Package 'soccermatics'

October 1, 2017

Version 0.8.3

Title Visualise spatial data from soccer matches

Description Provides tools to visualise x,y-coordinates of soccer players in the manner presented in David Sumpter's eponymous book. Uses ggplot to draw soccer pitch and overplot player trajectories, average player positions, heatmaps of player position, flow fields to show binned player movement or passing, and more.

Depends R (>= 3.4.1)

Imports dplyr, magrittr, ggplot2, ggforce

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Encoding UTF-8

LazyData true

Collate 'pipe.R' 'soccerPitchFG.R' 'soccerPitchBG.R' 'soccerDirection.R' 'soccerHeatmap.R' 'soccerSpokes.R' 'soccerFlow.R' 'soccerPath.R' 'soccerPositions.R' 'tromso.R' 'tromso_extra.R'

RoxygenNote 6.0.1

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R topics documented:

`soccerDirection` *Add an arrow showing the direction of play to a soccer pitch ggplot.*

Description

Draws an arrow showing the direction of play at the top of an existing soccer pitch ggplot.

Usage

```
soccerDirection(plot, direction = c("right", "left"), lengthPitch = 105,
  widthPitch = 68, arrow_col = "black", grass = FALSE, topBuffer = 0)
```

Arguments

`plot`	an existing ggplot object to add arrow to.
`direction`	character, direction of arrow (`"right"` or `"left"`).
`lengthPitch, widthPitch`	numeric, length and width of pitch in metres.
`arrow_col`	character, colour of arrow (defaults to `"black"`).
`grass`	if TRUE, draws pitch background in green and lines in white. If FALSE, draws pitch background in white and lines in black.
`topBuffer`	numeric, modify y-position of arrow

Value

a ggplot object

See Also

`soccerPitchBG` and `soccerPitchFG` for drawing a soccer pitch

Examples

```
data(tromso)
# draw heatmap of player #9's position
p <- soccerHeatmap(subset(tromso, id == 9), bins = 15, lengthPitch = 105, widthPitch = 68)
# add arrow showing direction of play to the right
soccerDirection(p, "right", lengthPitch = 105, widthPitch = 68)
```

`soccerFlow` *Draw a flow field on a soccer pitch.*

Description

Draws a flow field showing the mean direction of movement made in each sector of the pitch and adds pitch outlines. Note: This function is prototypical and intended to eventually visualise pass and shot event data, but there are no open-source samples of such data available as yet.

Usage

```
soccerFlow(df, xBins, yBins = NULL, lengthPitch = 105, widthPitch = 68,
  grass = FALSE, line_col = "black", lwd = 1, plot = NULL)
```

Arguments

`df`	dataframe containing x,y-coordinates of player position in columns named `'x'` and `'y'` and angular information (in radians, ranging between -pi and pi) in a column `'direction'`.
`xBins, yBins`	integer, the number of horizontal (length-wise) and vertical (width-wise) bins the soccer pitch is to be divided up into. If no value for `yBins` is provided, it will take the value of `xBins`.
`lengthPitch, widthPitch`	numeric, length and width of pitch in metres.
`grass`	if TRUE, draws pitch background in green and lines in white. If FALSE, draws pitch background in white and lines in black.
`line_col`	colour of pitch lines.
`lwd`	thickness of arrow lines.
`plot`	optional, adds wagon wheels to an existing ggplot object if provided

Value

a ggplot object of a heatmap on a soccer pitch.

See Also

`soccerHeatmap` for drawing a heatmap of player position, or `soccerSpokes` for drawing spokes to show all directions in each area of the pitch.

Examples

```
data(tromso_extra)
# draw flow field showing mean direction of player #8's movement
soccerFlow(subset(tromso_extra, id == 8), xBins = 5, grass = TRUE)
# draw flow field over player heatmap
p <- soccerHeatmap(subset(tromso_extra, id == 8), xBins = 5)
soccerFlow(subset(tromso_extra, id == 8), xBins = 5, plot = p)
```

`soccerHeatmap` *Draw a heatmap on a soccer pitch.*

Description

Draws a heatmap showing player position frequency in each area of the pitch and adds soccer pitch outlines.

Usage

```
soccerHeatmap(df, xBins, lengthPitch = 105, widthPitch = 68, yBins = NULL,
  colLow = "white", colHigh = "red")
```

Arguments

`df`	dataframe containing x,y-coordinates of player position in columns named `'x'` and `'y'`.
`xBins, yBins`	integer, the number of horizontal (length-wise) and vertical (width-wise) bins the soccer pitch is to be divided up into. If no value for `yBins` is provided, it will take the value of `xBins`.
`lengthPitch, widthPitch`	numeric, length and width of pitch in metres.
`colLow, colHigh`	character, colours for the low and high ends of the heatmap gradient.

