

# Package ‘WVPlots’

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**Title** Common Plots for Analysis

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<https://winvector.github.io/WVPlots/>

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**BugReports** <https://github.com/WinVector/WVPlots/issues>

**Description** Select data analysis plots, under a standardized calling interface implemented on top of 'ggplot2' and 'plotly'.  
Plots of interest include: 'ROC', gain curve, scatter plot with marginal distributions, conditioned scatter plot with marginal densities, box and stem with matching theoretical distribution, and density with matching theoretical distribution.

**License** GPL-2 | GPL-3

**VignetteBuilder** knitr

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**Suggests** knitr, RUnit, plotly, hexbin

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---

BinaryYScatterPlot      *Plot a scatter plot of a binary variable with smoothing curve.*

---

### Description

Plot the scatter plot of a binary variable with a smoothing curve.

### Usage

```
BinaryYScatterPlot(frame, xvar, yvar, title, ..., se = FALSE,
  use_glm = TRUE, point_color = "black", smooth_color = "blue")
```

### Arguments

frame	data frame to get values from
xvar	name of the independent column in frame
yvar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
se	if TRUE, add error bars (defaults to FALSE). Ignored if useGLM is TRUE
use_glm	if TRUE, "smooths" with a one-variable logistic regression (defaults to TRUE)
point_color	color for points
smooth_color	color for smoothing line

### Details

The points are jittered for legibility. By default, a logistic regression fit is used, so that the smoothing curve represents the probability of  $y == 1$  (as fit by the logistic regression). If `use_glm` is set to FALSE, a standard smoothing curve (either loess or a spline fit) is used.

### Examples

```
set.seed(34903490)
x = rnorm(50)
y = 0.5*x^2 + 2*x + rnorm(length(x))
frm = data.frame(x=x,y=y,yC=y>=as.numeric(quantile(y,probs=0.8)))
frm$absY <- abs(frm$y)
frm$posY = frm$y > 0
frm$costX = 1
WVPlots::BinaryYScatterPlot(frm, "x", "posY",
  title="Example 'Probability of Y' Plot")
```

---

ClevelandDotPlot      *Plot a Cleveland dot plot.*

---

### Description

Plot counts of a categorical variable.

### Usage

```
ClevelandDotPlot(frm, xvar, title, ..., sort = -1, limit_n = NULL,
  stem = TRUE, color = "black")
```

### Arguments

frm	data frame to get values from
xvar	name of the independent (input or model) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
sort	if TRUE sort data
limit_n	if not NULL number of items to plot
stem	if TRUE add stems/whiskers to plot
color	color for points and stems

### Details

Assumes that xvar is a factor or can be coerced to one (character or integral).

- `sort < 0` sorts the factor levels in decreasing order (most frequent level first)
- `sort > 0` sorts the factor levels in increasing order (good when used in conjunction with `coord_flip()`)
- `sort = 0` leaves the factor levels in "natural order" – usually alphabetical
- `stem = FALSE` will plot only the dots, without the stem to the `y=0` line.
- `limit_n = NULL` plots all the levels, `N` an integer limits to the top `N` most populous levels

### Examples

```
set.seed(34903490)
# discrete variable: letters of the alphabet
# frequencies of letters in English
# source: http://en.algorithm.net/article/40379/Letter-frequency-English
letterFreqs = c(8.167, 1.492, 2.782, 4.253, 12.702, 2.228,
  2.015, 6.094, 6.966, 0.153, 0.772, 4.025, 2.406, 6.749, 7.507, 1.929,
  0.095, 5.987, 6.327, 9.056, 2.758, 0.978, 2.360, 0.150, 1.974, 0.074)
letterFreqs = letterFreqs/100
```

```

letterFrame = data.frame(letter = letters, freq=letterFreqs)
# now let's generate letters according to their letter frequencies
N = 1000
randomDraws = data.frame(draw=1:N,
  letter=sample(letterFrame$letter, size=N,
    replace=TRUE, prob=letterFrame$freq))
WVPlots::ClevelandDotPlot(randomDraws, "letter",
  title = "Example Cleveland-style dot plot")

# Note the use of sort = 0, and that the graph correctly includes counts
# with no occurrences (5, and 7)
WVPlots::ClevelandDotPlot(mtcars, "carb", sort = 0, "Example of counting integer values")

```

---

ConditionalSmoothedScatterPlot

*Plot a scatter plot with smoothing line.*

---

## Description

Plot a scatter plot with a smoothing line; the smoothing window is aligned either left, center or right.

## Usage

```

ConditionalSmoothedScatterPlot(frame, xvar, yvar, groupvar, title, ...,
  k = 3, align = "center", point_color = "black",
  smooth_color = "black", palette = "Dark2")

```

## Arguments

frame	data frame to get values from
xvar	name of the independent column in frame. Assumed to be regularly spaced
yvar	name of the dependent (output or result to be modeled) column in frame
groupvar	name of the grouping column in frame. Can be NULL for an unconditional plot
title	title for plot
...	no unnamed argument, added to force named binding of later arguments.
k	width of smoothing window. Must be odd for a center-aligned plot. Defaults to 3
align	smoothing window alignment: 'center', 'left', or 'right'. Defaults to 'center'
point_color	color of points, when groupvar is NULL
smooth_color	color of smoothing line, when groupvar is NULL
palette	name of Brewer palette, when groupvar is non-NULL (can be NULL)

**Details**

xvar is the continuous independent variable and yvar is the dependent binary variable. Smoothing is by a square window of width k.

If palette is NULL, and groupvar is non-NULL, plot colors will be chosen from the default ggplot2 palette. Setting palette to NULL allows the user to choose a non-Brewer palette, for example with [scale\\_fill\\_manual](#).

**Examples**

```
y = c(1,2,3,4,5,10,15,18,20,25)
x = seq_len(length(y))
df = data.frame(x=x, y=y, group=x>5)
WVPlots::ConditionalSmoothedScatterPlot(df, "x", "y", NULL,
  title="left smooth, one groups", align="left")
WVPlots::ConditionalSmoothedScatterPlot(df, "x", "y", "group",
  title="left smooth, two groups", align="left")
```

---

DiscreteDistribution *Plot distribution of a single discrete numerical variable.*

---

**Description**

Similar to calling ClevelandDotPlot with sort = 0 on a numerical x variable that takes on a discrete set of values.

**Usage**

```
DiscreteDistribution(frm, xvar, title, ..., stem = TRUE,
  color = "black")
```

**Arguments**

frm	data frame to get values from
xvar	numeric: name of the variable whose distribution is to be plotted
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
stem	if TRUE add whisker/stems to plot
color	color of points and stems

**Examples**

```
frmx = data.frame(x = rbinom(1000, 20, 0.5))
WVPlots::DiscreteDistribution(frmx, "x", "Discrete example")
```

---

DoubleDensityPlot      *Plot two density plots conditioned on an outcome variable.*

---

### Description

Plot two density plots conditioned on a binary outcome variable.

### Usage

```
DoubleDensityPlot(frame, xvar, truthVar, title, ..., truth_target = NULL,
  palette = "Dark2")
```

### Arguments

frame	data frame to get values from
xvar	name of the independent (input or model) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
truth_target	if not NULL compare to this scalar value.
palette	name of Brewer palette (can be NULL)

### Details

The use case for this visualization is to plot the distribution of a predictive model score (usually the predicted probability of a desired outcome) conditioned on the actual outcome. However, you can use it to compare the distribution of any numerical quantity conditioned on a binary feature. See the examples.

The plot will degrade gracefully in degenerate conditions, for example when only one category is present.

If palette is NULL, plot colors will be chosen from the default ggplot2 palette. Setting palette to NULL allows the user to choose a non-Brewer palette, for example with [scale\\_fill\\_manual](#).

