hexbin
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ColorRamps

Color Ramps on Perceptually Linear Scales

Description

Functions for returning colors on perceptually linear scales, where steps correspond to ‘just detectable differences’.

Usage

LinGray (n, beg=1, end=92)
BTC (n, beg=1, end=256)
LinOCS (n, beg=1, end=256)
heat.ob (n, beg=1, end=256)
magent (n, beg=1, end=256)
plinrain(n, beg=1, end=256)

Arguments

n number of colors to return from the ramp
beg beginning of ramp, integer from 1-255
end end of ramp, integer from 1-255

Details

Several precalculated color ramps, that are on a perceptually linear color scale. A perceptually linear color scale is a scale where each jump corresponds to a “just detectable difference” in color and the scale is perceived as linear by the human eye (empirically determined).

When using the ramps, if beg is less than end the ramp will be reversed.

Value

returns an array of colors

Author(s)

Nicholas Lewin-Koh

References


See Also

rainbow, terrain.colors, rgb, hsv
erode.hexbin

Examples

h <- hexbin(rnorm(10000), rnorm(10000))
plot(h, colramp = BTY)
## looks better if you shave the tails:
plot(h, colramp = function(n) {LinOCS(n, beg = 15, end = 225)})

erode.hexbin  

Erosion of a Hexagon Count Image

Description

This erosion algorithm removes counts from hexagon cells at a rate proportional to the cells’ exposed surface area. When a cell becomes empty, algorithm removes the emptied cell and notes the removal order. Cell removal increases the exposure of any neighboring cells. The last cell removed is a type of bivariate median.

Usage

erode(hbin, cdfcut = 0.5)
erode.hexbin(hbin, cdfcut = 0.5)

Arguments

hbin          an object of class hexbin.
cdfcut        number in (0,1) indicating the confidence level for the limits.

Details

The algorithm extracts high count cells with containing a given fraction (cdfcut) of the total counts. The algorithm extracts all cells if cdfcut=0. The algorithm performs gray-level erosion on the extracted cells. Each erosion cycle removes counts from cells. The counts removed for each cell are a multiple of the cell’s exposed-face count. The algorithm choses the multiple so at least one cell will be empty or have a count deficit on each erosion cycle. The erode vector contain an erosion number for each cell. The value of erode is

$6 \times \text{erosion\_cycle\_at\_cell\_removal} - \text{cell\_deficit\_at\_removal}$

Cells with low values are eroded first. The cell with the highest erosion number is a candidate bivariate median. A few ties in erode are common.

Value

An "erodebin" object (with all the slots from hbin) and additionally with high count cells and a component erode that gives the erosion order.

See Also

hexbin, smooth.hexbin, hcell2xy, gplot.hexbin, grid.hexagons, grid.hexlegend
Examples

```r
set.seed(153)
x <- rnorm(10000)
y <- rnorm(10000)
bin <- hexbin(x, y)

smbin <- smooth.hexbin(bin)
erodebin <- erode.hexbin(smbin, cdfcut = .5)
plot(erodebin)

## bivariate boxplot
hboxplot(erodebin, main = "hboxplot(erodebin)")

# show erosion order
plot(bin, style = "lat", minarea = 1, maxarea = 1,
     legend = FALSE, border = gray(.7))

grid.hexagons(erodebin, style = "lat", minarea = 1, maxarea = 1, pen = "green")
xy <- hcell2xy(erodebin)
grid.text(lab = as.character(erodebin@erode), xy$x, xy$y,
          gp = gpar(col = "white", cex = 0.65))
```

getHMedian

Get coordinates of the median cell after the erode operation

Description

A method for a eroded hexbin object to extract the coordinates of the median cell. The median is simply the cell with the highest erosion number or the last cell to be eroded.

Usage

```
getHMedian(ebin)
```

Arguments

- **ebin**: result of `erode.hexbin()`.

Methods

```
ebin = "erodebin" ...
```

See Also

```
erode.hexbin
```
Examples

```r
set.seed(153)
x <- rnorm(10000)
y <- rnorm(10000)
bin <- hexbin(x, y)
smbin <- smooth.hexbin(bin)
erodebin <- erode.hexbin(smbin, cdfcut=.5)
getHMedian(erodebin)
```

Description

Plots Hexagons visualizing the counts in an hexbin object. Different styles are available. Provides a legend indicating the count representations.

Usage

```r
gplot.hexbin(x, style = "colorscale", legend = 1.2, lcex = 1,
             minarea = 0.04, maxarea = 0.8, mincnt = 1, maxcnt = max(x@count),
             trans = NULL, inv = NULL, colorcut = seq(0, 1, length = min(17, maxcnt)),
             border = NULL, density = NULL, pen = NULL,
             colramp = function(n) LinGray(n, beg = 90, end = 15),
             xlab = "", ylab = "", main = "", newpage = FALSE,
             type = c("p", "l", "n"), xaxt = c("s", "n"), yaxt = c("s", "n"),
             clip = "on", verbose = getOption("verbose"))
```

Arguments

- `x`: an object of class `hexbin`.
- `style`: string specifying the style of hexagon plot, see `grid.hexagons` for the possibilities.
- `legend`: numeric width of the legend in inches of `FALSE`. In the latter case, or when 0, no legend is not produced.
- `lcex`: characters expansion size for the text in the legend
- `minarea`: fraction of cell area for the lowest count
- `maxarea`: fraction of the cell area for the largest count
- `mincnt`: cells with fewer counts are ignored.
maxcnt  
cells with more counts are ignored.

trans  
function specifying a transformation for the counts such as sqrt.

inv  
the inverse transformation of trans.

colorcut  
vector of values covering [0, 1] that determine hexagon color class boundaries 
and hexagon legend size boundaries. Alternatively, an integer (<= maxcnt) 
specifying the number of equispaced colorcut values in [0,1].

border, density, pen  
color for polygon borders and filling of each hexagon drawn, passed to grid.hexagons.

colramp  
function accepting an integer n as an argument and returning n colors.

xlab, ylab  
x- and y-axis label.

main  
main title.

newpage  
should a new page start?.

type, xaxt, yaxt  
strings to be used (when set to "n") for suppressing the plotting of hexagon 
symbols, or the x- or y-axis, respectively.

clip  
either 'on' or 'off' are the allowed arguments, when on everything is clipped to 
the plotting region.

verbose  
logical indicating if some diagnostic output should happen.

...  
all arguments of gplot.hexbin can also be used for the S4 plot method.

Details

This is the (S4) plot method for hexbin (and erodebin) objects (erodebin-class).

To use the standalone function gplot.hexbin() is deprecated. For style, minarea etc, see 
the Details section of grid.hexagons’ help page.

The legend functionality is somewhat preliminary. Later versions may include refinements and 
handle extreme cases (small and large) for cell size and counts.

Value

invisibly, a list with components

plot.vp  
the hexViewport constructed and used.

legend.vp  
if a legend has been produced, its viewport.

Author(s)

Dan Carr (dcarr@voxel.galaxy.gmu.edu), ported by Nicholas Lewin-Koh (kohnicho@comp.nus.edu.sg) 
and Martin Maechler.

References

see in grid.hexagons.

See Also

hexbin, hexViewport, smooth.hexbin, erode.hexbin, hcell2xy, hboxplot, hdiffplot.
Examples

```r
## 1) simple binning of spherical normal:
x <- rnorm(10000)
y <- rnorm(10000)
bin <- hexbin(x,y)

## Plot method for hexbin!
## ---- ------ --------
plot(bin)
# nested lattice
plot(bin, style= "nested.lattice")

# controlling the colorscheme
plot(bin, colramp=BTY, colorcut=c(0,.1,.2,.3,.4,.6,1))

## 2) A mixture distribution
x <- c(rnorm(5000),rnorm(5000,4,1.5))
y <- c(rnorm(5000),rnorm(5000,2,3))
bin <- hexbin(x,y)

pens <- cbind(c("#ECE2F0","#A6BDDB","#1C9099"),
              c("#FFF7BC","#FEC44F","#D95F0E"))
plot(bin, style= "nested.lattice", pen=pens)
# now really crazy
plot(bin, style= "nested.lattice", pen=pens,border=2,density=35)

# lower resolution binning and overplotting with counts
bin <- hexbin(x,y,xbins=25)
P <- plot(bin, style="lattice", legend=FALSE,
         minarea=1, maxarea=1, border="white")

##
pushHexport(P$plot.vp)
xy <- hcell2xy(bin)
# to show points rather than counts :
grid.points(x,y,pch=18,gp=gpar(cex=.3,col="green"))
grid.text(as.character(bin@count), xy$x,xy$y,
          gp=gpar(cex=0.3, col="red"),default.units="native")
popViewport()

## Be creative, have fun!
```

grid.hexagons

Add Hexagon Cells to Plot

Description

Plots cells in an hexbin object. The function distinguishes among counts using 5 different styles. This function is the hexagon plotting engine from the plot method for hexbin objects.