Details

uses `ggplot2::geom_bin2d` to map 2D bin counts

Value

a ggplot object of a heatmap on a soccer pitch.

See Also

`soccerPitchBG` for a background soccer pitch for the purpose of drawing position maps, player trajectories, etc..

Examples

```
data(tromso)
# simple heatmap of player #9's position
soccerHeatmap(subset(tromso, id == 8), xBins = 10)

# draw heatmap with approximately 5m x 5m bins (pitchLength / 5 = 21, pitchWidth / 5 = 13.6)
soccerHeatmap(subset(tromso, id == 8), xBins = 21, yBins = 14)
```

---

soccerPath *Draw a path of player trajectory on a soccer pitch.*

Description

Draws a path connecting consecutive x,y-coordinates of a player on a soccer pitch.

Usage

```
soccerPath(df, id_var = NULL, lengthPitch = 105, widthPitch = 68,
  grass = FALSE, col = "black", lwd = 1, legend = TRUE)
```

Arguments

df	dataframe containing x,y-coordinates of player position in columns named 'x' and 'y'.
id_var	character, the name of the column containing player identity. Only required if 'df' contains multiple players.
lengthPitch, widthPitch	numeric, length and width of pitch in metres.
grass	if TRUE, draws pitch background in green and lines in white. If FALSE, draws pitch background in white and lines in black.
col	colour of path if no 'id_var' is provided. If an 'id_var' is present, colours from ColorBrewer's 'Paired' palette are used.
lwd	thickness of path

Value

a ggplot object

Examples

```
data(tromso)
# draw path of player #8 over first 1200 frames
subset(tromso, id == 8)[1:1200,] %>%
  soccerPath(col = "red", grass = TRUE)
# draw path of all players over first 1200 frames
tromso %>%
```

```
  dplyr::group_by(id) %>%
  dplyr::slice(1:1200) %>%
  soccerPath("id")
```

---

soccerPitchBG *Draw a soccer pitch.*

Description

Draws a soccer pitch as a ggplot object for the purpose of adding layers such as player positions, player trajectories, etc..

Usage

```
soccerPitchBG(lengthPitch = 105, widthPitch = 68, grass = FALSE,
  line_col = "black")
```

Arguments

lengthPitch, widthPitch	numeric, length and width of pitch in metres.
grass	if TRUE, draws pitch background in green and lines in white. If FALSE, draws pitch background in white and lines in black.
line_col	colour of pitch lines

Value

a ggplot object

See Also

soccerPitchFG for drawing a soccer pitch as foreground over an existing ggplot object

Examples

```
# get x,y-coords of player #8 during first 10 minutes
data(tromso)
dd <- subset(tromso, id == 9)[1:1200,]
# draw player path on pitch
soccerPitchBG(lengthPitch = 105, widthPitch = 68, grass = TRUE) +
  geom_path(data = dd, aes(x, y), lwd = 2)
```

soccerPitchFG *Add soccer pitch outlines to an existing ggplot*

Description

Draws soccer pitch outlines (with transparent fill) over an existing ggplot object to provide context for heatmaps, passing maps, etc..

Usage

```
soccerPitchFG(plot, lengthPitch = 105, widthPitch = 68,
  line_col = "black")
```

Arguments

plot	an existing ggplot object to add layers to.
lengthPitch, widthPitch	numeric, length and width of pitch in metres.

Value

a ggplot object

See Also

soccerPitchBG for a background soccer pitch for the purpose of drawing position maps, player trajectories, etc..

Examples

```
data(tromso)
# draw heatmap of player #9's position
p <- soccerHeatmap(subset(tromso, id == 8), bins = 15, lengthPitch = 105, widthPitch = 68)
# add pitch lines to plot
soccerPitchFG(p, lengthPitch = 105, widthPitch = 68)
```

soccerPositions *Plot average player position on a soccer pitch.*

Description

Draws the average x,y-positions of all players in a dataframe and plots over a soccer pitch.

Usage

```
soccerPositions(df, id_var = "id", lengthPitch = 105, widthPitch = 68,
  col1 = "red", col2 = "white", size = 8, grass = FALSE)
```

Arguments

df	dataframe containing x,y-coordinates of player position in columns named 'x' and 'y'.
id_var	character, the name of the column containing player identity. Defaults to 'id'.
lengthPitch, widthPitch	numeric, length and width of pitch in metres.
col1	character, fill colour of position points.
col2	character, border colour of position points.
size	numeric, size of position points and text.
grass	if TRUE, draws pitch background in green and lines in white. If FALSE, draws pitch background in white and lines in black.

