

1 ggtreeExtra: A universal package to visualize compact circular layers of phylogenetic tree

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1.1 Examples to show how to use *ggtreeExtra* with some geometric function defined by ggplot2-based packages

The supplementary file1 has listed several examples to show how to map the associated data to circular phylogenetic tree using *ggtreeExtra*. These examples has contained the illustration how to use *ggtreeExtra* with common geometric function defined by *ggplot2*(Wickham 2016). Here, we show several cases that *ggtreeExtra* works with geometric function defined by ggplot2-based packages.

1.1.1 Working with *ggdist* package

ggdist(Kay 2020) can be used to display the distribution and uncertainty of data, *ggtreeExtra* can work with several geometric function defined by it (supplementary file Table.S1). If the associated data should be displayed the distribution, such as the gene expression in different samples.

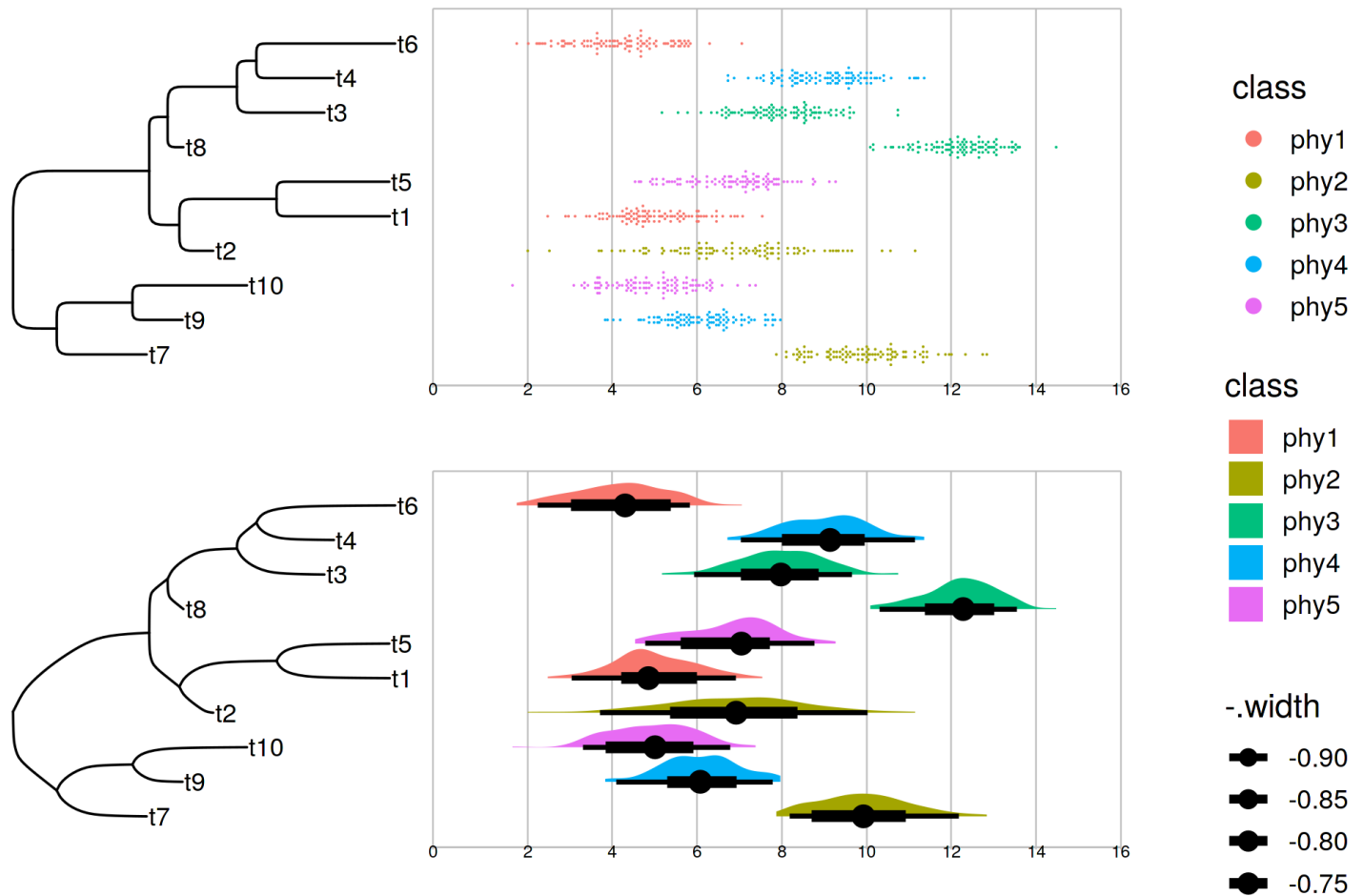
```
library(tibble)
library(tidyr)
library(ggdist)
library(ggtree)
library(ggplot2)
library(ggtreeExtra)
library(patchwork)
set.seed(1024)
df = tribble(
  ~id, ~class, ~value,
  "t1", "phy1", rnorm(100, mean = 5),
  "t2", "phy2", rnorm(100, mean = 7, sd = 1.5),
  "t3", "phy3", rnorm(100, mean = 8),
  "t4", "phy4", rnorm(100, mean = 9),
  "t5", "phy5", rnorm(100, mean = 7),
  "t6", "phy1", rnorm(100, mean = 4),
  "t7", "phy2", rnorm(100, mean = 10),
  "t8", "phy3", rnorm(100, mean = 12),
  "t9", "phy4", rnorm(100, mean = 6),
  "t10", "phy5", rnorm(100, mean = 5)
) %>% unnest(value)
tr <- rtree(10)
p1 <- ggtree(tr, layout="roundrect", size=0.3) + geom_tiplab(size=3)
p2 <- ggtree(tr, layout="ellipse", size=0.3) + geom_tiplab(size=3)
# The associate data (df)
p1 <- p1 +
  geom_fruit(data=df,
    geom=geom_dots,
    mapping=aes(y=id, x=value, fill=class),
    position=position_identityx(),
    color=NA,
    dotsize=3,
```

```

      pwidth=1.8,
      offset=0.1,
      orientation="y",
      side="both",
      grid.params=list(),
      axis.params=list(axis="x",text.size=2, nbreak=6)
    ) + theme(legend.key.size=unit(0.5, "cm"))
p2 <- p2 +
  geom_fruit(data=df,
    geom=geom_slabinterval,
    mapping=aes(y=id, x=value, fill=class),
    position=position_identityx(),
    pwidth=1.8,
    offset=0.1,
    orientation="y",
    side="right",
    stat=StatSampleSlabinterval,
    grid.params=list(),
    axis.params=list(axis="x",text.size=2, nbreak=6)
  ) +
  theme(legend.key.size=unit(0.5, "cm"))

p1 / p2

