=NULL, Solution *initial_solution=NU↩ LL)
- bool train ()

  Function that execute the training phase of a classification algorithm.
- double evaluate (Point p)

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

Additional Inherited Members

4.8.1 Detailed Description

Wrapper for the implementation of the Perceptron dual algorithm.

4.8.2 Member Function Documentation

4.8.2.1 evaluate()

```
double PerceptronDual::evaluate (
            Point p )  [virtual]
```

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

Parameters

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

Returns

int

Implements Classifier.

4.8.2.2 train()

```
bool PerceptronDual::train ( )  [virtual]
```

Function that execute the training phase of a classification algorithm.

Returns

void

Implements Classifier.

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

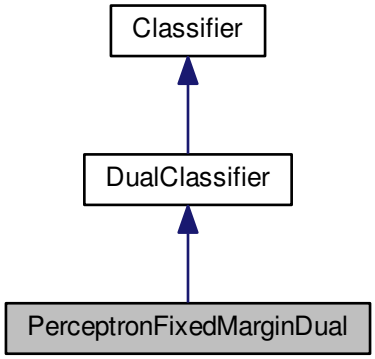
- includes/Perceptron.hpp
- src/Perceptron.cpp

4.9 PerceptronFixedMarginDual Class Reference

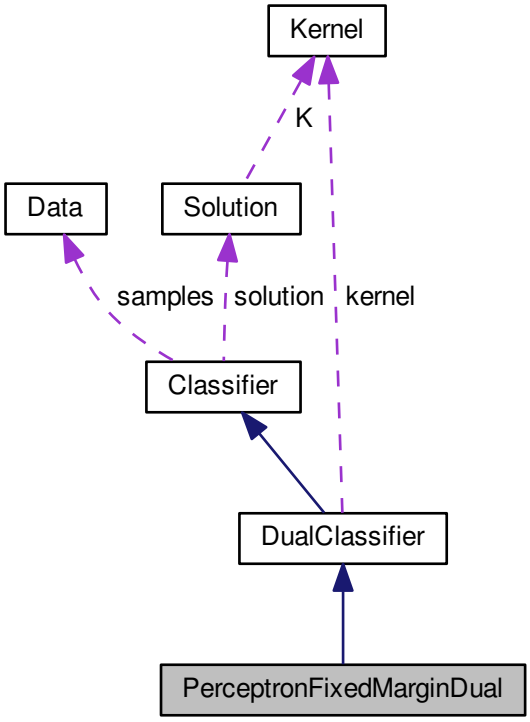
Wrapper for the implementation of the Perceptron dual with fixed margin algorithm.

```
#include <Perceptron.hpp>
```

Inheritance diagram for PerceptronFixedMarginDual:



Collaboration diagram for PerceptronFixedMarginDual:



Public Member Functions

- **PerceptronFixedMarginDual** (Data *samples=NULL, double gamma=1.0, double rate=0.5, Kernel *K=NULL, Solution *initial_solution=NULL)
- bool train ()

  Function that execute the training phase of a classification algorithm.
- double evaluate (Point p)

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

Additional Inherited Members

4.9.1 Detailed Description

Wrapper for the implementation of the Perceptron dual with fixed margin algorithm.

4.9.2 Member Function Documentation

4.9.2.1 evaluate()

```
double PerceptronFixedMarginDual::evaluate (
            Point p )  [virtual]
```

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

Parameters

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

Returns

int

Implements Classifier.

4.9.2.2 train()

```
bool PerceptronFixedMarginDual::train ( )  [virtual]
```

Function that execute the training phase of a classification algorithm.

Returns

void

Implements Classifier.

