Hands-on Exercise 10: Information Dashboard Design: R methods

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Overview

By the end of this hands-on exercise, you will be able to:

- create bullet chart by using ggplot2,
- create sparklines by using ggplot2 ,
- build industry standard dashboard by using R Shiny.

Importing Microsoft Access database

The data set

For the purpose of this study, a personal database in Microsoft Access mdb format called *Coffee Chain* will be used.

Importing database into R

In the code chunk below, `odbcConnectAccess()` of **RODBC** package is used used to import a database query table into R.

```
library(RODBC)
con <- odbcConnectAccess('data/Coffee Chain.mdb')
coffeechain <- sqlFetch(con, 'CoffeeChain Query')
write_rds(coffeechain, "data/CoffeeChain.rds")
odbcClose(con)
```

Note: Before running the code chunk, you need to change the R system to 32bit version. This is because the `odbcConnectAccess()` is based on 32bit and not 64bit

Getting started

For the purpose of this hands-on exercise, the following R packages will be used.

```
packages = c('tidyverse', 'lubridate',
             'ggthemes', 'reactable',
             'reactablefmtr',
             'gt', 'gtExtras')

for (p in packages){
  if(!require(p, character.only = T)){
    install.packages(p)
  }
  library(p,character.only = T)
}
```

- tidyverse provides a collection of functions for performing data science task such as importing, tidying, wrangling data and visualising data. It is not a single package but a collection of modern R packages including but not limited to readr, tidyr, dplyr, ggplot, tibble, stringr, forcats and purrr.
- lubridate provides functions to work with dates and times more efficiently.
- ggthemes is an extension of ggplot2. It provides additional themes beyond the basic themes of ggplot2.
- gtExtras provides some additional helper functions to assist in creating beautiful tables with gt, an R package specially designed for anyone to make wonderful-looking tables using the R programming language.
- reactablefmtr provides various features to streamline and enhance the styling of interactive reactable tables with easy-to-use and highly-customizable functions and themes.

Data Preparation

Importing Data

The code chunk below is used to import *CoffeeChain.rds* into R.

```
coffeechain <- read_rds("data/CoffeeChain.rds")
```

Note: This step is optional if *coffeechain* is already available in R.

Data wrangling

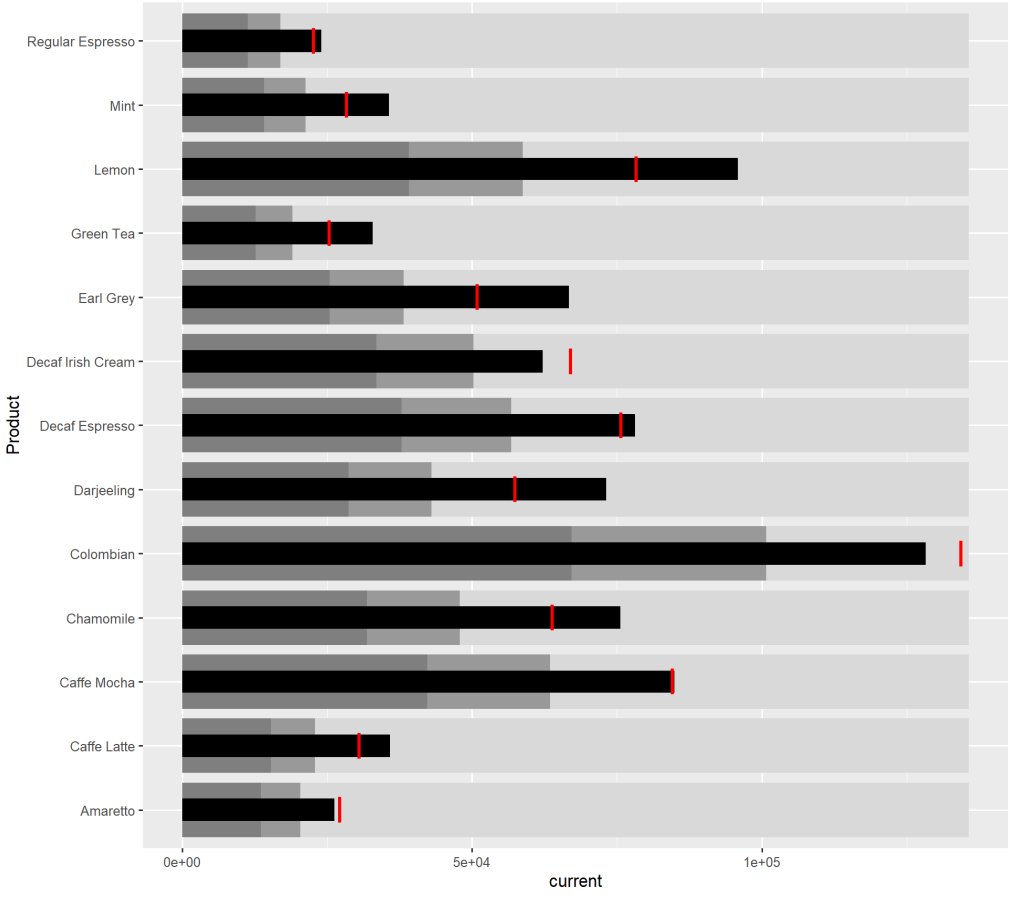
The code chunk below is used to aggregate Sales and Budgeted Sales at the Product level.

```
product <- coffeechain %>%
  group_by(`Product`) %>%
  summarise(`target` = sum(`Budget Sales`),
            `current` = sum(`Sales`)) %>%
  ungroup()
```

Bullet chart in ggplot2

The code chunk below is used to plot the bullet charts using ggplot2 functions.

```
ggplot(product, aes(Product, current)) +
  geom_col(aes(Product, max(target) * 1.01),
           fill="grey85", width=0.85) +
  geom_col(aes(Product, target * 0.75),
           fill="grey60", width=0.85) +
  geom_col(aes(Product, target * 0.5),
           fill="grey50", width=0.85) +
  geom_col(aes(Product, current),
           width=0.35,
           fill = "black") +
  geom_errorbar(aes(y = target,
                    x = Product,
                    ymin = target,
                    ymax= target),
                width = .4,
                colour = "red",
                size = 1) +
  coord_flip()
```



Plotting sparklines using ggplot2

In this section, you will learn how to plot sparklines by using ggplot2.

