TikZ annotations for ggplots with the ggtikz package

August 16, 2021

Contents

1 Prerequisites .......................... 1
  1.1 LaTeX side .......................... 1
  1.2 R side .............................. 2

2 Basic usage with ggtikz() ............ 2

3 Advanced usage with canvases and annotations 3
  3.1 Single-panel plots .................. 3
      3.1.1 Annotation relative to the whole plot 3
      3.1.2 Annotation relative to the panel 4
      3.1.3 Annotation relative to data coordinates 5
      3.1.4 Mixing panel and data references 6
      3.1.5 Turning off clipping 7
  3.2 Multi-panel plots: wrap ............ 9
      3.2.1 Annotations in separate panels, relative to data or panel coordinates 9
      3.2.2 Annotations in separate panels, relative to data coordinates 10
  3.3 Multi-panel plots: grid ............ 11
  3.4 Re-using annotations .............. 12

4 Using styles defined in the surrounding document 14

1 Prerequisites

1.1 LaTeX side

As the name implies, ggtikz requires tikz, which must be loaded in the document’s preamble. Furthermore, the calc tikz library is required.

Thus, the preamble must contain:

\usepackage{tikz}
\usetikzlibrary{calc}
1.2 R side

The tikzDevice package is required to render plots and gg tikz annotations to the tikz format. We also have to make some base plots, using ggplot2.

Here, we set the graphics device to tikz - gg tikz does not work with any other graphics device!

```r
library(knitr)
library(ggplot2)
library(ggtikz)
opts_chunk$set(
    dev = "tikz",
    external = TRUE,
    fig.path = "example-vignette-figures/",
    fig.width = 3,
    fig.height = 3,
    fig.align = "center"
)
```

2 Basic usage with ggtikz()

For simple one-step annotations, the ggtikz helper function is available.

It accepts a ggplot object as its first argument. Further arguments are passed on to ggtikz annotation (see section 3).

```r
p <- ggplot(mtcars, aes(disp, mpg)) + geom_point()
ggtikz(p, "\fill[red] (0.5,0.5) circle (2mm);", xy="plot")
```
3 Advanced usage with canvases and annotations

With `ggtikz()`, only a single annotation can be added to a plot. If multiple annotations are needed, then we first need to create a `ggtikzCanvas()`, to which one or more `ggtikzAnnotation()` can be added.

3.1 Single-panel plots

Let's create a single-panel plot for annotation.

```r
p <- ggplot(mtcars, aes(disp, mpg)) + geom_point()
```

We can then set up an annotation canvas and add tikz annotations. Note that first, we print the base plot to the device\(^1\), and then the annotation canvas. The annotation canvas does not take care of drawing the annotated plot (the `ggtikz()` helper does handle this with the `draw = TRUE` parameter).

3.1.1 Annotation relative to the whole plot

```r
canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation(
  "
  \draw (0,0) -- (1,1);
  \draw (0,1) -- (1,0);
  \fill[red] (0.5,0.5) circle (2mm);
  ",
  xy = "plot"
)
p # first draw the plot
canvas + annotation # then draw the annotations
```

\(^1\) No explicit calls to `tikz()` and `dev.off()` are needed, because knitr opens and closes the device automatically.
3.1.2 Annotation relative to the panel

canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation("\n\draw (0,0) -- (1,1);
\draw (0,1) -- (1,0);
\fill[red] (0.5,0.5) circle (2mm);
",
xy = "panel",
panelx = 1, panely = 1
)
p
canvas + annotation
3.1.3 Annotation relative to data coordinates

In addition to unitless tikz coordinates, you can also use absolute lengths, such as the 1 cm in the example below.

```r
canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation("\n\draw[thick,red] (100,20) -| (400,15);
\draw[<-] (153,24) -- ++(30:1cm) node[at end, anchor=south] {Interesting!};\n", xy = "data",
panelx = 1, panely = 1)
p
canvas + annotation
```
3.1.4 Mixing panel and data references

The reference frames for x and y coordinates can be separately assigned as data or panel. However, note that the plot reference frame must be given for both x and y directions (with the xy argument), and cannot be mixed!

```r
canvas <- ggtikzCanvas(p)
annotation <- ggtikzAnnotation(
  "\fill[red] (0.5,30) circle (2mm);",
  x = "panel", y = "data",
  panelx = 1, panely = 1
)
p
canvas + annotation
```
3.1.5 Turning off clipping