See Also

soccerPitchBG for a background soccer pitch for the purpose of drawing position maps, player trajectories, etc..

Examples

```
data(tromso)
# draw average player position of players
p <- soccerPositions(tromso, lengthPitch = 105, widthPitch = 68, grass = TRUE)
# draw arrow showing direction of play
soccerDirection(p, "right", lengthPitch = 105, widthPitch = 68, grass = TRUE)
```

---

soccerSpokes *Draw spokes on a soccer pitch.*

Description

Draws spokes showing the direction of all movements made in each sector of the pitch. Note: This function is prototypical and intended to eventually visualise pass and shot event data, but there are no open-source samples of such data available as yet.

Usage

```
soccerSpokes(df, xBins, lengthPitch = 105, widthPitch = 68,
  angleBins = 16, yBins = NULL, grass = FALSE, line_col = "black",
  lwd = 0.5, minLength = 0.6, minAlpha = 0.4, legend = TRUE,
  plot = NULL)
```

Arguments

df	dataframe containing x,y-coordinates of player position in columns named 'x' and 'y' and angular information (in radians, ranging between -pi and pi) in a column 'direction'.
xBins, yBins	integer, the number of horizontal (length-wise) and vertical (width-wise) bins the soccer pitch is to be divided up into. If no value for yBins is provided, it will take the value of xBins.
lengthPitch, widthPitch	numeric, length and width of pitch in metres.
angleBins	integer, the number of angle bins movement directions are divided up into. For example, a value of 4 clusters directions in each bin into north, east, south and west.
grass	if TRUE, draws pitch background in green and lines in white. If FALSE, draws pitch background in white and lines in black.
line_col	colour of pitch lines
lwd	thickness of arrow lines
minLength	numeric, ratio between size of shortest arrow and longest arrow depending on number of events.
minAlpha	numeric, minimum alpha of the arrow with the lowest number of events.
legend	if TRUE, adds legend showing relationship between arrow transparency and number of events
plot	optional, adds spokes to an existing ggplot object if provided

Value

a ggplot object of a heatmap on a soccer pitch.

See Also

soccerHeatmap for drawing a heatmap of player position, or soccerSpokes for summarising mean direction in each pitch sector

Examples

```
data(tromso_extra)
# resample movement dataset to plot 100 movement directions
# (in absence of pass / shot event data as yet)
id8 <- tromso_extra %>%
  dplyr::filter(id == 8) %>%
  dplyr::sample_n(100)
# 10x10 x,y-bins, 8 angle-bins, grass pitch
soccerSpokes(id8, xBins = 5, angleBins = 8, grass = TRUE, minLength = 0.3, minAlpha = 0.7)
# 5x5 x,y-bins, 16 angle-bins, blank pitch w/ grey lines
soccerSpokes(id8, xBins = 5, angleBins = 16, line_col = "grey40")
# draw spokes over player heatmap
p <- soccerHeatmap(id8, xBins = 5)
soccerSpokes(id8, xBins = 5, plot = p)
```

tromso *x,y-coordinates of 11 soccer players over 12000 frames each*

Description

x,y-coordinates of 11 soccer players over 10 minutes (Tromsø IL vs. Anzhi, 2013-11-07), captured at 20 Hz using the ZXY Sport Tracking system and made available in the publication ZXY Sport Tracking.

Usage

```
data(tromso)
```

Format

A dataframe containing 12000 frames of x,y-coordinates and timestamps from 11 players.

Source

ZXY Sport Tracking

References

Pettersen et al. (2014) Proceedings of the International Conference on Multimedia Systems (MMSys) (pdf)

Examples

```
data(tromso)
# draw path of player #8 on a soccer pitch
soccerPitchBG(lengthPitch = 105, widthPitch = 68, grass = TRUE) +
  geom_path(data = subset(tromso, id == 8), aes(x, y), lwd = 2)
```

tromso_extra *x,y-coordinates and additional positional information on 11 soccer players over 12000 frames each*

Description

x,y-coordinates of 11 soccer players over 10 minutes (Tromsø IL vs. Anzhi, 2013-11-07), plus additional information on player heading, direction, energy, speed, and total distance. Data captured at 20 Hz using the ZXY Sport Tracking system and made available in the publication ZXY Sport Tracking.

Usage

```
data(tromso_extra)
```

Format

A dataframe containing 12000 frames of x,y-coordinates and timestamps from 11 players.

Source

ZXY Sport Tracking

References

Pettersen et al. (2014) Proceedings of the International Conference on Multimedia Systems (MMSys) (pdf)

Examples

```
data(tromso_extra)
# draw flow field showing mean direction of player #8's movement
soccerFlow(subset(tromso_extra, id == 8), bins = 5, grass = TRUE)
```

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