### Examples

```
mpg = ggplot2::mpg
mpg$trans = gsub("\\(.*$", "", mpg$trans)
WVPlots::DoubleDensityPlot(mpg, "cty", "trans", "City driving mpg by transmission type")

# redo the last plot with a custom palette
cmap = c("auto" = "#b2df8a", "manual" = "#1f78b4")
plt = WVPlots::DoubleDensityPlot(mpg, "cty", "trans",
  palette = NULL,
  title="City driving mpg by transmission type")
plt + ggplot2::scale_color_manual(values=cmap) +
```

```

ggplot2::scale_fill_manual(values=cmap)

set.seed(34903490)
x = rnorm(50)
y = 0.5*x^2 + 2*x + rnorm(length(x))
frm = data.frame(score=x,
  truth=(y>=as.numeric(quantile(y,probs=0.8))),
  stuck=TRUE,
  rare=FALSE)
frm[1,'rare'] = TRUE
WVPlots::DoubleDensityPlot(frm, "score", "truth", title="Example double density plot")

```

---

DoubleHistogramPlot *Plot two histograms conditioned on an outcome variable.*

---

## Description

Plot two histograms conditioned on a binary outcome variable.

## Usage

```
DoubleHistogramPlot(frame, xvar, truthVar, title, ..., palette = "Dark2",
  breaks = 40)
```

## Arguments

frame	data frame to get values from
xvar	name of the independent (input or model) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
palette	name of Brewer palette (can be NULL)
breaks	breaks to pass to histogram

## Details

To distinguish the two conditions, one histogram is plotted upside-down.

The use case for this visualization is to plot a predictive model score (usually the predicted probability of a desired outcome) conditioned on the actual outcome. However, you can use it to compare any numerical quantity conditioned on a binary feature.

If `palette` is NULL, plot colors will be chosen from the default ggplot2 palette. Setting `palette` to NULL allows the user to choose a non-Brewer palette, for example with [scale\\_fill\\_manual](#).



**Examples**

```

set.seed(34903490)
x = rnorm(50)
y = 0.5*x^2 + 2*x + rnorm(length(x))
frm = data.frame(x=x,y=y,yC=y>=as.numeric(quantile(y,probs=0.8)))
frm$absY <- abs(frm$y)
frm$posY = frm$y > 0
frm$costX = 1
WVPlots::DoubleHistogramPlot(frm, "x", "yC", title="Example double histogram plot")

# redo the plot with a custom palette
plt = WVPlots::DoubleHistogramPlot(frm, "x", "yC", palette=NULL,
                                   title="Example double histogram plot")
cmap = c("TRUE" = "#b2df8a", "FALSE" = "#1f78b4")
plt + ggplot2::scale_color_manual(values=cmap) +
  ggplot2::scale_fill_manual(values=cmap)

```

GainCurvePlot

*Plot the cumulative gain curve of a sort-order.***Description**

Plot the cumulative gain curve of a sort-order.

**Usage**

```

GainCurvePlot(frame, xvar, truthVar, title, ..., estimate_sig = FALSE,
  large_count = 1000, truth_target = NULL, model_color = "darkblue",
  wizard_color = "darkgreen", shadow_color = "darkgray")

```

**Arguments**

frame	data frame to get values from
xvar	name of the independent (input or model score) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE compute significance.
large_count	numeric, upper bound target for number of plotting points.
truth_target	if not NULL compare to this scalar value.
model_color	color for the model curve
wizard_color	color for the "wizard" (best possible) curve
shadow_color	color for the shaded area under the curve

## Details

The use case for this visualization is to compare a predictive model score to an actual outcome (either binary (0/1) or continuous). In this case the gain curve plot measures how well the model score sorts the data compared to the true outcome value.

The x-axis represents the fraction of items seen when sorted by score, and the y-axis represents the cumulative summed true outcome represented by the items seen so far. See, for example, [https://www.ibm.com/support/knowledgecenter/SSLVMB\\_24.0.0/spss/tutorials/mlp\\_bankloan\\_outputtype\\_02.html](https://www.ibm.com/support/knowledgecenter/SSLVMB_24.0.0/spss/tutorials/mlp_bankloan_outputtype_02.html).

For comparison, GainCurvePlot also plots the "wizard curve": the gain curve when the data is sorted according to its true outcome.

To improve presentation quality, the plot is limited to approximately large\_count points (default: 1000). For larger data sets, the data is appropriately randomly sampled down before plotting.

## Examples

```
set.seed(34903490)
y = abs(rnorm(20)) + 0.1
x = abs(y + 0.5*rnorm(20))
frm = data.frame(model=x, value=y)
WVPlots::GainCurvePlot(frm, "model", "value",
  title="Example Continuous Gain Curve")
```

---

GainCurvePlotC	<i>Plot the cumulative gain curve of a sort-order with costs.</i>
----------------	---

---

## Description

Plot the cumulative gain curve of a sort-order with costs.

## Usage

```
GainCurvePlotC(frame, xvar, costVar, truthVar, title, ...,
  estimate_sig = FALSE, large_count = 1000, model_color = "darkblue",
  wizard_color = "darkgreen", shadow_color = "darkgray")
```

## Arguments

frame	data frame to get values from
xvar	name of the independent (input or model score) column in frame
costVar	cost of each item (drives x-axis sum)
truthVar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.

<code>estimate_sig</code>	logical, if TRUE compute significance
<code>large_count</code>	numeric, upper bound target for number of plotting points
<code>model_color</code>	color for the model curve
<code>wizard_color</code>	color for the "wizard" (best possible) curve
<code>shadow_color</code>	color for the shaded area under the curve

### Details

`GainCurvePlotC` plots a cumulative gain curve for the case where items have an additional cost, in addition to an outcome value.

The x-axis represents the fraction of total cost experienced when items are sorted by score, and the y-axis represents the cumulative summed true outcome represented by the items seen so far.

For comparison, `GainCurvePlotC` also plots the "wizard curve": the gain curve when the data is sorted according to its true outcome/cost (the optimal sort order).

To improve presentation quality, the plot is limited to approximately `large_count` points (default: 1000). For larger data sets, the data is appropriately randomly sampled down before plotting.

### See Also

[GainCurvePlot](#)

### Examples

```
set.seed(34903490)
y = abs(rnorm(20)) + 0.1
x = abs(y + 0.5*rnorm(20))
frm = data.frame(model=x, value=y)
frm$costs=1
frm$costs[1]=5
WVPlots::GainCurvePlotC(frm, "model", "costs", "value",
  title="Example Continuous Gain CurveC")
```

---

GainCurvePlotWithNotation

*Plot the cumulative gain curve of a sort-order with extra notation*

---

### Description

Plot the cumulative gain curve of a sort-order with extra notation.

**Usage**

```
GainCurvePlotWithNotation(frame, xvar, truthVar, title, gainx, labelfun,
  ..., estimate_sig = FALSE, large_count = 1000,
  model_color = "darkblue", wizard_color = "darkgreen",
  shadow_color = "darkgray", crosshair_color = "red",
  text_color = "black")
```

**Arguments**

frame	data frame to get values from
xvar	name of the independent (input or model score) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
gainx	the point on the x axis corresponding to the desired label
labelfun	a function to return a label for the marked point
...	no unarmed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE compute significance
large_count	numeric, upper bound target for number of plotting points
model_color	color for the model curve
wizard_color	color for the "wizard" (best possible) curve
shadow_color	color for the shaded area under the curve
crosshair_color	color for the annotation location lines
text_color	color for the annotation text

**Details**

This is the standard gain curve plot (see [GainCurvePlot](#)) with a label attached to a particular value of x. The label is created by a function `labelfun`, which takes as inputs the x and y coordinates of a label and returns a string (the label).

**See Also**

[GainCurvePlot](#)

**Examples**

```
set.seed(34903490)
y = abs(rnorm(20)) + 0.1
x = abs(y + 0.5*rnorm(20))
frm = data.frame(model=x, value=y)
gainx = 0.10 # get the top 10% most valuable points as sorted by the model
# make a function to calculate the label for the annotated point
labelfun = function(gx, gy) {
  pctx = gx*100
```

```

pcty = gy*100

paste("The top ", pctx, "% most valuable points by the model\n",
      "are ", pcty, "% of total actual value", sep='')
}
WVPlots::GainCurvePlotWithNotation(frm, "model", "value",
  title="Example Gain Curve with annotation",
  gainx=gainx,labelfun=labelfun)

```

HexBinPlot

*Build a hex bin plot***Description**

Build a hex bin plot with rational color coding.