Usage

```r
grid.hexagons(dat, style = c("colorscale", "centroids", "lattice", "nested.lattice", "nested.centroids", "constant.col"), use.count=TRUE, cell.at=NULL,
```
grid.hexagons

minarea = 0.05, maxarea = 0.8, check.erosion = TRUE,
mincnt = 1, maxcnt = max(dat@count), trans = NULL,
colorcut = seq(0, 1, length = 17),
density = NULL, border = NULL, pen = NULL,
colramp = function(n){ LinGray(n,beg = 90, end = 15) },
def.unit= "native",
verbose = getOption("verbose"))

Arguments

dat an object of class hexbin, see hexbin.
style character string specifying the type of plotting; must be (a unique abbreviation)
of the values given in ‘Usage’ above.
use.count logical specifying if counts should be used.
cell.at numeric vector to be plotted instead of counts, must be same length as the num-
ber of cells.
minarea numeric, the fraction of cell area for the lowest count.
maxarea the fraction of the cell area for the largest count.
check.erosion logical indicating only eroded points should be used for "erodebin" objects;
simply passed to hcell2xy, see its documentation.
mincnt numeric; cells with counts smaller than mincnt are not shown.
maxcnt cells with counts larger than this are not shown.
trans a transformation function (or NULL) for the counts, e.g., sqrt.
colorcut a vector of values covering [0, 1] which determine hexagon color class bound-
daries or hexagon size boundaries – for style = "colorscale" only.
density grid.polygon argument for shading. 0 causes the polygon not to be filled.
border grid.polygon() argument. Draw the border for each hexagon.
pen colors for grid.polygon(). Determines the color with which the polygon
will be filled.
colramp function of an integer argument n returning n colors. n is determined
def.unit default unit to be used.
verbose logical indicating if some diagnostic output should happen.

Details

The six plotting styles have the following effect:

style="lattice" or "centroids": Plots the hexagons in different sizes based on counts.
The "lattice" version centers the hexagons at the cell centers whereas "centroids" moves
the hexagon centers close to the center of mass for the cells. In all cases the hexagons
will not plot outside the cell unless maxarea > 1. Counts are rescaled into the interval
[0,1] and colorcuts determine the class boundaries for sizes and counts. The pen argument
for this style should be a single color or a vector of colors of length(bin@count).

style="colorscale": Counts are rescaled into the interval [0,1] and colorcuts determines
the class boundaries for the color classes. For this style, the function passed as colramp is
used to define the n colors for the n+1 color cuts. The pen argument is ignored. See LinGray for
the default colramp and alternative "color ramp" functions.
**style="constant.col"**: This is an even simpler alternative to "colorscale", using constant colors (determined **pen** optionally).

**style="nested.lattice" and "nested.centroids"**: Counts are partitioned into classes by power of 10. The encoding nests hexagon size within powers of 10 color contours.

If the **pen** argument is used it should be a matrix of colors with 2 columns and either `ceiling(log10(max(bin@count)))` or `length(bin@count)` rows. The default uses the R color palatte so that pens numbers 2-11 determine colors for completely filled cell Pen 2 is the color for 1’s, Pen 3 is the color for 10’s, etc. Pens numbers 12-21 determine the color of the foreground hexagons. The hexagon size shows the relative count for the power of 10. Different color schemes give different effects including 3-D illusions.

**Hexagon size encoding minarea and maxarea** determine the area of the smallest and largest hexagons plotted. Both are expressed fractions of the bin cell size. Typical values might be .04 and 1. When both values are 1, all plotted hexagons are bin cell size, if maxarea is greater than 1 than hexagons will overlap. This is sometimes interesting with the lattice and centroid styles.

**Count scaling**

\[
\text{relcnt} \leftarrow \frac{\text{trans}(\text{cnt}) - \text{trans}(\text{mincnt})}{\text{trans}(\text{maxcnt}) - \text{trans}(\text{mincnt})}
\]

\[
\text{area} \leftarrow \text{minarea} + \text{relcnt} \times \text{maxarea}
\]

By default the transformation \(\text{trans}()\) is the identity function. The legend routine requires the transformation inverse for some options.

**Count windowing mincnt and maxcnt** Only routine only plots cells with cnts in \([\text{mincnts}, \text{maxcnts}]\)

**SIDE EFFECTS**

Adds hexagons to the plot.

**Author(s)**

Dan Carr <dcarr@voxel.galaxy.gmu.edu>; ported and extended by Nicholas Lewin-Koh (nikko@hailmail.net).

**References**


**See Also**

hexbin, smooth.hexbin, erode.hexbin, hcell2xy, gplot.hexbin, hboxplot, hdiffplot, grid.hexlegend

**Examples**

```r
set.seed(506)
x <- rnorm(10000)
y <- rnorm(10000)

# bin the points
bin <- hexbin(x, y)

# Typical approach uses plot( <hexbin> ) which controls the plot shape :
plot(bin, main = "Bivariate rnorm(10000)")
```
## but we can have more manual control:

# A mixture distribution
x <- c(rnorm(5000), rnorm(5000, 4, 1.5))
y <- c(rnorm(5000), rnorm(5000, 2, 3))
hb2 <- hexbin(x, y)

# Show color control and overplotting of hexagons
## 1) setup coordinate system:
P <- plot(hb2, type="n", main = "Bivariate mixture (10000)")# asp=1

## 2) add hexagons (in the proper viewport):
pushHexport(P$plot.vp)
grid.hexagons(hb2, style= "lattice", border = gray(.1), pen = gray(.6),
           minarea = .1, maxarea = 1.5)
popViewport()

## How to treat 'singletons' specially:
P <- plot(hb2, type="n", main = "Bivariate mixture (10000)")# asp=1
pushHexport(P$plot.vp)
grid.hexagons(hb2, style= "nested.centroids", mincnt = 2)# not the single ones
grid.hexagons(hb2, style= "centroids", maxcnt = 1, maxarea=0.04)# single points
popViewport()

grid.hexlegend

Add a Legend to a Hexbin Plot

Description
Plots the legend for the `plot` method of `hexbin`. Provides a legend indicating the count representations.

Usage
```r
grid.hexlegend(legend, ysize, lcex, inner, style = ,
               minarea = 0.05, maxarea = 0.8, mincnt = 1, maxcnt, trans = NULL,
               inv = NULL, colorcut, density = NULL, border = NULL, pen = NULL,
               colramp = function(n) { LinGray(n,beg = 90,end = 15) },
               leg.unit = "native")
```

Arguments
- `legend` positive number giving width of the legend in inches.
- `ysize` height of legend in inches
- `lcex` the characters expansion size for the text in the legend, see `par(cex=)`.
- `inner` the inner diameter of a hexagon in inches.
- `style` the hexagon style; see `grid.hexagons`.
- `minarea`, `maxarea` fraction of the cell area for the lowest and largest count, respectively.
grid.hexlegend

mincnt, maxcnt
minimum and maximum count accepted in plot.

trans
a transformation function for the counts such as \texttt{sqrt}.

inv
the inverse transformation function.

colorcut
numeric vector of values covering \([0, 1]\) the determine hexagon color classes boundaries and hexagon legend size boundaries.

border
argument for \texttt{polygon()} . Draw the border for each hexagon.

density
argument for \texttt{polygon()} filling. A 0 causes the polygon not to be filled.

pen
color argument used for \texttt{polygon(col = .)}. Determines the color with which the polygon will be filled.

colramp
function accepting an integer \(n\) as an argument and returning \(n\) colors.

leg.unit
unit to use

Details

The \texttt{plot} method for \texttt{hexbin} objects calls this function to produce a legend by setting the graphics parameters, so \texttt{hex.legend} itself is not a standalone function.

The legend function is \textbf{preliminary}. Later version will include refinements and handle extreme cases (small and large) for cell size and counts.

See the \textbf{Details} section of \texttt{grid.hexagons}’s help page.

Value

This function does not return any value.

Author(s)

Dan Carr <dcarr@voxel.galaxy.gmu.edu>

ported by Nicholas Lewin-Koh <kohnicho@comp.nus.edu.sg>

References

see in \texttt{grid.hexagons}.

See Also

\texttt{hexbin, grid.hexagons, smooth.hexbin, erode.hexbin, hcell2xy, gplot.hexbin}.

Examples

```r
## Not a stand alone function; typically only called from plot.hexbin()
## Not run:
grid.hexlegend(legend = 2, ysize = 1, lcrex=8, inner=0.2,
               maxcnt = 100, colorcut = c(0.5,0.5))
## End(Not run)
```
hboxplot

2-D Generalization of Boxplot

Description

If `bin` is an eroded `hexbin` object, i.e., an `erodebin` object, `hboxplot()` plots the high counts cells selected by `erode()`. By default, the high counts cells contain 50 percent of the counts so analagous to the interquartile “range”. The function distinguishes the last cells eroded using color. These cells correspond to one definition of the bivariate median.