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

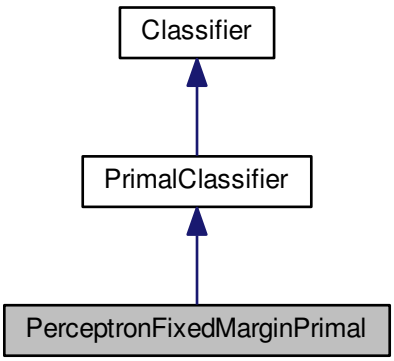
- includes/Perceptron.hpp
- src/Perceptron.cpp

4.10 PerceptronFixedMarginPrimal Class Reference

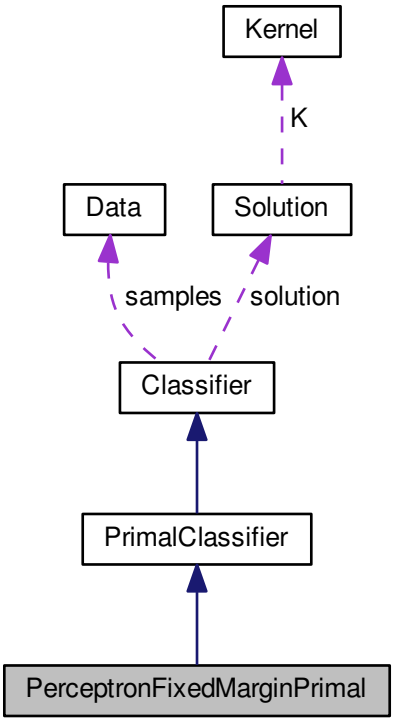
Wrapper for the implementation of the Perceptron primal with fixed margin algorithm.

```
#include <Perceptron.hpp>
```

Inheritance diagram for PerceptronFixedMarginPrimal:



Collaboration diagram for PerceptronFixedMarginPrimal:



Public Member Functions

- **PerceptronFixedMarginPrimal** (Data *samples=NULL, double gamma=1.0, double q=2, double rate=0.5, Solution *initial_solution=NULL)
- bool train ()

  Function that execute the training phase of a classification algorithm.
- double evaluate (Point p)

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

Additional Inherited Members

4.10.1 Detailed Description

Wrapper for the implementation of the Perceptron primal with fixed margin algorithm.

4.10.2 Member Function Documentation

4.10.2.1 evaluate()

```
double PerceptronFixedMarginPrimal::evaluate (
            Point p )  [virtual]
```

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

Parameters

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

Returns

int

Implements Classifier.

4.10.2.2 train()

```
bool PerceptronFixedMarginPrimal::train ( )  [virtual]
```

Function that execute the training phase of a classification algorithm.

Returns

void

Implements Classifier.

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

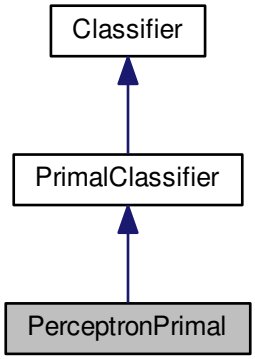
- includes/Perceptron.hpp
- src/Perceptron.cpp

4.11 PerceptronPrimal Class Reference

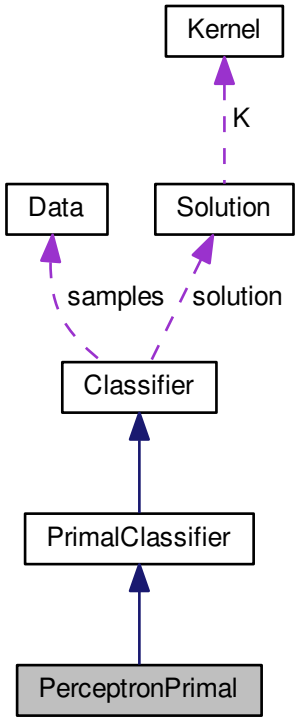
Wrapper for the implementation of the Perceptron primal algorithm.

```
#include <Perceptron.hpp>
```

Inheritance diagram for PerceptronPrimal:



Collaboration diagram for PerceptronPrimal:



Public Member Functions

- **PerceptronPrimal** (Data ∗samples=NULL, double q=2, double rate=0.5, Solution ∗initial_solution=NULL)

- bool train ()

  Function that execute the training phase of a classification algorithm.
- double evaluate (Point p)

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

Additional Inherited Members

4.11.1 Detailed Description

Wrapper for the implementation of the Perceptron primal algorithm.