```



SFig. S1: This example to show `ggtreeExtra` works with `geom_dots` and `geom_slabinterval` of `ggdist` (Kay 2020). And `ggtreeExtra` also support other layout of `ggtree` (Yu et al. 2017).

1.1.2 Working with *ggpattern* package

ggpattern(FC 2020) provides geometric layers which support filled areas with geometric and image-based patterns. Some geometric layers of it can also work with *ggtreeExtra*.

```
library(ggtree)
library(ggtreeExtra)
library(ggpattern)
library(ggplot2)

set.seed(1024)

tr <- rtree(20)
dat <- data.frame(id=tr$tip.label,
                  value=abs(rnorm(20, 3)),
                  group=c(rep("A", 5), rep("B", 5), rep("C", 5), rep("D", 5)))

dt <- data.frame(id=rep(tr$tip.label, 8), value=abs(rnorm(20 * 8, 8, 1.5)),
                  class=rep(rep(c("A", "B", "C", "D"), 5), 8))

p <- ggtree(
  tr,
  layout="fan",
  open.angle=180
)

p1 <- p +
  geom_fruit(
    data=dat,
    geom=geom_bar_pattern,
    mapping=aes(y=id, x=value, pattern=group, pattern_angle=group),
    width=0.6,
    stat="identity",
    pwidth = 0.6,
    pattern_spacing = 0.01,
    pattern_size = 0.1,
    pattern_density = 0.4,
    fill = "grey",
    pattern_fill="grey35",
    position=position_identityx(),
    axis.params=list(axis="xy")
  ) +
  theme(
    legend.position= c(0.94, 0.8),
    legend.key.size = unit(0.3, 'cm')
  )

p2 <- p +
  geom_fruit(
    data=dat,
    geom=geom_bar_pattern,
    mapping=aes(y=id, x=value, pattern=group, pattern_fill=group),
    width=0.6,
    stat="identity",
    pwidth = 0.6,
    pattern_spacing = 0.01,
    pattern_size = 0.1,
    pattern_density = 0.4,
    fill = "grey",
```

```

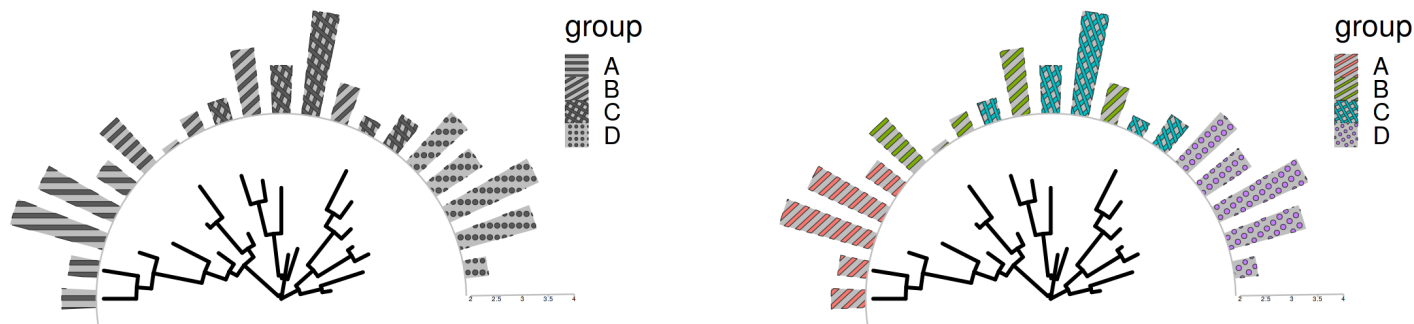
    position=position_identityx(),
    axis.params=list(axis="xy")
  ) +
  theme(
    legend.position= c(0.94, 0.8),
    legend.key.size = unit(0.3, 'cm')
  )

p3 <- p +