Usage

```r
hboxplot(bin, xbnds = NULL, ybnds = NULL,
         density, border = c(0, grey(0.7)), pen = c(2, 3),
         unzoom = 1.1, clip = "off", reshape = FALSE,
         xlab = NULL, ylab = NULL, main = "")
```

Arguments

- `bin`: an object of class `hexbin`.
- `xbnds, ybnds`: global x- and y-axis plotting limits for multiple plots.
- `density, border`: arguments for `polygon()` each of length two, the first for the median, the second for the other cells.
- `pen`: colors ("pen numbers") for `polygon()`.
- `unzoom`: plot limit expansion factor when `xbnds` is missing.
- `clip`: either ‘on’ or ‘off’ are the allowed arguments, when on everything is clipped to the plotting region.
- `reshape`: logical value to reshape the plot although `xbnds` and `ybnds` are present.
- `xlab, ylab, main`: x- and y- axis labels and main title

Details

The `density, border,` and `pen` arguments correspond to the `polygon` function calls for plotting two types of cells. The cell types, pen numbers and suggested colors are

<table>
<thead>
<tr>
<th>TYPE</th>
<th>PEN</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>cells of bin</td>
<td>2</td>
<td>light gray</td>
</tr>
<tr>
<td>last eroded cells of bin (median cells)</td>
<td>1</td>
<td>black</td>
</tr>
</tbody>
</table>

The erode components of the hexbin objects must be present for the medians cells to plot.

When `xbnds` is missing or `reshape` is true, the plot changes graphics parameters and resets them. When `xbnds` is missing the function also zooms in based on the available data to provide increased resolution.

The zoom used the hexagon cell centers. The unzoom argument backs off a bit so the whole hexagon will fit in the plot.
**hcell2xyInt**

Change cell ids to 2d integer coordinate system

Transforms the cell representation of a lattice into a 2d integer coordinate system.

**Usage**

```r
hcell2xyInt(hbin, xbins=NULL, xbnds=NULL, ybnds=NULL, shape=NULL)
```

**Arguments**

- `hbin` a object of class "hexbin", typically produced by `hexbin(*)`.
- `xbins` the number of bins partitioning the range of `xbnds`.
- `xbnds, ybnds` horizontal and vertical limits of the binning region in x or y units respectively; must be numeric vector of length 2.
- `shape` the `shape` = yheight/xwidth of the plotting regions.

**Value**

Invisibly, the `hexViewport()` used internally. Used to add to the plot afterwards.

**References**

see in `grid.hexagons`.

**See Also**

`hexbin, erode, hcell2xy, gplot.hexbin, grid.hexagons, grid.hexlegend`

**Examples**

```r
## boxplot of smoothed counts
x <- rnorm(10000)
y <- rnorm(10000)
bin <- hexbin(x,y)
erodebin <- erode(smooth.hexbin(bin))

hboxplot(erodebin)
hboxplot(erodebin, density = c(32,7), border = c(2,4))
hp <- hboxplot(erodebin, density = c(-1,17),
               main = "hboxplot(erode*(smooth*(.)))")
pushHexport(hp)
grid.points(x[1:10], y[1:10])# just non-sense to show the principle
popViewport()
```


**hcell2xy**

**Details**

Takes a grid defined by either the hexbin parameters or dimen in a hexbin object and translates the cell ids for the grid into 2d integer coordinates.

**Value**

An integer matrix with two columns, i and j representing the integer xy coordinates of the hexagon grid.

- **i**
  
  Integer coordinate of the rows, increases from bottom to top

- **j**
  
  Integer coordinate of the columns, increases from left to right

**Author(s)**

Nicholas Lewin-Koh

**See Also**

  * hcell2xy

**Examples**

```r
x<-rnorm(10000)
y<-rnorm(10000)
hbin<-hexbin(x,y)
ijInt<-hcell2xyInt(hbin)
```

---

**hcell2xy**

*Compute X and Y Coordinates for Hexagon Cells*

**Description**

Computes x and y coordinates from hexagon cell id’s.

**Usage**

```r
hcell2xy(hbin, check.erosion = TRUE)
```

**Arguments**

- **hbin**
  
  a object of class "hexbin". typically produced by `hexbin(*)`.

- **check.erosion**
  
  logical indicating if only the eroded points should be returned in the case where `hbin` inherits from "erodebin" (see `erodebin-class`); is TRUE by default.

**Details**

The hexbin object `hbin` contains all the needed information. The purpose of this function is to reduce storage. The cost is additional calculation.
hdiffplot

Value

A list with two components of the same length as bin$cell, x, y

See Also

hexbin.

Examples

x <- rnorm(10000)
y <- rnorm(10000)
plot(x,y, pch=".")
hbin <- hexbin(x,y)
str(xys <- hcell2xy(hbin))
points(xys, cex=1.5, col=2) ; title("hcell2xy( hexbin(..) )", col.main=2)

---

hdiffplot

Plot of Domain and Median Differences of Two "hexbin" Objects

Description

Let bin1 and bin2 represent two hexbin objects with scaling, plot shapes, and bin sizes. This plot distinguishes cells unique to bin1, cells in common, and cells unique to bin2 using color. When the erode components are present, color also distinguishes the two erosion medians. An arrow shows the vector from the median of bin1 to the median of bin2.

Usage

hdiffplot(bin1, bin2 = NULL, xbnds, ybnds, focus = NULL,
col.control = list(medhex = "white", med.bord = "black",
focus = NULL, focus.border = NULL, back.col = "grey"),
arrows = TRUE, size = unit(0.1, "inches"), lwd = 2,
eps = 1e-6, unzoom = 1.08, clip="off", xlab = "", ylab = "",
main = deparse(mycall), ...)

Arguments

bin1, bin2 two objects of class hexbin.
xbnds, ybnds global x- and y-axis plotting limits. Used primarily for multiple comparison plots.
focus a vector of integers specifying which hexbin objects should be treated as focal. Excluded hexbins are treated as background.
col.control a list for detailed color control.
arrows a logical indicating whether or not to draw arrows between the focal hexbin objects median cells.
hdiffplot

<table>
<thead>
<tr>
<th>border</th>
<th>border arguments to polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td>size</td>
<td>arrow type size in inches.</td>
</tr>
<tr>
<td>eps</td>
<td>distance criteria for distinct medians</td>
</tr>
<tr>
<td>unzoom</td>
<td>plot limit expansion factor when xnds is missing</td>
</tr>
<tr>
<td>clip</td>
<td>either 'on' or 'off' are the allowed arguments, when on everything is clipped to the plotting region</td>
</tr>
<tr>
<td>lwd</td>
<td>Line width for arrows, ignored when arrows=FALSE or when bins have no erosion component</td>
</tr>
<tr>
<td>xlab</td>
<td>label for x-axis</td>
</tr>
<tr>
<td>ylab</td>
<td>label for y-axis</td>
</tr>
<tr>
<td>main</td>
<td>main title for the plot; automatically constructed by default.</td>
</tr>
<tr>
<td>...</td>
<td>............</td>
</tr>
</tbody>
</table>

Details

The hexbin objects for comparison, bin1 and bin2, must have the same plotting limits and cell size. The plot produces a comparison overlay of the cells in the two objects. If external global scaling is not supplied, the algorithm determines plotting limits to increase resolution. For example, the objects may be the result of the erode.hexbin() and include only high count cells containing 50 of the counts. The density, border, and pen arguments correspond to the polygon function calls for plotting six types of cells. The cell types are respectively:

- unique cells of bin1,
- joint cells,
- unique cells of bin2,
- median cell of bin1,
- median cell of bin2,
- median cell if identical.

The erode components of the hexbin objects must be present for the medians to plot. The algorithm select a single cell for the median if there are algorithmic ties.

The pen numbers for types of cells start at Pen 2. Pen 1 is presumed black. The suggested six additional colors are light blue, light gray, light red, blue, red, and black. Carr (1991) shows an example for black and white printing. That plot changes the six colors to light gray, dark gray, white, black, black, and black. It changes the 4th, 5th, and 6th argument of border to TRUE. It also changes 4th, 5th and 6th argument of density to 0. In other words cells in common do not show and medians cells appear as outlines.

When xbnds is missing, the plot changes graphics parameters and resets them. The function also zooms in based on the available data to provide increased resolution.

References

see in grid.hexagons.