**Usage**

```
HexBinPlot(d, xvar, yvar, title, ..., lightcolor = "#deebf7",
  darkcolor = "#000000", bins = 30, binwidth = NULL, na.rm = FALSE)
```

**Arguments**

d	data frame
xvar	name of x variable column
yvar	name of y variable column
title	plot title
...	not used, forces later arguments to bind by name
lightcolor	light color for least dense areas
darkcolor	dark color for most dense areas
bins	passed to geom_hex
binwidth	passed to geom_hex
na.rm	passed to geom_hex

**Details**

Builds a standard ggplot2 hexbin plot, with a color scale such that dense areas are colored darker (the default ggplot2 fill scales will color dense areas lighter).

The user can choose an alternate color scale with endpoints lightcolor and darkcolor; it is up to the user to make sure that lightcolor is lighter than darkcolor.

Requires the hexbin package.

**Value**

a ggplot2 hexbin plot

**See Also**[geom\\_hex](#)**Examples**

```

if(requireNamespace("hexbin", quietly = TRUE)) {
  set.seed(634267)
  dframe = data.frame(x = rnorm(1000), y = rnorm(1000))
  print(HexBinPlot(dframe, "x", "y", "Example hexbin"))

  diamonds = ggplot2::diamonds
  print(HexBinPlot(diamonds, "carat", "price", "Diamonds example"))

  # change the colorscale
  print(HexBinPlot(diamonds, "carat", "price", "Diamonds example",
                  lightcolor="#fed98e",
                  darkcolor="#993404"))
}

```

LiftCurvePlot

*Plot the cumulative lift curve of a sort-order.***Description**

Plot the cumulative lift curve of a sort-order.

**Usage**

```

LiftCurvePlot(frame, xvar, truthVar, title, ..., large_count = 1000,
              include_wizard = TRUE, truth_target = NULL,
              model_color = "darkblue", wizard_color = "darkgreen")

```

**Arguments**

frame	data frame to get values from
xvar	name of the independent (input or model score) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
large_count	numeric, upper bound target for number of plotting points
include_wizard	logical, if TRUE plot the ideal or wizard plot.
truth_target	if not NULL compare to this scalar value.
model_color	color for the model curve
wizard_color	color for the "wizard" (best possible) curve

**Details**

The use case for this visualization is to compare a predictive model score to an actual outcome (either binary (0/1) or continuous). In this case the lift curve plot measures how well the model score sorts the data compared to the true outcome value.

The x-axis represents the fraction of items seen when sorted by score, and the y-axis represents the lift seen so far (cummulative value of model over cummulative value of random selection)..

For comparison, LiftCurvePlot also plots the "wizard curve": the lift curve when the data is sorted according to its true outcome.

To improve presentation quality, the plot is limited to approximately large\_count points (default: 1000). For larger data sets, the data is appropriately randomly sampled down before plotting.

**Examples**

```
set.seed(34903490)
y = abs(rnorm(20)) + 0.1
x = abs(y + 0.5*rnorm(20))
frm = data.frame(model=x, value=y)
WVPlots::LiftCurvePlot(frm, "model", "value",
  title="Example Continuous Lift Curve")
```

---

LogLogPlot

*Log-log plot*


---

**Description**

Plot a trend on log-log paper.

**Usage**

```
LogLogPlot(frame, xvar, yvar, title, ..., use_coord_trans = FALSE,
  point_color = "black", linear_color = "#018571",
  quadratic_color = "#a6611a", smoothing_color = "blue")
```

**Arguments**

frame	data frame to get values from
xvar	name of the independent (input or model) column in frame
yvar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
use_coord_trans	logical if TRUE, use coord_trans instead of coord_trans(x = "log10", y = "log10") instead of scale_x_log10() + scale_y_log10() (useful when there is not enough range to show ticks).

<code>point_color</code>	the color of the data points
<code>linear_color</code>	the color of the linear growth lines
<code>quadratic_color</code>	the color of the quadratic growth lines
<code>smoothing_color</code>	the color of the smoothing line through the data

### Details

This plot is intended for plotting functions that are observed costs or durations as a function of problem size. In this case we expect the ideal or expected cost function to be non-decreasing. Any negative trends are assumed to arise from the noise model. The graph is specialized to compare non-decreasing linear and non-decreasing quadratic growth.

Some care must be taken in drawing conclusions from log-log plots, as the transform is fairly violent. Please see: "(Mar's Law) Everything is linear if plotted log-log with a fat magic marker" (from Akin's Laws of Spacecraft Design [http://spacecraft.ssl.umd.edu/akins\\_laws.html](http://spacecraft.ssl.umd.edu/akins_laws.html)), and "So You Think You Have a Power Law" <http://bactra.org/weblog/491.html>.

### Examples

```
set.seed(5326)
frm = data.frame(x = 1:20)
frm$y <- 5 + frm$x + 0.2 * frm$x * frm$x + 0.1*abs(rnorm(nrow(frm)))
WVPlots::LogLogPlot(frm, "x", "y", title="Example Trend")
```

---

PairPlot

*Build a pair plot*

---

### Description

Creates a matrix of scatterplots, one for each possible pair of variables.

### Usage

```
PairPlot(d, meas_vars, title, ..., group_var = NULL, alpha = 1,
         palette = "Dark2", point_color = "darkgray")
```

### Arguments

<code>d</code>	data frame
<code>meas_vars</code>	the variables to be plotted
<code>title</code>	plot title
<code>...</code>	not used, forces later arguments to bind by name
<code>group_var</code>	variable for grouping and colorcoding



alpha	alpha for points on plot
palette	name of a brewer palette (NULL for ggplot2 default coloring)
point_color	point color for monochrome plots (no grouping)

**Details**

If palette is NULL, and group\_var is non-NULL, plot colors will be chosen from the default ggplot2 palette. Setting palette to NULL allows the user to choose a non-Brewer palette, for example with [scale\\_color\\_manual](#).

**Value**

a ggplot2 pair plot

**Examples**

```
PairPlot(iris, colnames(iris)[1:4], "Example plot", group_var = "Species")

# custom palette
colormap = c('#a6611a', '#dfc27d', '#018571')
PairPlot(iris, colnames(iris)[1:4], "Example plot",
         group_var = "Species", palette=NULL) +
  ggplot2::scale_color_manual(values=colormap)

# no color-coding
PairPlot(iris, colnames(iris)[1:4], "Example plot")
```

---

PlotDistCountBinomial *Plot count data with a theoretical binomial*

---

**Description**

Compares empirical count data to a binomial distribution

**Usage**

```
PlotDistCountBinomial(frm, xvar, trial_size, title, ..., p = NULL,
  limit_to_observed_range = FALSE, count_color = "black",
  binom_color = "blue")
```

**Arguments**

frm	data frame to get values from
xvar	column of frm that counts the number of successes for each trial
trial_size	the number of "coin flips" in a trial

title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
p	mean of the binomial. If NULL, use empirical mean
limit_to_observed_range	If TRUE, limit plot to observed counts
count_color	color of empirical distribution
binom_color	color of theoretical binomial

### Details

This function is useful for comparing the number of successes that occur in a series of trials, all of the same size, to a binomial of a given success-probability.

Plots the empirical distribution of successes, and a theoretical matching binomial. If the mean of the binomial,  $p$ , is given, the binomial with success-probability  $p$  is plotted. Otherwise,  $p$  is taken to be the pooled success rate of the data:  $\text{sum}(\text{frm}[[\text{xvar}]]) / (\text{trial\_size} * \text{nrow}(\text{frm}))$ . The mean of the binomial is reported in the subtitle of the plot (to three significant figures).

If `limit_to_observed_range` is TRUE, the range of the plot will only cover the range of the empirical data. Otherwise, the range of the plot will be  $0 : \text{trial\_size}$  (the default).