4.11.2 Member Function Documentation

4.11.2.1 evaluate()

```
double PerceptronPrimal::evaluate (
            Point p )  [virtual]
```

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

Parameters

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

Returns

int

Implements Classifier.

4.11.2.2 train()

```
bool PerceptronPrimal::train ( )  [virtual]
```

Function that execute the training phase of a classification algorithm.

Returns

void

Implements Classifier.

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

- includes/Perceptron.hpp
- src/Perceptron.cpp

4.12 Point Class Reference

Class of a Point of doubles in a space of n dimensions.

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

Public Member Functions

- **Point** (int dim, int val=0)
- 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)

4.12.1 Detailed Description

Class of a Point of doubles in a space of n dimensions.

4.12.2 Member Function Documentation

4.12.2.1 dot()

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

Computes the dot product with a vector.

Parameters

p	(???)

Returns

double

4.12.2.2 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

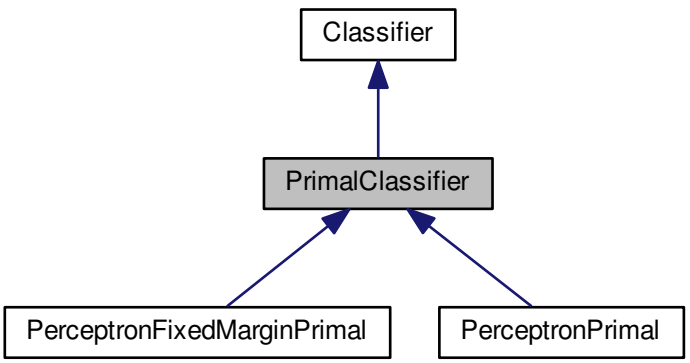
double

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

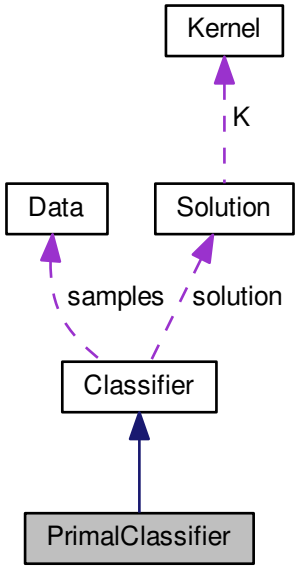
- includes/Point.hpp
- src/Point.cpp

4.13 PrimalClassifier Class Reference

Inheritance diagram for PrimalClassifier:



Collaboration diagram for PrimalClassifier:



Public Member Functions

- void setNorm (double q)

  setNorm Set the norm used by the classifier. (Euclidean norm is the default)
- Solution getSolution ()

  getSolution Returns the solution of the primal classifier.

Protected Attributes

- std::vector< double > w

  Weights vector.
- double q = 2

  Norm used in the classification. (Euclidean Norm is the default)
- double flexible = 0.0

  Flexibilidade.

4.13.1 Member Function Documentation

4.13.1.1 getSolution()

```
Solution PrimalClassifier::getSolution ( )
```

getSolution Returns the solution of the primal classifier.

Returns

Solution

4.13.1.2 setNorm()

```
void PrimalClassifier::setNorm (
            double q )
```

setNorm Set the norm used by the classifier. (Euclidean norm is the default)

Parameters

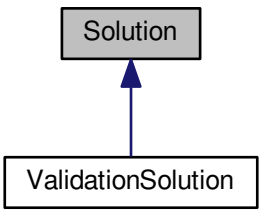
q	Norm that will be used by the classifier.

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

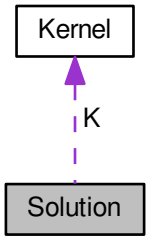
- includes/PrimalClassifier.hpp
- src/PrimalClassifier.cpp

4.14 Solution Class Reference

Inheritance diagram for Solution:



Collaboration diagram for Solution:



Public Attributes

- std::vector< double > w

  Weights vector.
- Kernel K

  Kernel for Dual methods.
- std::vector< double > alpha

  Alpha Vector for Dual methods.
- double bias = 0

  Bias of the solution.
- std::vector< int > fnames

  Features names of the resulting solution.
- double margin = 0

  Margin generated from the classifier that generated the solution.
- double norm = 0

  Norm of the solution.