See Also

hexbin, smooth.hexbin, erode.hexbin, hcell2xy, gplot, hexbin, hboxplot, grid.hexagons, grid.hexlegend.
hexbinplot

Examples

```r
## Comparison of two bivariate boxplots
x1 <- rnorm(10000)
y1 <- rnorm(10000)
x2 <- rnorm(10000, mean = .5)
y2 <- rnorm(10000, mean = .5)
xbnds <- range(x1, x2)
ybnds <- range(y1, y2)

bin1 <- hexbin(x1, y1, xbnds = xbnds, ybnds = ybnds)
bin2 <- hexbin(x2, y2, xbnds = xbnds, ybnds = ybnds)
erodebin1 <- erode.hexbin(smooth.hexbin(bin1))
erodebin2 <- erode.hexbin(smooth.hexbin(bin2))

erodebin1 <- erode.hexbin(smooth.hexbin(bin1))
erodebin2 <- erode.hexbin(smooth.hexbin(bin2))

hdiffplot(erodebin1, erodebin2)

## Compare three of them: --------------------
x3 <- rnorm(10000, mean = -1)
y3 <- rnorm(10000, mean = -.5)
xbnds <- range(x1, x2, x3)
ybnds <- range(y1, y2, y3)

bin1 <- hexbin(x1, y1, xbnds = xbnds, ybnds = ybnds)
bin2 <- hexbin(x2, y2, xbnds = xbnds, ybnds = ybnds)
bin3 <- hexbin(x3, y3, xbnds = xbnds, ybnds = ybnds)
erodebin1 <- erode.hexbin(smooth.hexbin(bin1))
erodebin2 <- erode.hexbin(smooth.hexbin(bin2))
erodebin3 <- erode.hexbin(smooth.hexbin(bin3))

bnlst <- list(b1 = erodebin1, b2 = erodebin2, b3 = erodebin3)
hdiffplot(bnlst)
```

---

hexbinplot  

**Trellis Hexbin Displays**

Description

Display of hexagonally binned data, as implemented in the `hexbin` package, under the Trellis framework, with associated utilities. `hexbinplot` is the high level generic function, with the "formula" method doing the actual work. `prepanel.hexbinplot` and `panel.hexbinplot` are associated prepanel and panel functions. `hexlegendGrob` produces a suitable legend.

Usage

`hexbinplot(x, data, ...)`

## S3 method for class 'formula':
`hexbinplot(x, data = NULL,
prepanel = prepanel.hexbinplot,
panel = panel.hexbinplot,
groups = NULL,`
hexbinplot

aspect = "xy",
trans = NULL,
inv = NULL,
colorkey = TRUE,
..., 
maxcnt,
legend = NULL,
legend.width = TRUE,
subset)

prepanel.hexbinplot(x, y, type = character(0), ...)

panel.hexbinplot(x, y, ..., groups = NULL)

hexlegendGrob(legend = 1.2,
inner = legend / 5,
cex.labels = 1,
cex.title = 1.2,
style = "colorscale",
minarea = 0.05, maxarea = 0.8,
mincnt = 1, maxcnt,
trans = NULL, inv = NULL,
colorcut = seq(0, 1, length = 17),
density = NULL, border = NULL, pen = NULL,
colramp = function(n) { LinGray(n,beg = 90,end = 15) },
..., 
vp = NULL,
draw = FALSE)

Arguments

x For hexbinplot, the object on which method dispatch is carried out.
For the "formula" methods, a formula describing the form of conditioning plot. Formulas that are valid for xyplot are acceptable.
In panel.hexbinplot, the x variable.

y In panel.hexbinplot, the y variable.

data For the formula method, a data frame containing values for any variables in the formula, as well as groups and subset if applicable (using groups currently causes an error with the default panel function). By default, the environment where the function was called from is used.

minarea, maxarea, mincnt, maxcnt, trans, inv, colorcut, density, border, pen, col,
see gplot.hexbin

prepanel, panel, aspect
See xyplot. aspect="fill" is not allowed. The current default of "xy"
may not always be the best choice, often aspect=1 will be more reasonable.

colorkey logical, whether a legend should be drawn. Currently a legend can be drawn
only on the right.

legend.width, legend
width of the legend in inches when style is "nested.lattice" or "nested.centroids".
The name legend.width is used to avoid conflict with the standard trellis argument legend. It is possible to specify additional legends using the legend
or key arguments as long as they do not conflict with the hexbin legend (i.e., are not on the right).

inner

Inner radius in inches of hexagons in the legend when style is "nested.lattice" or "nested.centroids".

cex.labels, cex.title

in the legend, multiplier for numeric labels and text annotation respectively

type

character vector controlling additional augmentation of the display. A "g" in type adds a reference grid, "r" adds a regression line (y on x), "smooth" adds a loess smooth

draw

logical, whether to draw the legend grob. Useful when hexlegendGrob is used separately

vp

grid viewport to draw the legend in

... extra arguments, passed on as appropriate. Arguments to gplot.hexbin, xyplot, panel.hexbinplot and hexlegendGrob can be supplied to the high level hexbinplot call.

panel.hexbinplot calls one of two (unexported) low-level functions depending on whether groups is supplied (although specifying groups currently leads to an error). Arguments of the appropriate function can be supplied; some important ones are

xbins: number of hexagons covering x values. The number of y-bins depends on this, the aspect ratio, and xbnds and ybnds

xbnds, ybnds: Numeric vector specifying range of values that should be covered by the binning. In a multi-panel display, it is not necessarily a good idea to use the same bounds (which along with xbins and the aspect ratio determine the size of the hexagons) for all panels. For example, when data is concentrated in small subregions of different panels, more detail will be shown by using smaller hexagons covering those regions. To control this, xbnds and ybnds can also be character strings "panel" or "data" (which are not very good names and may be changed in future). In the first case, the bounds are taken to be the limits of the panel, in the second case, the limits of the data (packet) in that panel. Note that all panels will have the same limits (enough to cover all the data) by default if relation="free" in the standard trellis argument scales, but not otherwise.

groups in hexbinplot, a grouping variable that is evaluated in data, and passed on to the panel function.

subset an expression that is evaluated in evaluated in data to produce a logical vector that is used to subset the data before being used in the plot.

Details

The panel function panel.hexbinplot creates a hexbin object from data supplied to it and plots it using grid.hexagons. To make panels comparable, all panels have the same maxcnt value, by default the maximum count over all panels. This default value can be calculated only if the aspect ratio is known, and so aspect="fill" is not allowed. The default choice of aspect ratio is different from the choice in hexbin (namely, 1), which may sometimes give better results for multi-panel displays. xbnds and ybnds can be numeric range vectors as in hexbin, but they can also be character strings specifying whether all panels should have the same bins. If they are not, then bins in different panels could be of different sizes, in which case style="lattice" and style="centroids" should be interpreted carefully.
hexbin

The dimensions of the legend and the size of the hexagons therein are given in absolute units (inches) by \texttt{legend.width} and \texttt{inner only when style} is "nested.lattice" or "nested.centroids". For other styles, the dimensions of the legend are determined relative to the plot. Specifically, the height of the legend is the same as the height of the plot (the panel and strip regions combined), and the width is the minimum required to fit the legend in the display. This is different in some ways from the \texttt{hexbin} implementation. In particular, the size of the hexagons in the legend are completely unrelated to the sizes in the panels, which is pretty much unavoidable because the sizes need not be the same across panels if \texttt{xbnds} or \texttt{ybnds} is "data". The size of the hexagons encode information when \texttt{style} is "lattice" or "centroids", consequently a warning is issued when a legend is drawn with either of these styles.

\textbf{Value}

\texttt{hexbinplot} produces an object of class "trellis". The \texttt{update} method can be used to update components of the object and the \texttt{print} method (usually called by default) will plot it on an appropriate plotting device. \texttt{hexlegendGrob} produces a "grob" (grid object).

\textbf{Author(s)}

Deepayan Sarkar \{deepayan@stat.wisc.edu\}

\textbf{See Also}

\texttt{hexbin, xyplot}

\textbf{Examples}

```r
mixdata <-
data.frame(x = c(rnorm(5000), rnorm(5000, 4, 1.5)),
y = c(rnorm(5000), rnorm(5000, 2, 3)),
a = gl(2, 5000))
hexbinplot(y ~ x, mixdata, aspect = 1,
    trans = sqrt, inv = function(x) x^2)
hexbinplot(y ~ x | a, mixdata)
hexbinplot(y ~ x | a, mixdata, style = "lattice",
    xbnds = "data", ybnds = "data")
hexbinplot(y ~ x | a, mixdata, style = "nested.centroids")
hexbinplot(y ~ x | a, mixdata, style = "nested.centroids",
    border = FALSE, type = c("g", "smooth"))
```
Arguments

x, y vectors giving the coordinates of the bivariate data points to be binned. Alternatively a single plotting structure can be specified: see xy.coords. NA's are allowed and silently omitted.

xbins the number of bins partitioning the range of xbnds.

shape the shape = yheight/xwidth of the plotting regions.

xbnds, ybnds horizontal and vertical limits of the binning region in x or y units respectively; must be numeric vector of length 2.

xlab, ylab optional character strings used as labels for x and y. If NULL, sensible defaults are used.