### See Also

[PlotDistHistBeta](#), [PlotDistDensityBeta](#),

### Examples

```
set.seed(23590)
class_size = 35
nclasses = 100
true_frate = 0.4
fdata = data.frame(n_female = rbinom(nclasses, class_size, true_frate))

title = paste("Distribution of count of female students, class size =", class_size)
# compare to empirical p
PlotDistCountBinomial(fdata, "n_female", class_size, title)

# compare to theoretical p of 0.5
PlotDistCountBinomial(fdata, "n_female", class_size, title,
  p = 0.5)

# Example where the distribution is not of a true single binomial
fdata2 = rbind(data.frame(n_female = rbinom(50, class_size, 0.25)),
  data.frame(n_female = rbinom(10, class_size, 0.60)) )
PlotDistCountBinomial(fdata2, "n_female", class_size, title)
```

---

PlotDistCountNormal *Plot distribution details as a histogram plus matching normal*

---

## Description

Compares empirical data to a normal distribution with the same mean and standard deviation.

## Usage

```
PlotDistCountNormal(frm, xvar, title, ..., binWidth = c(),  
  hist_color = "black", normal_color = "blue", mean_color = "blue",  
  sd_color = "blue")
```

## Arguments

frm	data frame to get values from
xvar	name of the independent (input or model) column in frame
title	title to place on plot
...	no unarmed argument, added to force named binding of later arguments.
binWidth	width of histogram bins
hist_color	color of empirical histogram
normal_color	color of matching theoretical normal
mean_color	color of mean line
sd_color	color of 1-standard deviation lines (can be NULL)

## Details

Plots the histograms of the empirical distribution and of the matching normal distribution. Also plots the mean and plus/minus one standard deviation.

Bin width for the histogram is calculated automatically to yield approximately 50 bins across the range of the data, unless the binWidth argument is explicitly passed in. binWidth is reported in the subtitle of the plot.

## Examples

```
set.seed(52523)  
d <- data.frame(wt=100*rnorm(100))  
PlotDistCountNormal(d, 'wt', 'example')  
  
# no sd lines  
PlotDistCountNormal(d, 'wt', 'example', sd_color=NULL)
```

---

PlotDistDensityBeta *Plot empirical rate data as a density with the matching beta distribution*

---

### Description

Compares empirical rate data to a beta distribution with the same mean and standard deviation.

### Usage

```
PlotDistDensityBeta(frm, xvar, title, ..., curve_color = "lightgray",
  beta_color = "blue", mean_color = "blue", sd_color = "darkgray")
```

### Arguments

frm	data frame to get values from
xvar	name of the independent (input or model) column in frame
title	title to place on plot
...	force later arguments to bind by name
curve_color	color for empirical density curve
beta_color	color for matching theoretical beta
mean_color	color for mean line
sd_color	color for 1-standard deviation lines (can be NULL)

### Details

Plots the empirical density, the theoretical matching beta, the mean value, and plus/minus one standard deviation from the mean.

### Examples

```
set.seed(52523)
N = 100
pgray = 0.1 # rate of gray horses in the population
herd_size = round(runif(N, min=25, 50))
ngray = rbinom(N, herd_size, pgray)
hdata = data.frame(n_gray=ngray, herd_size=herd_size)

# observed rate of gray horses in each herd
hdata$rate_gray = with(hdata, ngray/herd_size)

title = "Observed prevalence of gray horses in population"

PlotDistDensityBeta(hdata, "rate_gray", title) +
  ggplot2::geom_vline(xintercept = pgray, linetype=4, color="maroon") +
  ggplot2::annotate("text", x=pgray+0.01, y=0.01, hjust="left",
```

```
label = paste("True prevalence =", pgray))

# no sd lines
PlotDistDensityBeta(hdata, "rate_gray", title,
                    sd_color=NULL)
```

---

PlotDistDensityNormal *Plot an empirical density with the matching normal distribution*

---

## Description

Compares empirical data to a normal distribution with the same mean and standard deviation.

## Usage

```
PlotDistDensityNormal(frm, xvar, title, ..., adjust = 0.5,
                      curve_color = "lightgray", normal_color = "blue",
                      mean_color = "blue", sd_color = "darkgray")
```

## Arguments

frm	data frame to get values from
xvar	name of the independent (input or model) column in frame
title	title to place on plot
...	no unarmed argument, added to force named binding of later arguments.
adjust	passed to <code>geom_density</code> ; controls smoothness of density plot
curve_color	color for empirical density curve
normal_color	color for theoretical matching normal
mean_color	color of mean line
sd_color	color for 1-standard deviation lines (can be NULL)

## Details

Plots the empirical density, the theoretical matching normal, the mean value, and plus/minus one standard deviation from the mean.

## See Also

[geom\\_density](#)

**Examples**

```

set.seed(52523)
d <- data.frame(wt=100*rnorm(100))
PlotDistDensityNormal(d, 'wt', 'example')

# no sd lines
PlotDistDensityNormal(d, 'wt', 'example', sd_color=NULL)

```

---

PlotDistHistBeta      *Plot empirical rate data as a histogram plus matching beta*

---

**Description**

Compares empirical rate data to a beta distribution with the same mean and standard deviation.

**Usage**

```

PlotDistHistBeta(frm, xvar, title, ..., bins = 30,
  hist_color = "darkgray", beta_color = "blue", mean_color = "blue",
  sd_color = "darkgray")

```

**Arguments**

frm	data frame to get values from
xvar	name of the independent (input or model) column in frame
title	title to place on plot
...	force later arguments to bind by name
bins	passed to geom_histogram(). Default: 30
hist_color	color of empirical histogram
beta_color	color of matching theoretical beta
mean_color	color of mean line
sd_color	color of 1-standard deviation lines (can be NULL)

**Details**

Plots the histogram of the empirical distribution and the density of the matching beta distribution. Also plots the mean and plus/minus one standard deviation.

The number of bins for the histogram defaults to 30. The binwidth can also be passed in instead of the number of bins.

**Value**

ggplot2 plot

**Examples**

```

set.seed(52523)
N = 100
pgray = 0.1 # rate of gray horses in the population
herd_size = round(runif(N, min=25, 50))
ngray = rbinom(N, herd_size, pgray)
hdata = data.frame(n_gray=ngray, herd_size=herd_size)

# observed rate of gray horses in each herd
hdata$rate_gray = with(hdata, n_gray/herd_size)

title = "Observed prevalence of gray horses in population"

PlotDistHistBeta(hdata, "rate_gray", title) +
  ggplot2::geom_vline(xintercept = pgray, linetype=4, color="maroon") +
  ggplot2::annotate("text", x=pgray+0.01, y=0.01, hjust="left",
                    label = paste("True prevalence =", pgray))

# no sd lines
PlotDistHistBeta(hdata, "rate_gray", title,
                 sd_color=NULL)

```

---

plotlyROC

*Use plotly to produce a ROC plot.*


---

**Description**

Use plotly to produce a ROC plot.

**Usage**

```
plotlyROC(d, predCol, outcomeCol, outcomeTarget, title, ...,
         estimate_sig = FALSE)
```

**Arguments**

d	dataframe
predCol	name of column with numeric predictions
outcomeCol	name of column with truth
outcomeTarget	value considered true
title	character title for plot
...	no unnamed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE estimate and display significance of difference from AUC 0.5.

**Value**

plotly plot

**See Also**[ROCPlot](#)**Examples**

```

if(requireNamespace("plotly", quietly = TRUE)) {
  set.seed(34903490)
  x = rnorm(50)
  y = 0.5*x^2 + 2*x + rnorm(length(x))
  frm = data.frame(x=x,yC=y>=as.numeric(quantile(y,probs=0.8)))
  plotlyROC(frm, 'x', 'yC', TRUE, 'example plot', estimate_sig = TRUE)
}

```

---

plot\_fit\_trajectory     *Plot the trajectory of a model fit.*

---

**Description**

Plot a history of model fit performance over the a trajectory of times.