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

- includes/Solution.hpp

4.15 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**

4.15.1 Detailed Description

Class with methods for statistical computations.

4.15.2 Member Function Documentation

4.15.2.1 getDistCenters()

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

Returns distance of centers of the classes.

Parameters

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

Returns

double

4.15.2.2 getDistCentersWithoutFeats()

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

Returns distance of centers of the classes without given features.

Parameters

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

Returns

double

4.15.2.3 getFeatureMean()

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

Computes the mean of a feature in the sample.

Parameters

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

Returns

double

4.15.2.4 getFeatureStdev()

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

Computes the standard deviation of a feature.

Parameters

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

Returns

double

4.15.2.5 getRadius()

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

Returns radius of the ball that circ. the data.

Parameters

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

Returns

double

4.15.2.6 mean()

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

Compute the mean (average) of a vector.

Parameters

p	(???) Point to compute the mean.

Returns

double

4.15.2.7 stdev()

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

Compute the standard deviation of a vector.

Parameters

p	(???) Point to compute stdev.

Returns

double

4.15.2.8 variance() [1/2]

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

Compute the variance of a vector.

Parameters

p	(???) Vector to compute the variance.

Returns

double

4.15.2.9 variance() [2/2]

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

Compute the variance of a sample.

Parameters

data	(???) Sample to compute the variance.
index	(???) 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

4.16 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, unsigned int seed)

  Divide sample into train and test.
- double **kFold** (int fold, int seed)
- void **validation** (int fold, int qtde)
- Data **getTestSample** ()
- Data **getTrainSample** ()

4.16.1 Detailed Description

Class of methods for the validation of ML algorithms.

4.16.2 Member Function Documentation

4.16.2.1 partTrainTest()

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

Divide sample into train and test.

Parameters

fold	Number of folds.
seed	Seed to feed the pseudo random number generator.

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

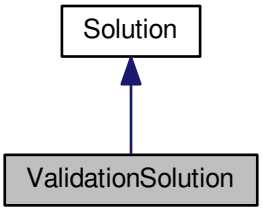
- includes/Validation.hpp
- src/Validation.cpp

4.17 ValidationSolution Class Reference

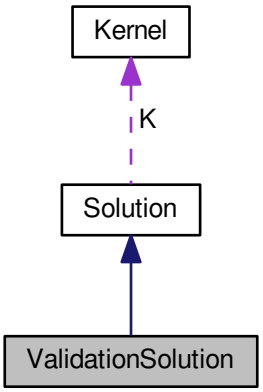
Solution for the validation of a ML method.

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

Inheritance diagram for ValidationSolution:



Collaboration diagram for ValidationSolution:



Additional Inherited Members

4.17.1 Detailed Description

Solution for the validation of a ML method.

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

- includes/ValidationSolution.hpp

4.18 Visualisation Class Reference

Class for visualize data using gnuplot.

```
#include <Visualisation.hpp>
```

Public Member Functions

- **Visualisation** (Data *sample)
- void setSample (Data sample)
  Set sample to be visualized.
- void setTitle (std::string title)
  Set plot title.
- void setStyle (std::string style)
  Set plot style. (points, lines, etc.)
- void plot2D (int x, int y)
  Plot the selected features in 2D.
- void plot3D (int x, int y, int z)
  Plot the selected features in 3D.
- void plot2DwithHyperplane (int x, int y, Solution w)
  Plot the data in 2D with separated by the hyperplane in the solution.
- void plot3DwithHyperplane (int x, int y, int z, Solution w)
  Plot the data in 2D with separated by the hyperplane in the solution.

4.18.1 Detailed Description

Class for visualize data using gnuplot.

4.18.2 Member Function Documentation

4.18.2.1 plot2D()

```
void Visualisation::plot2D (
            int x,
            int y )
```

Plot the selected features in 2D.

Parameters

x	(???) Feature to be used in the x-axis.
y	(???) Feature to be used in the y-axis.