IDs logical indicating if the individual cell “IDs” should be returned, see also below.

Details

Returns counts for non-empty cells only. The plot shape must be maintained for hexagons to appear with equal sides. Some calculations are in single precision.

Note that when plotting a hexbin object, the grid package is used. You must use its graphics (or those from package lattice if you know how) to add to such plots.

Value

an S4 object of class "hexbin". It has the following slots:

cell vector of cell ids that can be mapped into the (x,y) bin centers in data units.

count vector of counts in the cells.

xcm The x center of mass (average of x values) for the cell.

ycm The y center of mass (average of y values) for the cell.

xbins number of hexagons across the x axis. hexagon inner diameter =diff(xbnds)/xbins in x units.

shape plot shape which is yheight(inches) / xwidth(inches).

xbnds x coordinate bounds for binning and plotting.

ybbnds y coordinate bounds for binning and plotting.

dimen The i and j limits of cnt treated as a matrix cnt[i,j]

n number of (non NA) (x,y) points, i.e., sum(* @count).

ncells number of cells, i.e., length(* @count), etc.

call the function call.

xlab, ylab character strings to be used as axis labels.

cID of class, "integer or NULL", only if IDs was true, an integer vector of length n where cID[i] is the cell number of the i-th original point (x[i], y[i]). Consequently, the cell and count slots are the same as the names and entries of table(cID), see the example.

References

hexGraphPaper

Create a Hexgon Grid

Description

Creates a hexagon grid that can be added to a plot created with grid graphics.

Usage

hexGraphPaper(hb, xbinds = NULL, ybinds = NULL, xbins = 30, shape = 1,
               add = TRUE, fill.edges = 1, fill = 0, border = 1)

hgridcent(xbins, xbinds, ybinds, shape, edge.add = 0)

Arguments

hb

a object of class "hexbin", typically produced by hexbin(*).

xbinds, ybinds

horizontal and vertical limits of the binning region in x or y units respectively;
must be numeric vector of length 2.

xbins

the number of bins partitioning the range of xbinds.

shape

the shape = yheight/xwidth of the plotting regions.

add

a logical value indicating whether or not to add the grid to the current plot.

fill.edges

integer number of hexagons to add around the border

Examples

set.seed(101)
x <- rnorm(10000)
y <- rnorm(10000)
(bin <- hexbin(x, y))
## or
plot(hexbin(x, y + x*(x+1)/4),
     main = "(X, X(X+1)/4 + Y) where X,Y ~ rnorm(10000)")

## Using plot method for hexbin objects:
plot(bin, style = "nested.lattice")

hbi <- hexbin(y ~ x, xbins = 80, IDs= TRUE)
str(hbi)
tI <- table(hbi@cID)
stopifnot(names(tI) == hbi@cell,
          tI == hbi@count)

## NA's now work too:
x[runif(6, 0, length(x))] <- NA
y[runif(7, 0, length(y))] <- NA
hbN <- hexbin(x,y)
summary(hbN)

See Also

hcell2xy gplot.hexbin, grid.hexagons, grid.hexlegend.
fill: the fill color for the hexagons
border: the color of the border of the hexagons
edge.add: offset (typically fill.edges above) used in hgridcent.

Details

If a hexbin object is given then the parameters xbins and shape are ignored. Different bounds can still be specified. The fill.edges parameter should be an integer. fill.edges takes the current grid and adds a layer of hexagons around the grid for each level of fill. So for example if fill.edges=2 than the dimensions of the grid would be (i,j)+4.

hgridcent() is the utility function computing the resulting list (see section “Value”).

WARNING! If using a hexVP be sure to set clip to "on", otherwise the hexagon grid will bleed over the plot edges.

Value

Invisibly returns a list with the following components:

- x: The x coordinates of the grid
- y: the y coordinates of the grid
- dimen: a vector of length 2 giving the rows and columns of the grid
- dx: the horizontal diameter of the hexagons
- dy: the vertical diameter of the hexagons

Author(s)

Nicholas Lewin-Koh

See Also

hcell2xy, hexpolygon, grid.hexagons

Examples

x <- rnorm(10000)
y <- rnorm(10000,x,x)
hbin <- hexbin(x,y)
hvp <- plot(hbin,type="n")
pushHexplot(hvp$plot,clip="on")
hexGraphPaper(hbin,border=grey(.8))
grid.hexagons(hbin)
hexList

Conditional Bivariate Binning into Hexagon Cells

Description

Creates a list of \texttt{hexbin} objects. Basic components are a cell id and a count of points falling in each occupied cell. Basic methods are \texttt{show()}, \texttt{plot()} and \texttt{summary()}, but also \texttt{erode}.

Usage

\begin{verbatim}
hexList(x, y = NULL, given = NULL, xbins = 30, shape = 1,
        xbnds = NULL, ybnds = NULL, xlab = NULL, ylab = NULL)
\end{verbatim}

Arguments

\begin{itemize}
  \item \texttt{x} ~~Describe \texttt{x} here~~
  \item \texttt{y} ~~Describe \texttt{y} here~~
  \item \texttt{given} ~~Describe \texttt{given} here~~
  \item \texttt{xbins} ~~Describe \texttt{xbins} here~~
  \item \texttt{shape} ~~Describe \texttt{shape} here~~
  \item \texttt{xbnds} ~~Describe \texttt{xbnds} here~~
  \item \texttt{ybnds} ~~Describe \texttt{ybnds} here~~
  \item \texttt{xlab} ~~Describe \texttt{xlab} here~~
  \item \texttt{ylab} ~~Describe \texttt{ylab} here~~
\end{itemize}

Details

There is also a \texttt{coerce} method to produce \texttt{hexbinList} objects from \texttt{lists}.

Value

If it is a \texttt{LIST}, use

\begin{verbatim}
comp1 Description of \texttt{`comp1'}
comp2 Description of \texttt{`comp2'}
...
\end{verbatim}

Author(s)

Nicholas Lewin-Koh

See Also

\texttt{hexbin}, \texttt{hdiffplot}
**hexMA.loess**  

_Add Loess Fit to Hexplot_

### Description

Fit a loess line using the hexagon centers of mass as the x and y coordinates and the cell counts as weights.

### Usage

```
hexMA.loess(pMA, span = 0.4, col = "red", n = 200)
hexVP.loess(hbin, hvp = NULL, span = 0.4, col = "red", n = 200)
```

### Arguments

- `hbin`: an object of class `hexbin`, see `hexbin`.
- `hvp`: A `hexViewport` object.
- `pMA`: the list returned by `plotMAhex`.
- `span`: the parameter alpha which controls the degree of smoothing.
- `col`: line color for the loess fit.
- `n`: number of points at which the fit should be evaluated.

### Value

Returns invisibly the object associated with the loess fit.

### Author(s)

Nicholas Lewin-Koh

### See Also

`hexVP.abline, plotMAhex, gplot.hexbin, hexViewport; loess`

### Examples

```r
if(require(marray)){
data(swirl)
hb <- plotMAhex(swirl[,1], main = "M vs A plot with hexagons", legend=0)
hexVP.abline(hb$plot, h=0, col= gray(.6))
hexMA.loess(hb)
}
```
hexplom  

Hexbin Plot Matrices

Description

hexplom draws Conditional Hexbin Plot Matrices. It is similar to splom, except that the default display is different. Specifically, the default display is created using panel.hexplom, which is an alias for panel.hexbinplot.

Usage

hexplom(x, data, ...)

## S3 method for class 'formula':
hexplom(x, data = NULL, ...)

## S3 method for class 'data.frame':
hexplom(x, data = NULL, ..., groups = NULL, subset = TRUE)

## S3 method for class 'matrix':
hexplom(x, data = NULL, ..., groups = NULL, subset = TRUE)

panel.hexplom(...)

Arguments

x

The object on which method dispatch is carried out.

For the "formula" method, a formula describing the structure of the plot, which should be of the form ~ x | g1 * g2 * ..., where x is a data frame or matrix. Each of g1, g2, ... must be either factors or shingles. The conditioning variables g1, g2, ... may be omitted.