**Usage**

```

plot_fit_trajectory(d, column_description, title, ...,
  epoch_name = "epoch", needs_flip = c(), pick_metric = NULL,
  discount_rate = NULL, draw_ribbon = FALSE, draw_segments = FALSE,
  val_color = "#d95f02", train_color = "#1b9e77",
  pick_color = "#e6ab02")

```

**Arguments**

d	data frame to get values from.
column_description	description of column measures (data.frame with columns measure, validation, and training).
title	character title for plot.
...	force later arguments to be bound by name
epoch_name	name for epoch or trajectory column.
needs_flip	character array of measures that need to be flipped.
pick_metric	character metric to maximize.
discount_rate	numeric what fraction of over-fit to subtract from validation performance.
draw_ribbon	present the difference in training and validation performance as a ribbon rather than two curves? (default FALSE)



draw\_segments logical if TRUE draw over-fit/under-fit segments.  
 val\_color color for validation performance curve  
 train\_color color for training performance curve  
 pick\_color color for indicating optimal stopping point

### Details

This visualization can be applied to any staged machine learning algorithm. For example one could plot the performance of a gradient boosting machine as a function of the number of trees added. The fit history data should be in the form given in the example below.

The example below gives a fit plot for a history report from Keras R package. Please see <http://www.win-vector.com/blog/2017/12/plotting-deep-learning-model-performance-trajectories/> for some examples and details.

### Value

ggplot2 plot

### See Also

[plot\\_Keras\\_fit\\_trajectory](#)

### Examples

```
d <- data.frame(
  epoch = c(1, 2, 3, 4, 5),
  val_loss = c(0.3769818, 0.2996994, 0.2963943, 0.2779052, 0.2842501),
  val_acc = c(0.8722000, 0.8895000, 0.8822000, 0.8899000, 0.8861000),
  loss = c(0.5067290, 0.3002033, 0.2165675, 0.1738829, 0.1410933),
  acc = c(0.7852000, 0.9040000, 0.9303333, 0.9428000, 0.9545333) )

cT <- data.frame(
  measure = c("minus binary cross entropy", "accuracy"),
  training = c("loss", "acc"),
  validation = c("val_loss", "val_acc"),
  stringsAsFactors = FALSE)

plt <- plot_fit_trajectory(
  d,
  column_description = cT,
  needs_flip = "minus binary cross entropy",
  title = "model performance by epoch, dataset, and measure",
  epoch_name = "epoch",
  pick_metric = "minus binary cross entropy",
  discount_rate = 0.1)

suppressWarnings(print(plt)) # too few points for loess
```

---

plot\_Keras\_fit\_trajectory

*Plot the trajectory of a Keras model fit.*

---

## Description

Plot a history of model fit performance over the number of training epochs.

## Usage

```
plot_Keras_fit_trajectory(d, title, ..., epoch_name = "epoch",
    lossname = "loss", loss_pretty_name = "minus binary cross entropy",
    perfname = "acc", perf_pretty_name = "accuracy",
    pick_metric = loss_pretty_name, fliploss = TRUE,
    discount_rate = NULL, draw_ribbon = FALSE, val_color = "#d95f02",
    train_color = "#1b9e77", pick_color = "#e6ab02")
```

## Arguments

d	data frame to get values from.
title	character title for plot.
...	force later arguments to be bound by name
epoch_name	name for epoch or trajectory column.
lossname	name of training loss column (default 'loss')
loss_pretty_name	name for loss on graph (default 'minus binary cross entropy')
perfname	name of training performance column (default 'acc')
perf_pretty_name	name for performance metric on graph (default 'accuracy')
pick_metric	character: metric to maximize (NULL for no pick line - default loss_pretty_name)
fliploss	flip the loss so that "larger is better"? (default TRUE)
discount_rate	numeric: what fraction of over-fit to subtract from validation performance.
draw_ribbon	present the difference in training and validation performance as a ribbon rather than two curves? (default FALSE)
val_color	color for validation performance curve
train_color	color for training performance curve
pick_color	color for indicating optimal stopping point

**Details**

Assumes a performance matrix that carries information for both training and validation loss, and an additional training and validation performance metric, in the format that a Keras history object returns.

By default, flips the loss so that better performance is larger for both the loss and the performance metric, and then draws a vertical line at the minimum validation loss (maximum flipped validation loss). If you choose not to flip the loss, you should not use the loss as the `pick_metric`.

The example below gives a fit plot for a history report from Keras R package. Please see <http://winvector.github.io/FluidData/PlotExample/KerasPerfPlot.html> for some details.

**Value**

ggplot2 plot

**See Also**

[plot\\_fit\\_trajectory](#)

**Examples**

```
# example data (from Keras)
d <- data.frame(
  val_loss = c(0.3769818, 0.2996994, 0.2963943, 0.2779052, 0.2842501),
  val_acc  = c(0.8722000, 0.8895000, 0.8822000, 0.8899000, 0.8861000),
  loss    = c(0.5067290, 0.3002033, 0.2165675, 0.1738829, 0.1410933),
  acc     = c(0.7852000, 0.9040000, 0.9303333, 0.9428000, 0.9545333) )

plt <- plot_Keras_fit_trajectory(
  d,
  title = "model performance by epoch, dataset, and measure")

suppressWarnings(print(plt)) # too few points for loess
```

---

PRPlot

*Plot Precision-Recall plot.*

---

**Description**

Plot Precision-Recall plot.

**Usage**

```
PRPlot(frame, xvar, truthVar, truthTarget, title, ...,
  estimate_sig = FALSE)
```

**Arguments**

frame	data frame to get values from
xvar	name of the independent (input or model) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
truthTarget	value we consider to be positive
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE compute significance

**Details**

See <http://www.nature.com/nmeth/journal/v13/n8/full/nmeth.3945.html> for a discussion of precision and recall, and how the precision/recall plot relates to the ROC plot.

In addition to plotting precision versus recall, PRPlot reports the best achieved F1 score, and plots an isoline corresponding to that F1 score.

**See Also**

[ROCPlot](#)

**Examples**

```
set.seed(34903490)
x = rnorm(50)
y = 0.5*x^2 + 2*x + rnorm(length(x))
frm = data.frame(x=x,y=y,yC=y>=as.numeric(quantile(y,probs=0.8)))
frm$absY <- abs(frm$y)
frm$posY = frm$y > 0
frm$costX = 1
WVPlots::PRPlot(frm, "x", "yC", TRUE, title="Example Precision-Recall plot")
```

---

PRTPlot

---

*Plot Precision-Recall or Enrichment-Recall as a function of threshold.*


---

**Description**

Plot classifier performance metrics as a function of threshold.

**Usage**

```
PRTPlot(frame, predVar, truthVar, truthTarget, title, ...,
  plotvars = c("precision", "recall"), thresholdrange = c(-Inf, Inf),
  linecolor = "black")
```

**Arguments**

frame	data frame to get values from
predVar	name of the column of predicted scores
truthVar	name of the column of actual outcomes in frame
truthTarget	value we consider to be positive
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
plotvars	variables to plot, must be at least one of the measures listed below. Defaults to c("precision", "recall")
thresholdrange	range of thresholds to plot.
linecolor	line color for the plot

**Details**

For a classifier, the precision is what fraction of predicted positives are true positives; the recall is what fraction of true positives the classifier finds, and the enrichment is the ratio of classifier precision to the average rate of positives. Plotting precision-recall or enrichment-recall as a function of classifier score helps identify a score threshold that achieves an acceptable tradeoff between precision and recall, or enrichment and recall.

In addition to precision/recall, PRTPlot can plot a number of other metrics:

- precision: fraction of predicted positives that are true positives
- recall: fraction of true positives that were predicted to be true
- enrichment: ratio of classifier precision to prevalence of positive class
- sensitivity: the same as recall (also known as the true positive rate)
- specificity: fraction of true negatives to all negatives (or 1 - false\_positive\_rate)
- false\_positive\_rate: fraction of negatives predicted to be true over all negatives

For example, plotting sensitivity/false\_positive\_rate as functions of threshold will "unroll" an ROC Plot.

Plots are in a single column, in the order specified by plotvars.