  geom_fruit(
    data=dt,
    geom=geom_boxplot_pattern,
    mapping=aes(y=id, x=value, pattern=class, pattern_angle = class),
    size=0.1,
    outlier.size=0.5,
    pwidth=0.5,
    pattern_size = 0.1,
    pattern_density = 0.4,
    pattern_spacing =0.01,
    fill = "grey",
    pattern_fill="grey35",
    position=position_dodge(),
    grid.params=list(),
    axis.params=list(axis="x")
  ) +
  theme(
    legend.position= c(0.94, 0.8),
    legend.key.size = unit(0.5, 'cm')
  )

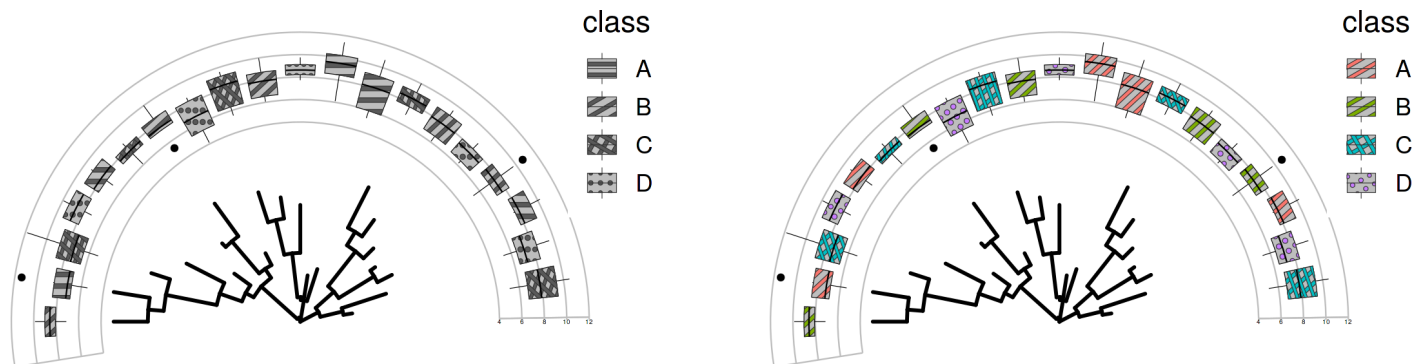
p4 <- p +
  geom_fruit(
    data=dt,
    geom=geom_boxplot_pattern,
    mapping=aes(y=id, x=value, pattern=class, pattern_fill = class),
    size=0.1,
    outlier.size=0.5,
    pwidth = 0.5,
    pattern_size = 0.1,
    pattern_density = 0.4,
    pattern_spacing =0.01,
    fill = "grey",
    position=position_dodge(),
    grid.params=list(),
    axis.params=list(axis="x")
  ) +
  theme(
    legend.position= c(0.94, 0.8),
    legend.key.size = unit(0.5, 'cm')
  )

p1 + p2
p3 + p4

```



SFig. S2: This example to show `ggtreeExtra` works with `geom_bar_pattern` and `geom_boxplot_pattern` of `ggpattern`(FC 2020).



SFig. S3: This example to show `ggtreeExtra` works with `geom_bar_pattern` and `geom_boxplot_pattern` of `ggpattern`(FC 2020).

Reference

- FC, Mike. 2020. *Ggpattern: Geoms with Patterns*.
- Kay, Matthew. 2020. *ggdist: Visualizations of Distributions and Uncertainty*. <https://doi.org/10.5281/zenodo.3879620>.
- Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. <https://ggplot2.tidyverse.org>.
- Yu, Guangchuang, David Smith, Huachen Zhu, Yi Guan, and Tommy Tsan-Yuk Lam. 2017. “Ggtree: An R Package for Visualization and Annotation of Phylogenetic Trees with Their Covariates and Other Associated Data.” *Methods in Ecology and Evolution* 8 (1): 28–36. <https://doi.org/10.1111/2041-210X.12628>.