For the data.frame and matrix methods, a data frame or matrix as appropriate.

data

For the formula method, an optional data frame in which variables in the formula (as well as groups and subset, if any) are to be evaluated. By default, the environment where the function was called from is used.

groups, subset, ...

see splom. The non-standard evaluation of groups and subset only applies in the formula method. Apart from arguments that apply to splom (many of which are only documented in xyplot), additional arguments meant for panel.hexplom (which is an alias for panel.hexbinplot) may also be supplied. Such arguments may include ones that control details of the hexbin calculations, documented in gplot.hexbin

Value

An object of class "trellis". The update method can be used to update components of the object and the print method (usually called by default) will plot it on an appropriate plotting device.
hexpolygon

**Author(s)**

Deepayan Sarkar  Deepayan.Sarkar@R-project.org, Nicholas Lewin-Koh  nikko@hailmail.net

**See Also**

splom, xyplot, hexbinplot, Lattice, panel.pairs

**Examples**

```
## Simple hexplom
data(NHANES)
hexplom(~NHANES[,7:14], xbins=15)

## With colors and conditioning
hexplom(~NHANES[,9:13] | Sex, data = NHANES,
        xbins = 15, colramp = magent)

## With custom panel function
hexplom(NHANES[,9:13], xbins = 20,colramp = BTY,
        upper.panel = panel.hexboxplot)
```

---

**hexpolygon**

*Hexagon Coordinates and Polygon Drawing*

**Description**

Simple ‘low-level’ function for computing and drawing hexagons. Can be used for ‘grid’ (package grid) or ‘traditional’ (package graphics) graphics.

**Usage**

```
hexcoords(dx, dy = NULL, n = 1, sep = NULL)

hexpolygon(x, y, hexC = hexcoords(dx, dy, n = 1), dx, dy = NULL,
            fill = 1, border = 0, hUnit = "native", ...)
```

**Arguments**

- **dx, dy**  horizontal and vertical width of the hexagon(s).
- **n**  number of hexagon “repeats”.
- **sep**  separator value to be put between coordinates of different hexagons. The default, NULL doesn’t use a separator.
- **x, y**  numeric vectors of the same length specifying the hexagon centers around which to draw.
- **hexC**  a list as returned from hexcoords(). Its component no.sep determines if grid or traditional graphics are used. The default (via default of hexcoords) is now to use grid graphics.
- **fill, border**  passed to grid.polygon (for grid).
hUnit: string or NULL determining in which units (x,y) values are.

... further arguments passed to polygon (for graphics).

Value

hexcoords() returns a list with components

x, y: numeric vectors of length \( n \times 6 \) (or \( n \times 7 \) if sep is not NULL) specifying the hexagon polygon coordinates (with sep appended to each 6-tuple).

no.sep: a logical indicating if sep was NULL.

hexpolygon returns what its last grid.polygon(.) or polygon(.) call returns.

Author(s)

Martin Maechler, originally.

See Also

grid.hexagons which builds on these.

Examples

str(hexcoords(1, sep = NA)) # multiple of (6 + 1)
str(hexcoords(1, sep = NULL))# no separator -> multiple of 6

## hexpolygon()s:
x <- runif(20, -2, 2)
y <- x + rnorm(20)

## 1) traditional 'graphics'
plot(x,y, asp = 1, "plot() + hexpolygon()")
hexpolygon(x,y, dx = 0.1, density = 25, col = 2, lwd = 1.5)

## 2) "grid":
addBit <- function(bnds, f = 0.05) bnds + c(-f, f) * diff(bnds)
sc <- addBit(rxy <- range(x,y))## same extents (cheating asp=1)
grid.newpage()
pushViewport(plotViewport(.1+c(4,4,2,1), xscale = sc, yscale = sc))
grid.rect()
grid.xaxis()
grid.yaxis()
grid.points(x,y)
hexpolygon(x,y, hexcoords(dx = 0.1, sep= NULL), border = "blue", fill=NA)
popViewport()
Description

A wrapper for tapply except that it operates with each hexagon bin being the category. The function operates on the data associated on the points from each bin.

Usage

`hexTapply(hbin, dat, FUN = sum, ..., simplify=TRUE)`

Arguments

- `hbin`: a object of class "hexbin", typically produced by `hexbin(*)`.
- `dat`: A vector of data the same length as `hbin@cID`
- `FUN`: the function to be applied. In the case of functions like +, *, etc., the function name must be quoted. If `FUN` is NULL, tapply returns a vector which can be used to subscript the multi-way array `tapply` normally produces.
- `...`: optional arguments to `FUN`.
- `simplify`: If FALSE, `tapply` always returns an array of mode "list". If TRUE (the default), then if `FUN` always returns a scalar, `tapply` returns an array with the mode of the scalar.

Details

This function is a wrapper for tapply, except that the cell id is always the categorical variable. This function is specifically good for adding variables to the cAtt slot of a hexbin object or for plotting a third variable in a hexagon plot. See below for examples.

Value

Returns a vector of the result of 'FUN' as in `tapply`. See `tapply` for detailed description of output.

Author(s)

Nicholas Lewin-Koh

See Also

tapply, hexbin

Examples

data(NHANES)
hbin<-hexbin(log(NHANES$Diet.Iron+1),log(NHANES$BMI),xbins=25,IDs=TRUE)
hvp<-plot(hbin)
mtrans<-hexTapply(hbin,NHANES$Transferin,median,na.rm=TRUE)
pushHexport(hvp$plot.vp)
grid.hexagons(hbin,style='lattice',pen=0,border='red',use.count=FALSE,
**hexViewport**  
*Compute a Grid Viewport for Hexagon / Hexbin Graphics*

### Description

Builds a grid viewport for hexagon or hexbin graphics. This builds on the concepts of the grid package, see `viewport`.

### Usage

```r
hexViewport(x, offset = unit(0, "inches"), mar = NULL, xbnds = NULL, ybnds = NULL, newpage = FALSE, clip = "off", vp.name = NULL)
```

### Arguments

- **x**: a `hexbin` object.
- **offset**: a `unit` object.
- **mar**: margins as `units`, of length 4 or 1.
- **xbnds**, **ybnds**: bounds for x- and y- plotting range; these default to the corresponding slots of `x`.
- **newpage**: logical indicating if a new graphics page should be opened, i.e., `grid.newpage()`.
- **clip**: simply passed to `viewport()`.
- **vp.name**: name of viewport; defaults to random name.

### Value

An S4 object of class "hexVP", see `hexVP-class` for more, with its main slot `hexVp` a viewport for grid graphics.

### See Also

`viewport` and the main "handlers" `pushHexport` and `popViewport`; further `gplot.hexbin` and `hboxplot` which build on `hexViewport`.

### Examples

```r
set.seed(131)
x <- rnorm(7777)
y <- rt(7777, df=3)

## lower resolution binning and overplotting with counts
bin <- hexbin(x, y, xbins=25)
P <- plot(bin)
xy <- hcell2xy(bin)
pushHexport(P$plot.vp)
```
hexVP.abline

Description

This function adds one or more straight lines through the current plot; it is the hexbin version of abline().

Usage

hexVP.abline(hvp, a = NULL, b = NULL, h = numeric(0), v = numeric(0),
              col = "black", lty = 1, lwd = 2, ...)

Arguments

  hvp               A hexViewport object that is currently on the active device
  a, b              the intercept and slope or if b is NULL, an lm object or a vector of length 2 with
c                     c(intercept, slope)
  h                 the y-value for a horizontal line.
  v                 the x-value for a vertical line.
  col, lty, lwd     line color, type and width.
  ...               further graphical parameters.

Details

The first form specifies the line in intercept/slope form (alternatively a can be specified on its own
and is taken to contain the slope and intercept in vector form).

The h= and v= forms draw horizontal and vertical lines at the specified coordinates.

The coef form specifies the line by a vector containing the slope and intercept.

lm is a regression object which contains reg$coef. If it is of length 1 then the value is taken to
be the slope of a line through the origin, otherwise, the first 2 values are taken to be the intercept
and slope.

Author(s)

Nicholas Lewin-Koh

See Also

gplot.hexbin, hexViewport, hexMA.loess
hexVP-class

Formal class "hexVP" of a Hexagon Viewport

Description

Hexagon Viewports are “value-added” grid viewports (see viewport) where the extra slots contain scaling and “embedding” information. A hexViewport is created by taking the available area in the current viewport on the graphics device and maximizing the amount of area with a fixed aspect ratio. The default when the shape parameter is 1, is a 1:1 aspect ratio in terms of the size of the viewport, not the scale of the x and y axis. The plotting area is centered within the existing margins and the maximum size determined. Extra area is then allocated to the margins. This viewport is replicated twice, once with clipping set to "on" and once with clipping "off". This feature can be used for toggling clipping on and off while editing the plot.

Objects from the Class

Objects are typically created by calls to hexViewport() or by low level calls of the form new("hexVP", ...).