It is possible to turn off clipping for annotations, in order to draw outside of the plot area.

```r
canvas <- ggtikzCanvas(p)
annotation_clip <- ggtikzAnnotation(
  "\fill[red] (0.1,0) circle (5mm);",
  xy = "panel",
  panelx = 1, panely = 1
)

annotation_unclip <- ggtikzAnnotation(
  "\fill[blue] (0.9,0) circle (5mm);",
  xy = "panel",
  panelx = 1, panely = 1,
  clip = "off"
)

annotation_unclip2 <- ggtikzAnnotation(
  "\draw[thick, dashed] (0,0) -- (0.5,-0.2) -- (1,0);",
  xy = "panel",
  panelx = 1, panely = 1,
  clip = "off"
)

p

canvas + annotation_clip + annotation_unclip + annotation_unclip2
```
However, note that the surrounding plot area is not automatically unclipped to accommodate for the annotations. This can be alleviated manually by increasing the plot margins.

```r
p + theme(plot.margin = margin(t=0.5, b = 1, unit = "cm"))
```

```r
canvas + annotation_clip + annotation_unclip + annotation_unclip2
```
3.2 Multi-panel plots: wrap

\[ p\_wrap \leftarrow p + \text{facet}\_wrap(~cyl, \text{scales}="\text{free}", \text{ncol}=2) \]

3.2.1 Annotations in separate panels, relative to data or panel coordinates

\[
\text{canvas} \leftarrow \text{ggtikzCanvas}(p\_wrap)
\]

# Relative to data coordinates
\[
\text{annotation1} \leftarrow \text{ggtikzAnnotation}(
\text{"}
\node[pin=90:(110,27)], circle, fill=red, inner sep=0, outer sep=0, minimum size=2pt at (110,27);\n\text{"},
xy = "data",
panelx = 1, panely = 1
\text{)}
\]

# Relative to data coordinates
\[
\text{annotation2} \leftarrow \text{ggtikzAnnotation}(
\text{"}
\node[pin=90:(200,19)], circle, fill=red, inner sep=0, outer sep=0, minimum size=2pt at (200,19);\n\text{"},
xy = "data",
panelx = 2, panely = 1
\text{)}
\]

# Relative to panel coordinates
\[
\text{annotation3} \leftarrow \text{ggtikzAnnotation}(
\text{"}
\node[draw, anchor=center] at (0.5, 0.5) {Center of panel};
\text{"},
xy = "panel",
panelx = 1, panely=2
\text{)}
\]
3.2.2 Annotations in separate panels, relative to data coordinates

canvas <- ggtikzCanvas(p_wrap)
annotation1 <- ggtikzAnnotation(""
  \node[pin=90:(110,27)], circle, fill=red,
  inner sep=0, outer sep=0, minimum size=2pt]
  at (110,27)
{};
",
xy = "data",
panelx = 1, panely = 1
)
annotation2 <- ggtikzAnnotation(""
  \node[pin=90:(200,19)], circle, fill=red,
  inner sep=0, outer sep=0, minimum size=2pt]
  at (200,19)
{};
",
xy = "data",
panelx = 2, panely = 1
)
3.3 Multi-panel plots: grid

Annotations can also be made on individual panels of plots faceted with `facet_grid`.

```r
p_grid <- p + facet_grid(gear~cyl, scales="free", as.table=FALSE)
```

```r
canvas <- ggtikzCanvas(p_grid)
annot_grid1 <- ggtikzAnnotation("\node[fill=white, draw, text width=2cm] at (0.5,0.5) 
{panelx=1, panely=1};",
xy = "panel",
panelx = 1, panely = 1)
annot_grid2 <- ggtikzAnnotation("\node[fill=white, draw, text width=2cm] at (0.5,0.5) 
{panelx=2, panely=3};",
xy = "panel",
panelx = 2, panely = 3)
annot_grid3 <- ggtikzAnnotation("\draw[<-, blue] (90,15) -- ++(30:5mm)
node [at end, anchor=south west] {(90,15)};")
```
3.4 Re-using annotations

Annotations can be re-used between plots and `ggtikz` canvases. However, be aware that panel position specifications rely on the visual position of the panels, and not on the value of the facet variables.

```r
p_grid2 <- p + facet_grid(gear~cyl, scales="free", as.table=TRUE)
canvas2 <- ggtikzCanvas(p_grid2)
```
It is also not possible to add annotations to a plot for which the requested panels are not available.
canvas <- ggtikzCanvas(p)
canvas + annot_grid2

## Error in get_annotation_valid.ggtikzCanvas(self, ggtikzAnnotation): Annotation wants to be placed in panelx = 2, but the plot only has 1.

4 Using styles defined in the surrounding document

Annotations can access styles which are defined in the containing document before the relevant .tikz file is included, allowing you to re-use global styles. Note that by default, knitr sets the option external to TRUE. Therefore, tikz graphics are pre-compiled to pdf. In that case, the tikzDevice needs to know about these styles, or an error will occur during externalization.

\[ \texttt{\tikzset{\texttt{\textbackslash loud/.style=\{ draw=yellow, fill=red, text=blue}}}} \]

p
```r
canvas <- ggplotCanvas(p)
styled_annot <- ggplotAnnotation(
  "\node[loud] at (0.5,0.5) {Look at me!};",
  xy = "plot"
)
p
canvas + styled_annot
```