**See Also**

[PRPPlot](#), [ROCPlot](#)

**Examples**

```
df <- iris
df$isVersicolor <- with(df, Species=='versicolor')
model = glm(isVersicolor ~ Petal.Length + Petal.Width + Sepal.Length + Sepal.Width,
            data=df, family=binomial)
df$pred = predict(model, newdata=df, type="response")
```

```

WVPlots::PRTPlot(df, "pred", "isVersicolor", TRUE, title="Example Precision-Recall threshold plot")

WVPlots::PRTPlot(df, "pred", "isVersicolor", TRUE,
  plotvars = c("sensitivity", "specificity", "false_positive_rate"),
  title="Sensitivity/specificity/FPR as functions of threshold")

```

---

 ROCPlot

*Plot receiver operating characteristic plot.*


---

### Description

Plot receiver operating characteristic plot.

### Usage

```

ROCPlot(frame, xvar, truthVar, truthTarget, title, ...,
  estimate_sig = FALSE, returnScores = FALSE, nrep = 100,
  parallelCluster = NULL, curve_color = "darkblue",
  fill_color = "black", diag_color = "black")

```

### Arguments

frame	data frame to get values from
xvar	name of the independent (input or model) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
truthTarget	value we consider to be positive
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE estimate and display significance of difference from AUC 0.5.
returnScores	logical if TRUE return detailed permutedScores
nrep	number of permutation repetitions to estimate p values.
parallelCluster	(optional) a cluster object created by package parallel or package snow.
curve_color	color of the ROC curve
fill_color	shading color for the area under the curve
diag_color	color for the AUC=0.5 line ( $x=y$ )

### Details

See <http://www.nature.com/nmeth/journal/v13/n8/full/nmeth.3945.html> for a discussion of true positive and false positive rates, and how the ROC plot relates to the precision/recall plot.

**See Also**[PRTPlot](#)**Examples**

```

set.seed(34903490)
x = rnorm(50)
y = 0.5*x^2 + 2*x + rnorm(length(x))
frm = data.frame(x=x,yC=y>=as.numeric(quantile(y,probs=0.8)))
WVPlots::ROCPlot(frm, "x", "yC", TRUE, title="Example ROC plot", estimate_sig = TRUE)

```

---

ROCPlotPair	<i>Compare two ROC plots.</i>
-------------	-------------------------------

---

**Description**

Plot two receiver operating characteristic curves from the same data.frame.

**Usage**

```

ROCPlotPair(frame, xvar1, xvar2, truthVar, truthTarget, title, ...,
  estimate_sig = FALSE, returnScores = FALSE, nrep = 100,
  parallelCluster = NULL, palette = "Dark2")

```

**Arguments**

frame	data frame to get values from
xvar1	name of the first independent (input or model) column in frame
xvar2	name of the second independent (input or model) column in frame
truthVar	name of the dependent (output or result to be modeled) column in frame
truthTarget	value we consider to be positive
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE estimate and display significance of difference from AUC 0.5.
returnScores	logical if TRUE return detailed permutedScores
nrep	number of permutation repetitions to estimate p values.
parallelCluster	(optional) a cluster object created by package parallel or package snow.
palette	name of a brewer palette (NULL for ggplot2 default coloring)

**Details**

The use case for this function is to compare the performance of two models when applied to a data set, where the predictions from both models are columns of the same data frame.

If `palette` is `NULL`, plot colors will be chosen from the default `ggplot2` palette. Setting `palette` to `NULL` allows the user to choose a non-Brewer palette, for example with [scale\\_color\\_manual](#).

**See Also**

[ROCPlot](#)

**Examples**

```
set.seed(34903490)
x1 = rnorm(50)
x2 = rnorm(length(x1))
y = 0.2*x2^2 + 0.5*x2 + x1 + rnorm(length(x1))
frm = data.frame(x1=x1,x2=x2,yC=y>=as.numeric(quantile(y,probs=0.8)))
# WVPlots::ROCPlot(frm, "x1", "yC", TRUE, title="Example ROC plot")
# WVPlots::ROCPlot(frm, "x2", "yC", TRUE, title="Example ROC plot")
WVPlots::ROCPlotPair(frm, "x1", "x2", "yC", TRUE,
  title="Example ROC pair plot", estimate_sig = TRUE)
```

---

ROCPlotPair2

*Compare two ROC plots.*

---

**Description**

Plot two receiver operating characteristic curves from different data frames.

**Usage**

```
ROCPlotPair2(nm1, frame1, xvar1, truthVar1, truthTarget1, nm2, frame2,
  xvar2, truthVar2, truthTarget2, title, ..., estimate_sig = TRUE,
  returnScores = FALSE, nrep = 100, parallelCluster = NULL,
  palette = "Dark2")
```

**Arguments**

<code>nm1</code>	name of first model
<code>frame1</code>	data frame to get values from
<code>xvar1</code>	name of the first independent (input or model) column in frame
<code>truthVar1</code>	name of the dependent (output or result to be modeled) column in frame
<code>truthTarget1</code>	value we consider to be positive
<code>nm2</code>	name of second model



frame2	data frame to get values from
xvar2	name of the first independent (input or model) column in frame
truthVar2	name of the dependent (output or result to be modeled) column in frame
truthTarget2	value we consider to be positive
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
estimate_sig	logical, if TRUE estimate and display significance of difference from AUC 0.5.
returnScores	logical if TRUE return detailed permutedScores
nrep	number of permutation repetitions to estimate p values.
parallelCluster	(optional) a cluster object created by package parallel or package snow.
palette	name of Brewer palette to color curves (can be NULL)

## Details

Use this curve to compare model predictions to true outcome from two data frames, each of which has its own model predictions and true outcome columns.

If palette is NULL, plot colors will be chosen from the default ggplot2 palette. Setting palette to NULL allows the user to choose a non-Brewer palette, for example with [scale\\_color\\_manual](#).

## See Also

[ROCPlot](#)

## Examples

```
set.seed(34903490)
x1 = rnorm(50)
x2 = rnorm(length(x1))
y = 0.2*x2^2 + 0.5*x2 + x1 + rnorm(length(x1))
frm = data.frame(x1=x1,x2=x2,yC=y>=as.numeric(quantile(y,probs=0.8)))
# WVPlots::ROCPlot(frm, "x1", "yC", TRUE, title="Example ROC plot")
# WVPlots::ROCPlot(frm, "x2", "yC", TRUE, title="Example ROC plot")
WVPlots::ROCPlotPair2('train',frm, "x1", "yC", TRUE,
                      'test', frm, "x2", "yC", TRUE,
                      title="Example ROC pair plot", estimate_sig = TRUE)
```

---

run\_WVPlots\_tests      *Run WVPlots package tests.*

---

### Description

For all files with names of the form "`^test_+\\.R$`" in the package directory `unit_tests` run all functions with names of the form "`^test_+.$`" as RUnit tests. Attaches RUnit and `pkg`, requires RUnit. Stops on error.

### Usage

```
run_WVPlots_tests(..., verbose = TRUE,
  package_test_dirs = "unit_tests", test_dirs = character(0),
  stop_on_issue = TRUE, stop_if_no_tests = TRUE,
  require_RUnit_attached = FALSE, require_pkg_attached = TRUE,
  rngKind = "Mersenne-Twister", rngNormalKind = "Inversion")
```

### Arguments

`...`                    not used, force later arguments to bind by name.

`verbose`                logical, if TRUE print more.

`package_test_dirs`      directory names to look for in the installed package.

`test_dirs`              paths to look for tests in.

`stop_on_issue`        logical, if TRUE stop after errors or failures.

`stop_if_no_tests`      logical, if TRUE stop if no tests were found.

`require_RUnit_attached` logical, if TRUE require RUnit be attached before testing.

`require_pkg_attached`    logical, if TRUE require `pkg` be attached before testing.

`rngKind`                pseudo-random number generator method name.

`rngNormalKind`        pseudo-random normal generator method name.

### Details

Based on <https://github.com/RcppCore/Rcpp/blob/master/tests/doRUnit.R>. This version is GPL-3, works derived from it must be distributed GPL-3.