Returns

void

4.18.2.2 plot2DwithHyperplane()

```
void Visualisation::plot2DwithHyperplane (
            int x,
            int y,
            Solution w )
```

Plot the data in 2D with separated by the hyperplane in the solution.

Parameters

x	(???) Feature to be used in the x-axis.
y	(???) Feature to be used in the y-axis.

Returns

void

4.18.2.3 plot3D()

```
void Visualisation::plot3D (
            int x,
            int y,
            int z )
```

Plot the selected features in 3D.

Parameters

x	(???) Feature to be used in the x-axis.
y	(???) Feature to be used in the y-axis.
z	(???) Feature to be used in the z-axis.

Returns

void

4.18.2.4 plot3DwithHyperplane()

```
void Visualisation::plot3DwithHyperplane (
            int x,
            int y,
            int z,
            Solution w )
```

Plot the data in 2D with separated by the hyperplane in the solution.

Parameters

x	(???) Feature to be used in the x-axis.
y	(???) Feature to be used in the y-axis.
z	(???) Feature to be used in the z-axis.

Returns

void

4.18.2.5 setSample()

```
void Visualisation::setSample (
            Data sample )
```

Set sample to be visualized.

Parameters

sample	(???) Data to set for visualization.

Returns

void

4.18.2.6 setStyle()

```
void Visualisation::setStyle (
            std::string style )
```

Set plot style. (points, lines, etc.)

Parameters

style	(???) Style to be set.

Returns

void

4.18.2.7 setTitle()

```
void Visualisation::setTitle (
            std::string title )
```

Set plot title.

Parameters

title	(???) Plot title.

Returns

void

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

- includes/Visualisation.hpp
- src/Visualisation.cpp

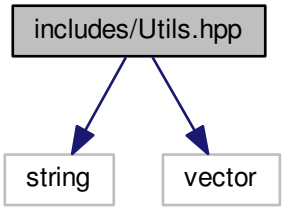
Chapter 5

File Documentation

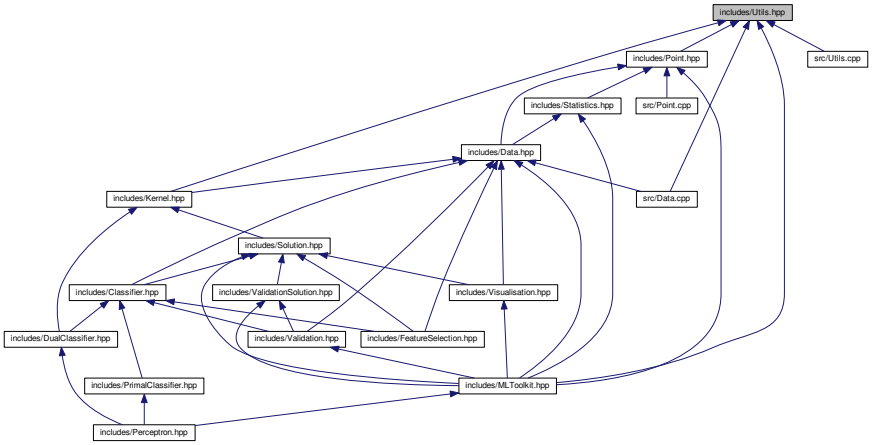
5.1 includes/Utils.hpp File Reference

```
#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.
- std::string itos (int n)

  itos Integer to string conversion.
- std::string dtoa (double n)

  dtoa Double to string conversion.

5.1.1 Detailed Description

Utils functions

Author

Mateus Coutinho Marim

5.1.2 Function Documentation

5.1.2.1 dtoa()

```
std::string dtoa (
            double n )
```

dtoa Double to string conversion.

Parameters

n	Double to be converted.

Returns

string

5.1.2.2 is_number()

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

Verify if the string is a number.

Parameters

str	String to be tested.

Returns

bool

5.1.2.3 itos()