Slots

hexVp.off: Object of class "viewport" with clipping set to off, see viewport.
hexVp.on: Object of class "viewport", with the same dimensions and parameters as hexVp.off, but with clipping set to on, see viewport.
mar: unit vector of four margins (typically in "lines").
fig: unit vector of two figure sizes (typically in "npc").
plt: unit vector of two figure sizes (typically in "npc").
xscale: numeric of length two specifying x-range.
yscale: numeric of length two specifying y-range.

Methods

These are methods accessing the slots of corresponding name.

getFig signature(hvp = "hexVP"): ...
getMargins signature(hvp = "hexVP"): ...
getPlt signature(hvp = "hexVP"): ...
ggetXscale signature(hvp = "hexVP"): ...
ggetYscale signature(hvp = "hexVP"): ...

Author(s)

Nicholas Lewin-Koh (kohnicho@comp.nus.edu.sg).

See Also

The constructor function hexViewport, hexbin, and its S4 plotting method, gplot.hexbin.
Examples

```r
example(hexViewport, echo=FALSE)
## continued:
str(P$plot.vp)
```

Description

Methods for the generic function `hsmooth` in package `hexbin`: There is currently only the one for `hexbin` objects.

Usage

```r
## S4 method for signature 'hexbin':
hsmooth(bin, wts)
```

Arguments

- `bin` a `hexbin` object, or an extension such as `erodebin-class`.
- `wts` weights vector, see `smooth.hexbin`

Methods

- `bin = "hexbin"` is just the `smooth.hexbin` function (for back compatibility); see its documentation, also for examples.

Description

Check points for inclusion

Usage

```r
inout.hex(hbin, mincnt)
```

Arguments

- `hbin` an object of class `hexbin`.
- `mincnt` Cutoff, id’s for counts less than mincnt are returned

Details

Check which points are in hexagons with `count <= mincnt` and returns the row ids for those points. One can use the ids to plot low count hexagons as points instead.
list2hexList

Value
A vector with the row ids of points which fall in hexagons with \texttt{count} less than or equal to \texttt{mincnt}

Author(s)
Nicholas Lewin-Koh

See Also
\texttt{plotMAhex}

---

\texttt{list2hexList} \hspace{1cm} \textit{Convert list to hexList}

Description
Converts a list of hexbin objects with same xbnds, ybnds, shape and xbins to a \texttt{hexList} object.

Usage
\texttt{list2hexList(binlst)}

Arguments

\begin{itemize}
\item \texttt{binlst} \hspace{1cm} A list of hexbin objects
\end{itemize}

Value

\begin{itemize}
\item a \texttt{hexList} object
\end{itemize}

Author(s)
Nicholas Lewin-Koh

See Also
\texttt{hexList,hdiffplot}
Description

This is a somewhat large interesting dataset, a data frame of 15 variables (columns) on 9575 persons (rows).

Usage

data(NHANES)

Format

This data frame contains the following columns:

Cancer.Incidence binary factor with levels No and Yes.
Cancer.Death  binary factor with levels No and Yes.
Age numeric vector giving age of the person in years.
Smoke  a factor with levels Current, Past, Nonsmoker, and Unknown.
Ed numeric vector of \{0,1\} codes giving the education level.
Race numeric vector of \{0,1\} codes giving the person’s race.
Weight numeric vector giving the weight in kilograms
BMI numeric vector giving Body Mass Index, i.e., Weight/Height^2 where Height is in meters, and missings (61% !) are coded as 0 originally.
Diet.Iron numeric giving Dietary iron.
Albumin numeric giving albumin level in g/l.
Serum.Iron numeric giving Serum iron in µg/l.
TIBC numeric giving Total Iron Binding Capacity in µg/l.
Transferin numeric giving Transferin Saturation which is just 100*serum.iron/TIBC.
Hemoglobin numeric giving Hemoglobin level.
Sex a factor with levels F (female) and M (male).

Source

unknown

Examples

data(NHANES)
summary(NHANES)
## Missing Data overview :
nNA <- sapply(NHANES, function(x)sum(is.na(x)))
cbind(nNA[nNA > 0])
# Which are just these 6 :
## Not run:
Diet.Iron 141
Albumin 252
### old-classes

**Class "unit" and "viewport" as S4 classes**

**Description**

Package "hexbin" now uses S4 classes throughout and hence needs to `setOldClass` both "unit" and "viewport" (which are S3 classes from the `grid` package), in order to be able to use those in slots of its own classes.

**Objects from the Class**

A virtual Class: No objects may be created from it.

**Extends**

Class "oldClass", directly.

**Methods**

No methods defined with class "unit" in the signature.

### optShape

**Optimal Shape Parameter for Hexbin Viewport**

**Description**

Takes a viewport or a given height and width and returns the shape parameter that will fill the specified plotting region with the appropriately shaped hexagons. If margins are specified the margins are subtracted from height and width before the shape parameter is specified.

**Usage**

```r
optShape(vp, height = NULL, width = NULL, mar = NULL)
```

**Arguments**

- `vp` a viewport object, optional see details
- `height` the height of the plotting region, can be numeric or units
- `width` The width of the plotting region, can be numeric or units
- `mar` A four element numeric or units vector describing the margins in the order `c(bottom, left, top, right)`
**Value**

A scalar numeric value specifying shape.

**Warning**

If a viewport is given as an argument it should already be pushed on the graphics device or it will have null units and a meaningless shape parameter will be returned.

**Author(s)**

Nicholas Lewin-Koh

**See Also**

`hexViewport`, `hexVP-class`, `hexbin`

**Examples**

```r
x <- rgamma(10000,.9)
m <- as.logical(rbinom(10000,1,.17))
x[m] <- -x[m]
y <- rnorm(x,abs(x))
vp <- plotViewport(xscale= range(x)+c(-.5,.5),
               yscale= range(y)+c(-.5,.5),
               default.units = "native")
grid.newpage()
pushViewport(vp)
grid.rect()
shape <- optShape(vp)
shape
hb <- hexbin(x,y,xbins=40,shape=shape)
grid.hexagons(hb,colramp=BTY)
```

**Description**

A panel function to add a boxplot to a hexbin lattice plot.

**Usage**

```r
panel.hexboxplot(x, y, xbins = 30,
               xbnds = c("data", "panel"), ybnds = c("data", "panel"),
               .prelim = FALSE, .cpl = current.panel.limits(),
               .xlim = .cpl$xlim, .ylim = .cpl$ylim,
               .aspect.ratio, type = character(0), cdfcut = 0.25,
               shadow = 0.05, ..., check.erosion = TRUE)
```
Arguments

- `x`, `y` numeric vector or factor.
- `xbins` the number of bins partitioning the range of `xbnds`.
- `xbnds`, `ybinds` horizontal and vertical limits of the binning region in x or y units respectively; must be numeric vector of length 2.
- `.prelim`, `.cpl`, `.xlim`, `.ylim`, `.aspect.ratio` for internal use.
- `type` character vector controlling additional augmentation of the display. A "g" in `type` adds a reference grid, an "hg" adds a hexagonal grid.
- `cdfcut` number in (0,1) indicating the confidence level for the erosion limits. See `erode.hexbin` for more information.
- `shadow` number in (0,1) indicating the confidence level for the erosion limits of a boxplot shadow. See `erode.hexbin` for more information.
- `...` potential further arguments passed on.
- `check.erosion` logical indicating only eroded points should be used for "erodebin" objects; simply passed to `hcell2xy`, see its documentation.

Value

There is no return value from this function. The results are plotted on the current active device.

Author(s)

Nicholas Lewin-Koh ⟨nikko@hailmail.net⟩

See Also

`hexbinplot`, `panel.hexgrid`, `panel.boxplot`

Examples

```r
mixdata <-
  data.frame(x = c(rnorm(5000), rnorm(5000, 4, 1.5)),
             y = rep(1:2, 5000))
hexbinplot(y ~ x, mixdata, panel = panel.hexboxplot)
```

Panel.hexgrid  

**Hexagonal grid for a lattice plot**

Description

A panel function to add a hexagonal grid to a lattice plot.

Usage

```r
panel.hexgrid(h, border = grey(0.85))
```
**panel.hexloess**

**Arguments**

- `h`: an object of class `hexbin`.
- `border`: a color for the hexagon border colors

**Value**

There is no return value from this function. The results are plotted on the current active device.

**Author(s)**

Nicholas Lewin-Koh (nikko@hailmail.net)

**See Also**

`hexbinplot`, `hexGraphPaper`

---

**Description**

A panel function to add a loess line to a hexbin lattice plot.

**Usage**

```r
panel.hexloess(bin, w = NULL, span = 2/3, degree = 1, family = c("symmetric", "gaussian"), evaluation = 50, lwd = add.line$lwd, lty = add.line$lty, col, col.line = add.line$col.line, ...)
```

**Arguments**

- `bin`: an object of class `hexbin`.
- `w`: optional counts for object `bin`.
- `span`: smoothness parameter for `loess`.
- `degree`: degree of local polynomial used.
- `family`: if "gaussian" fitting is by least-squares, and if "symmetric" a re-descending M-estimator is used.
- `evaluation`: number of points at which to evaluate the smooth curve.
- `lwd`: line weight graphical parameter.
- `lty`: line type graphical parameter.
- `col`: same as `col.line`.
- `col.line`: line color graphical parameter.
- `...`: optional arguments to `loess.control`.