### Value

RUnit test results (invisible).

---

ScatterBoxPlot	<i>Plot a scatter box plot.</i>
----------------	---------------------------------

---

### Description

Plot a boxplot with the data points superimposed.

### Usage

```
ScatterBoxPlot(frm, xvar, yvar, title, ..., pt_alpha = 0.3,  
               pt_color = "black", box_color = "black", box_fill = "lightgray")
```

### Arguments

frm	data frame to get values from
xvar	name of the independent column in frame; assumed discrete
yvar	name of the continuous column in frame
title	plot title
...	(doesn't take additional arguments, used to force later arguments by name)
pt_alpha	transparency of points in scatter plot
pt_color	point color
box_color	boxplot line color
box_fill	boxplot fill color (can be NA for no fill)

### Details

xvar is a discrete variable and yvar is a continuous variable.

### See Also

[ScatterBoxPlotH](#)

### Examples

```
classes = c("a", "b", "c")  
means = c(2, 4, 3)  
names(means) = classes  
label = sample(classes, size=1000, replace=TRUE)  
meas = means[label] + rnorm(1000)  
frm2 = data.frame(label=label,  
                  meas = meas)  
WVPlots::ScatterBoxPlot(frm2, "label", "meas", pt_alpha=0.2, title="Example Scatter/Box plot")
```

---

ScatterBoxPlotH      *Plot a scatter box plot in horizontal mode.*

---

### Description

Plot a boxplot with the data points superimposed. Box plots are aligned horizontally.

### Usage

```
ScatterBoxPlotH(frm, xvar, yvar, title, ..., pt_alpha = 0.3,
  pt_color = "black", box_color = "black", box_fill = "lightgray")
```

### Arguments

frm	data frame to get values from
xvar	name of the continuous column in frame
yvar	name of the independent column in frame; assumed discrete
title	plot title
...	(doesn't take additional arguments, used to force later arguments by name)
pt_alpha	transparency of points in scatter plot
pt_color	point color
box_color	boxplot line color
box_fill	boxplot fill color (can be NA for no fill)

### Details

xvar is a continuous variable and yvar is a discrete variable.

### See Also

[ScatterBoxPlot](#)

### Examples

```
classes = c("a", "b", "c")
means = c(2, 4, 3)
names(means) = classes
label = sample(classes, size=1000, replace=TRUE)
meas = means[label] + rnorm(1000)
frm2 = data.frame(label=label,
  meas = meas)
WVPlots::ScatterBoxPlotH(frm2, "meas", "label", pt_alpha=0.2, title="Example Scatter/Box plot")
```

---

ScatterHist	<i>Plot a scatter plot with marginals.</i>
-------------	--

---

### Description

Plot a scatter plot with optional smoothing curves or contour lines, and marginal histogram/density plots. Based on <http://www.win-vector.com/blog/2015/06/wanted-a-perfect-scatterplot-with-marginals/>. See also `ggExtra::ggMarginal`.

### Usage

```
ScatterHist(frame, xvar, yvar, title, ..., smoothmethod = "lm",
  estimate_sig = FALSE, minimal_labels = TRUE, binwidth_x = NULL,
  binwidth_y = NULL, adjust_x = 1, adjust_y = 1, point_alpha = 0.5,
  contour = FALSE, point_color = "black", hist_color = "gray",
  smoothing_color = "blue", density_color = "blue",
  contour_color = "blue")
```

### Arguments

frame	data frame to get values from
xvar	name of the independent (input or model) column in frame
yvar	name of the dependent (output or result to be modeled) column in frame
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
smoothmethod	(optional) one of 'auto', 'loess', 'gam', 'lm', 'identity', or 'none'.
estimate_sig	logical if TRUE and smoothmethod is 'identity' or 'lm', report goodness of fit and significance of relation.
minimal_labels	logical drop some annotations
binwidth_x	numeric binwidth for x histogram
binwidth_y	numeric binwidth for y histogram
adjust_x	numeric adjust x density plot
adjust_y	numeric adjust y density plot
point_alpha	numeric opaqueness of the plot points
contour	logical if TRUE add a 2d contour plot
point_color	color for scatter plots
hist_color	fill color for marginal histograms
smoothing_color	color for smoothing line
density_color	color for marginal density plots
contour_color	color for contour plots

## Details

If `smoothmethod` is:

- `'auto'`, `'loess'` or `'gam'`: the appropriate smoothing curve is added to the scatterplot.
- `'lm'` (the default): the best fit line is added to the scatterplot.
- `'identity'`: the line  $x = y$  is added to the scatterplot. This is useful for comparing model predictions to true outcome.
- `'none'`: no smoothing line is added to the scatterplot.

If `estimate_sig` is TRUE and `smoothmethod` is:

- `'lm'`: the R-squared of the linear fit is reported.
- `'identity'`: the R-squared of the exact relation between `xvar` and `yvar` is reported.

Note that the identity R-squared is NOT the square of the correlation between `xvar` and `yvar` (which includes an implicit shift and scale). It is the coefficient of determination between `xvar` and `yvar`, and can be negative. See [https://en.wikipedia.org/wiki/Coefficient\\_of\\_determination](https://en.wikipedia.org/wiki/Coefficient_of_determination) for more details. If `xvar` is the output of a model to predict `yvar`, then the identity R-squared, not the `lm` R-squared, is the correct measure.

If `smoothmethod` is neither `'lm'` or `'identity'` then `estimate_sig` is ignored.

## Value

plot grid

## See Also

[ScatterHistC](#)

## Examples

```
set.seed(34903490)
x = rnorm(50)
y = 0.5*x^2 + 2*x + rnorm(length(x))
frm = data.frame(x=x,y=y)
WVPlots::ScatterHist(frm, "x", "y",
  title= "Example Fit",
  smoothmethod = "gam",
  contour = TRUE)

# Same plot with custom colors
WVPlots::ScatterHist(frm, "x", "y",
  title= "Example Fit",
  smoothmethod = "gam",
  contour = TRUE,
  point_color = "#006d2c", # dark green
  hist_color = "#6baed6", # medium blue
  smoothing_color = "#54278f", # dark purple
  density_color = "#08519c", # darker blue
  contour_color = "#9e9ac8") # lighter purple
```

---

ScatterHistC	<i>Plot a conditional scatter plot with marginals.</i>
--------------	--

---

**Description**

Plot a scatter plot conditioned on a discrete variable, with marginal conditional density plots.

**Usage**

```
ScatterHistC(frame, xvar, yvar, cvar, title, ..., annot_size = 3,
             colorPalette = "Dark2", adjust_x = 1, adjust_y = 1)
```

**Arguments**

frame	data frame to get values from
xvar	name of the x variable
yvar	name of the y variable
cvar	name of condition variable
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
annot_size	numeric scale annotation text (if present)
colorPalette	name of a Brewer palette (see <a href="http://colorbrewer2.org/">http://colorbrewer2.org/</a> )
adjust_x	numeric: adjust x density plot
adjust_y	numeric: adjust y density plot

**Details**

xvar and yvar are the coordinates of the points, and cvar is the discrete conditioning variable that indicates which category each point (x,y) belongs to.

**Value**

plot grid

**See Also**

[ScatterHist](#)

**Examples**

```
set.seed(34903490)
frm = data.frame(x=rnorm(50),y=rnorm(50))
frm$cat <- frm$x+frm$y>0
WVPlots::ScatterHistC(frm, "x", "y", "cat",
                      title="Example Conditional Distribution")
```

---

 ScatterHistN

*Plot a height scatter plot with marginals.*


---

### Description

Plot a scatter plot conditioned on a continuous variable, with marginal conditional density plots.