```
std::string itos (
            int n )
```

itos Integer to string conversion.

Parameters

n	Integer to be converted.

Returns

string

5.1.2.4 maxAbsElement()

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

Returns the max absolute element.

Parameters

x	The vector used to obtain the max element.

Returns

The max absolute element found.

5.1.2.5 stodn()

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

Converts the string to a double.

Parameters

str	The string to be converted.

Returns

The double resulted from the conversion.

5.1.2.6 stoin()

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

Converts the string to an integer.

Parameters

str	String to be converted.

Returns

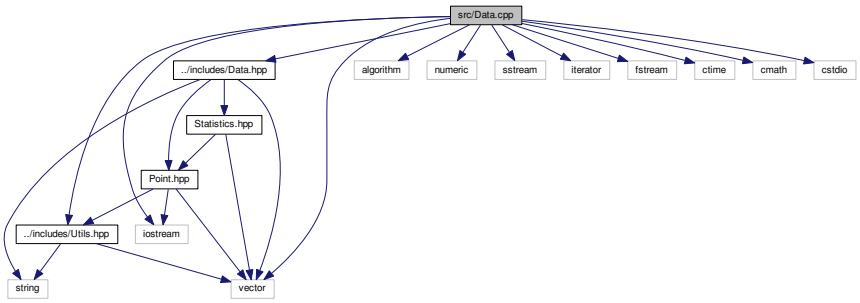
The integer resulted from the conversion.

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

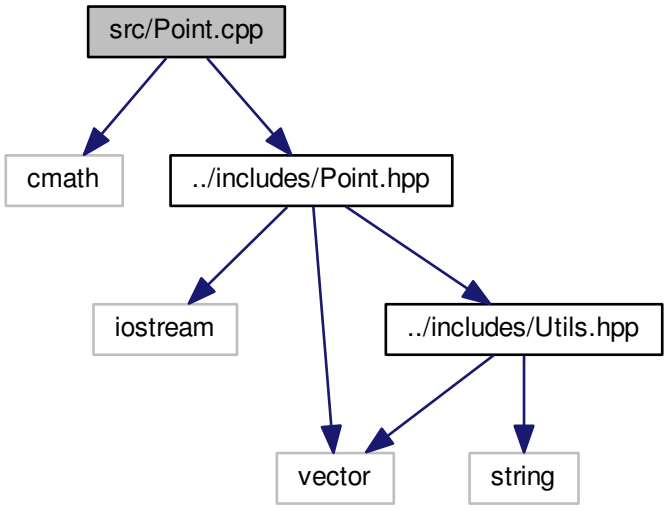
Implementation of the Data class methods.

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

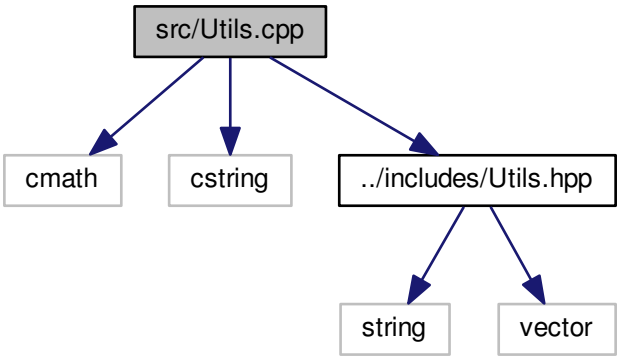
Implementation of the Point class methods.

5.4 src/Utils.cpp File Reference

Implementation of methods for general use in the system.

```
#include <cmath>
#include <cstring>
```

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



Macros

- #define **PRECISION** 1E-9
- #define **MAX_NUMBER_STRING_SIZE** 32

Functions

- bool **is_number** (string str)
- int **stoin** (string str)
- double **stodn** (string str)
- string itos (int n)

  itos Integer to string conversion.
- void **reverse** (char ∗str, int len)
- int **intToStr** (int x, char str[ ], int d)
- string dtoa (double n)

  dtoa Double to string conversion.
- 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

5.4.2 Function Documentation

5.4.2.1 dtoa()

```
string dtoa (
             double n )
```

dtoa Double to string conversion.

Parameters

n	Double to be converted.

Returns

string

5.4.2.2 itos()

```
string itos (
             int n )
```

itos Integer to string conversion.

Parameters

n	Integer to be converted.

Returns

string

Index