**Value**

There is no return value from this function. The results are plotted on the current active device.
plotMAhex

MA-plot using hexagon bins

Description

Creates an MA-plot using hexagons with color/glyph coding for control spots.

Usage

plotMAhex(MA, array = 1, xlab = "A", ylab = "M",
main = colnames(MA)[array], xlim = NULL, ylim = NULL,
status = NULL, values, pch, col, cex, nbin = 40,
zero.weights = FALSE, style = "colorscale", legend = 1.2,
lcex = 1, minarea = 0.04, maxarea = 0.8, mincnt = 2,
maxcnt = NULL, trans = NULL, inv = NULL, colorcut = NULL,
border = NULL, density = NULL, pen = NULL,
colramp = function(n) { LinGray(n, beg = 90, end = 15) },
newpage = TRUE, type = c("p", "l", "n"),
xaxt = c("s", "n"), yaxt = c("s", "n"),
verbose = getOption("verbose"))

Arguments

MA
an RGList, MAList or MArrayLM object, or any list with components M containing log-ratios and A containing average intensities. Alternatively a matrix, Affybatch or ExpressionSet object.

array
integer giving the array to be plotted. Corresponds to columns of M and A.

xlab, ylab, main
character strings giving label for x-axis, y-axis or main tile of the plot.

xlim, ylim
numeric vectors of length 2 giving limits for x-axis (or y-axis respectively), defaulting to min and max of the data.

status
character vector giving the control status of each spot on the array, of same length as the number of rows of M. If omitted, all points are plotted in the default color, symbol and size.

values
character vector giving values of status to be highlighted on the plot. Defaults to unique values of status. Ignored if there is no status vector.

pch
vector or list of plotting characters. Default to integer code 16. Ignored is there is no status vector.

col
numeric or character vector of colors, of the same length as values. Defaults to 1:length(values). Ignored if there is no status vector.
plotMAhex

cex numeric vector of plot symbol expansions, of the same length as values. Defaults to 0.2 for the most common status value and 1 for the others. Ignored if there is no status vector.

nbin ~~Describe nbin here~~

zero.weights logical, should spots with zero or negative weights be plotted?

style string specifying the style of hexagon plot, see grid.hexagons for the possibilities.

legend numeric width of the legend in inches of FALSE. In the latter case, or when 0, no legend is not produced.

lcex characters expansion size for the text in the legend.

minarea fraction of cell area for the lowest count.

maxarea fraction of the cell area for the largest count.

mincnt cells with fewer counts are ignored.

maxcnt cells with more counts are ignored.

trans function specifying a transformation for the counts such as sqrt.

inv the inverse transformation of trans.

colorcut vector of values covering [0, 1] that determine hexagon color class boundaries and hexagon legend size boundaries. Alternatively, an integer (<= maxcnt) specifying the number of equispaced colorcut values in [0,1].

border, density, pen color for polygon borders and filling of each hexagon drawn, passed to grid.hexagons.

colramp function accepting an integer n as an argument and returning n colors.

newpage should a new page start?

type, xaxt, yaxt strings to be used (when set to "n") for suppressing the plotting of hexagon symbols, or the x- or y-axis, respectively.

verbose logical indicating if some diagnostic output should happen.

Details

An MA-plot is a plot of log-intensity ratios (M-values) versus log-intensity averages (A-values). If MA is an RGList or MAList then this function produces an ordinary within-array MA-plot. If MA is an MArrayLM object, then the plot is an fitted model MA-plot in which the estimated coefficient is on the y-axis and the average A-value is on the x-axis.

If MA is a matrix or ExpressionSet object, then this function produces a between-array MA-plot. In this case the A-values in the plot are the average log-intensities across the arrays and the M-values are the deviations of the log-intensities for the specified array from the average. If there are more than five arrays, then the average is computed robustly using medians. With five or fewer arrays, it is computed by means.

The status vector is intended to specify the control status of each spot, for example "gene", "ratio control", "house keeping gene", "buffer" and so on. The vector is usually computed using the function controlStatus from package limma and a spot-types file. However the function may be used to highlight any subset of spots.

The arguments values, pch, col and cex can be included as attributes to status instead of being passed as arguments to plotMA.

See points for possible values for pch, col and cex.
Value
A plot is created on the current graphics device. A list with the following items is returned invisibly:

- `plot.vp`: the `hexViewport` constructed and used.
- `legend.vp`: if a legend has been produced, its `viewport`.
- `hbin`: a `hexbin` object built with `A` as the x coordinate and `M` as the y coordinate.

Author(s)
Nicholas Lewin-Koh, adapted from code by Gordon Smyth

References
See [http://www.statsci.org/micrarra/refs/maplots.html](http://www.statsci.org/micrarra/refs/maplots.html)

See Also
- `plotMA` from package `limma`, and `gplot.hexbin`.

Examples
```r
if(require(marray)){
  data(swirl)
  hb <- plotMAhex(swirl[,1],newpage=FALSE,
                  main = "M vs A plot with hexagons", legend=0)
  hexVP.abline(hb$plot.vp,h=0,col=gray(.6))
  hexMA.loess(hb)
}
```

---

**pushHexport**

*Push a Hexagon Viewport ("hexVP")*

Description
Push a Hexagon Viewport ("hexVP", see `hexVP-class`) on to the tree of (grid) viewports, calling `pushViewport`.

Usage

```r
pushHexport(hvp, clip = "off")
```

Arguments

- **hvp**: a hexagon viewport, i.e., an object of class "hexVP", see `hexVP-class`, typically produced by `hexViewport(...)`.  
- **clip**: which viewport to push, either 'on' or 'off' are the allowed arguments, see details.
**smooth.hexbin**  
*Hexagon Bin Smoothing*

**Description**  
Given a "hexbin" (hexagon bin) object, compute a discrete kernel smoother that covers seven cells, namely a center cell and its six neighbors. With two iterations the kernel effectively covers $1+6+12=19$ cells.

**Usage**  
`smooth.hexbin(bin, wts=c(48, 4, 1))`

**Arguments**  
- `bin` object of class "hexbin", typically resulting from `hexbin()` or `erode,hexbin-method`.
- `wts` numeric vector of length 3 for relative weights of the center, the six neighbor cells, and twelve second neighbors.

**Details**  
This discrete kernel smoother uses the center cell, immediate neighbors and second neighbors to smooth the counts. The counts for each resulting cell is a linear combination of previous cell counts and weights. The weights are:

- 1 center cell, weight = $wts[1]$
- 6 immediate neighbors, weight = $wts[2]$
- 12 second neighbors, weight = $wts[3]$

If a cell, its immediate and second neighbors all have a value of $\text{max}(\text{cnt})$, the new maximum count would be $\text{max}(\text{cnt}) \times \text{sum}(wts)$. It is possible for the counts to overflow.

The domain for cells with positive counts increases. The hexbin slots `xbins`, `xbnds`, `ybounds`, and `dimen` all reflect this increase. Note that usually `dimen[2] = xbins+1`.

The intent was to provide a fast, iterated, immediate neighbor smoother. However, the current hexbin plotting routines only support shifting even numbered rows to the right. Future work can:

1. add a shift indicator to hexbin objects that indicates left or right shifting.
2. generalize `plot.hexbin()` and `hexagons()`
3. provide an iterated kernel.

With $wts[3]=0$, the smoother only uses the immediate neighbors. With a shift indicator the
domain could increase by 2 rows (one bottom and on top) and 2 columns (one left and one right). However the current implementation increases the domain by 4 rows and 4 columns, thus reducing plotting resolution.

Value

an object of class "smoothbin", extending class "hexbin", see hexbin. The object includes the additional slot wts.

References

see grid.hexagons and hexbin.

See Also

hexbin, erode.hexbin, hcell2xy, gplot.hexbin, hboxplot, grid.hexagons, grid.hexlegend.

Examples

x <- rnorm(10000)
y <- rnorm(10000)
bin <- hexbin(x,y)
# show the smooth counts in gray level
smbin <- smooth.hexbin(bin)
plot(smbin, main = "smooth.hexbin(.)")

# Compare the smooth and the origin
smbin1 <- smbin
smbin1@count <- as.integer(ceiling(smbin@count/sum(smbin@wts)))
plot(smbin1)
smbin2 <- smooth.hexbin(bin,wts=c(1,0,0)) # expand the domain for comparability
plot(smbin2)
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