### Usage

```
ScatterHistN(frame, xvar, yvar, zvar, title, ..., annot_size = 3,
             colorPalette = "RdYlBu", nclus = 3, adjust_x = 1, adjust_y = 1)
```

### Arguments

frame	data frame to get values from
xvar	name of the x variable
yvar	name of the y variable
zvar	name of height variable
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
annot_size	numeric: scale annotation text (if present)
colorPalette	name of a Brewer palette (see <a href="http://colorbrewer2.org/">http://colorbrewer2.org/</a> )
nclus	scalar: number of z-clusters to plot
adjust_x	numeric: adjust x density plot
adjust_y	numeric: adjust y density plot

### Details

xvar and yvar are the coordinates of the points, and zvar is the continuous conditioning variable. zvar is partitioned into nclus disjoint ranges (by default, 3), which are then treated as discrete categories. The scatterplot and marginal density plots are color-coded by these categories.

### See Also

[ScatterHistC](#)

### Examples

```
set.seed(34903490)
frm = data.frame(x=rnorm(50),y=rnorm(50))
frm$z <- frm$x+frm$y
WVPlots::ScatterHistN(frm, "x", "y", "z", title="Example Joint Distribution")
```



---

**ShadedDensity***Plot the distribution of a variable with a tail shaded*

---

**Description**

Plot the distribution of a variable with a tail shaded. Annotate with the area of the shaded region.

**Usage**

```
ShadedDensity(frame, xvar, threshold, title, ..., tail = "left",  
              linecolor = "darkgray", shading = "darkblue", annotate_area = TRUE)
```

**Arguments**

frame	data frame to get values from
xvar	name of the variable to be density plotted
threshold	boundary value for the tail
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
tail	which tail to shade, 'left' (default) or 'right'
linecolor	color of density curve
shading	color of shaded region and boundaries
annotate_area	if TRUE (default), report the area of the shaded region

**See Also**

[ShadedDensityCenter](#)

**Examples**

```
set.seed(52523)  
d = data.frame(meas=rnorm(100))  
threshold = -1.5  
WVPlots::ShadedDensity(d, "meas", threshold,  
                       title="Example shaded density plot, left tail")  
WVPlots::ShadedDensity(d, "meas", -threshold, tail="right",  
                       title="Example shaded density plot, right tail")
```

---

ShadedDensityCenter *Plot the distribution of a variable with a center region shaded*

---

### Description

Plot the distribution of a variable with a center region shaded. Annotate with the area of the shaded region.

### Usage

```
ShadedDensityCenter(frame, xvar, boundaries, title, ...,  
  linecolor = "darkgray", shading = "darkblue", annotate_area = TRUE)
```

### Arguments

frame	data frame to get values from
xvar	name of the variable to be density plotted
boundaries	vector of the min and max boundaries of the shaded region
title	title to place on plot
...	no unnamed argument, added to force named binding of later arguments.
linecolor	color of density curve
shading	color of shaded region and boundaries
annotate_area	if TRUE (default), report the area of the shaded region

### See Also

[ShadedDensity](#)

### Examples

```
set.seed(52523)  
d = data.frame(meas=rnorm(100))  
boundaries = c(-1.5, 1.5)  
WVPlots::ShadedDensityCenter(d, "meas", boundaries,  
  title="Example center-shaded density plot")
```

---

ShadowHist	<i>Plot a Shadow Histogram Plot</i>
------------	-------------------------------------

---

### Description

Plot a histogram of a continuous variable `xvar`, faceted on a categorical conditioning variable, `condvar`. Each faceted plot also shows a "shadow plot" of the unconditioned histogram for comparison.

### Usage

```
ShadowHist(frm, xvar, condvar, title, ..., ncol = 1,
           monochrome = FALSE, palette = "Dark2", fillcolor = "darkblue",
           bins = 30, binwidth = NULL)
```

### Arguments

<code>frm</code>	data frame to get values from.
<code>xvar</code>	name of the primary continuous variable
<code>condvar</code>	name of conditioning variable (categorical variable, controls faceting).
<code>title</code>	title to place on plot.
<code>...</code>	no unnamed argument, added to force named binding of later arguments.
<code>ncol</code>	numeric: number of columns in <code>facet_wrap</code> .
<code>monochrome</code>	logical: if TRUE, all facets filled with same color
<code>palette</code>	character: if <code>monochrome==FALSE</code> , name of brewer color palette (can be NULL)
<code>fillcolor</code>	character: if <code>monochrome==TRUE</code> , name of fill color
<code>bins</code>	number of bins. Defaults to thirty.
<code>binwidth</code>	width of the bins. Overrides bins.

### Details

Currently supports only the `bins` and `binwidth` arguments (see [geom\\_histogram](#)), but not the `center`, `boundary`, or `breaks` arguments.

By default, the facet plots are arranged in a single column. This can be changed with the optional `ncol` argument.

If `palette` is NULL, and `monochrome` is FALSE, plot colors will be chosen from the default ggplot2 palette. Setting `palette` to NULL allows the user to choose a non-Brewer palette, for example with [scale\\_fill\\_manual](#). For consistency with previous releases, `ShadowHist` defaults to `monochrome = FALSE`, while `ShadowPlot` defaults to `monochrome = TRUE`.

Please see here for some interesting discussion <https://drsimonj.svbtle.com/plotting-background-data-for-group>

### Value

a ggplot2 histogram plot

## Examples

```
ShadowHist(iris, "Petal.Length", "Species",
           title = "Petal Length distribution by Species")

# make all the facets the same color
ShadowHist(iris, "Petal.Length", "Species",
           monochrome=TRUE,
           title = "Petal Length distribution by Species")
```

---

ShadowPlot

*Plot a Shadow Bar Plot*


---

## Description

Plot a bar chart of row counts conditioned on the categorical variable `condvar`, faceted on a second categorical variable, `refinevar`. Each faceted plot also shows a "shadow plot" of the totals conditioned on `condvar` alone.

## Usage

```
ShadowPlot(frm, condvar, refinevar, title, ..., monochrome = TRUE,
           palette = "Dark2", fillcolor = "darkblue", ncol = 1)
```

## Arguments

<code>frm</code>	data frame to get values from.
<code>condvar</code>	name of the primary conditioning variable (a categorical variable, controls x-axis).
<code>refinevar</code>	name of the second or refining conditioning variable (also a categorical variable, controls faceting).
<code>title</code>	title to place on plot.
<code>...</code>	no unnamed argument, added to force named binding of later arguments.
<code>monochrome</code>	logical: if TRUE, all facets filled with same color
<code>palette</code>	character: if <code>monochrome==FALSE</code> , name of brewer color palette (can be NULL)
<code>fillcolor</code>	character: if <code>monochrome==TRUE</code> , name of fill color for bars
<code>ncol</code>	numeric: number of columns in <code>facet_wrap</code> .

**Details**

This plot enables comparisons of subpopulation totals across both `condvar` and `refinevar` simultaneously.

By default, the facet plots are arranged in a single column. This can be changed with the optional `ncol` argument.

If `palette` is `NULL`, and `monochrome` is `FALSE`, plot colors will be chosen from the default `ggplot2` palette. Setting `palette` to `NULL` allows the user to choose a non-Brewer palette, for example with [scale\\_fill\\_manual](#). For consistency with previous releases, `ShadowPlot` defaults to `monochrome = TRUE`, while `ShadowHist` defaults to `monochrome = FALSE`.

Please see here for some interesting discussion <https://drsimonj.svbtle.com/plotting-background-data-for-group>

**Value**

a `ggplot2` bar chart counting examples grouped by `condvar`, faceted by `refinevar`.

**Examples**

```
ShadowPlot(mtcars, "carb", "cyl",
           title = "Number of example cars by carb and cyl counts")

# colorcode the facets
ShadowPlot(mtcars, "carb", "cyl",
           monochrome = FALSE,
           title = "Number of example cars by carb and cyl counts")
```

**Description**

Select data analysis plots, under a standardized calling interface implemented on top of `ggplot2` and `plotly`. Plots of interest include: ROC, gain curve, scatter plot with marginal distributions, conditioned scatter plot with marginal densities. box and stem with matching theoretical distribution, density with matching theoretical distribution.

**Details**

For more information:

- `vignette(package='WVPlots')`
- `RShowDoc('WVPlots_examples', package='WVPlots')`
- Website: <https://github.com/WinVector/WVPlots>

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