Preparing the data

```
sales_report <- coffeechain %>%
  filter(Date >= "2013-01-01") %>%
  mutate(Month = month(Date)) %>%
  group_by(Month, Product) %>%
  summarise(Sales = sum(Sales)) %>%
  ungroup() %>%
  select(Month, Product, Sales)
```

The code chunk below is used to compute the minimum, maximum and end othe the month sales.

```
mins <- group_by(sales_report, Product) %>%
  slice(which.min(Sales))
maxs <- group_by(sales_report, Product) %>%
  slice(which.max(Sales))
ends <- group_by(sales_report, Product) %>%
  filter(Month == max(Month))
```

The code chunk below is used to compute the 25 and 75 quantiles.

```
quarts <- sales_report %>%
  group_by(Product) %>%
  summarise(quart1 = quantile(Sales,
                              0.25),
            quart2 = quantile(Sales,
                              0.75)) %>%
  right_join(sales_report)
```

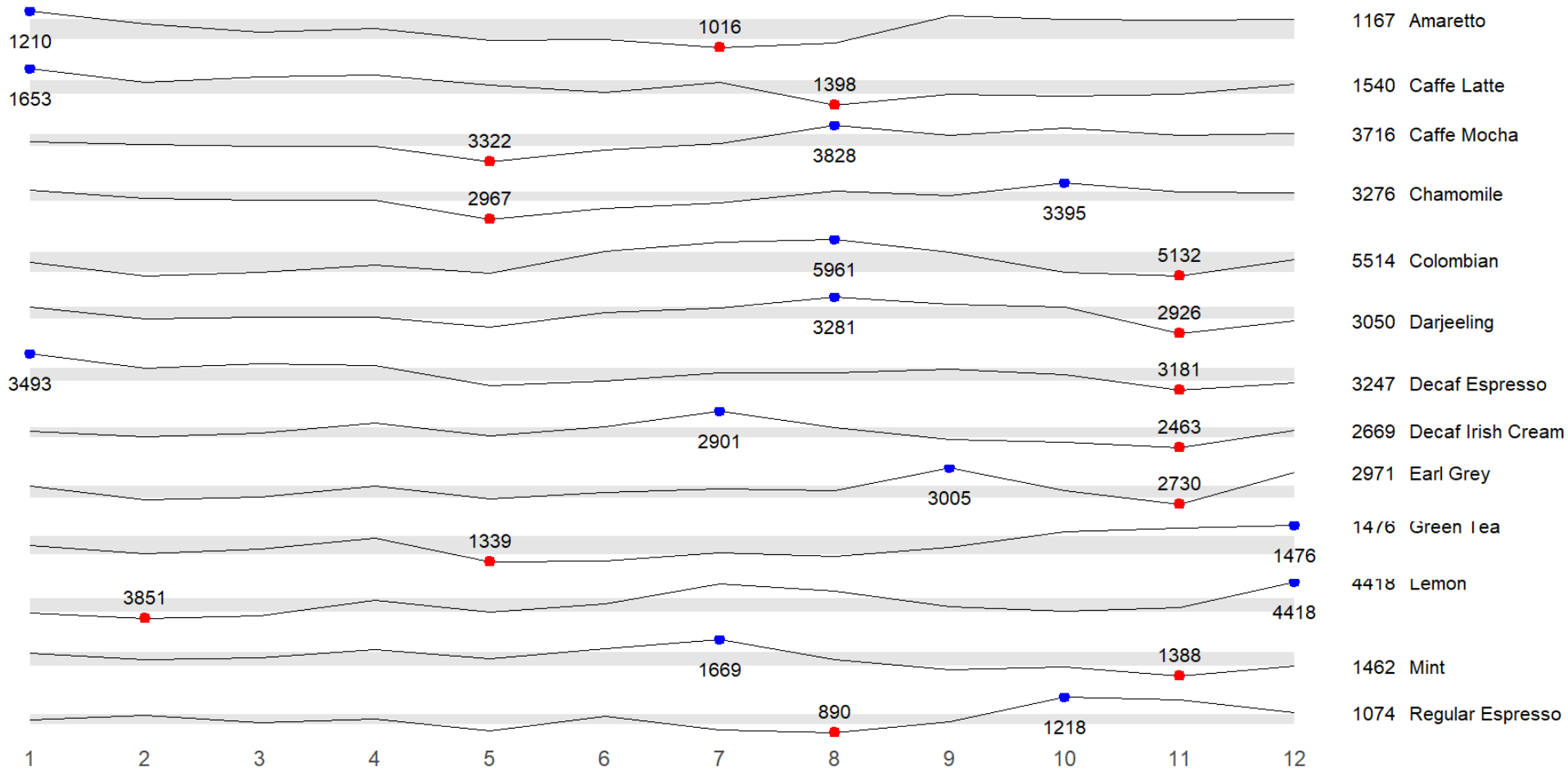
sparklines in ggplot2

The code chunk used.

```
ggplot(sales_report, aes(x=Month, y=Sales)) +
  facet_grid(Product ~ ., scales = "free_y") +
  geom_ribbon(data = quarts, aes(ymin = quart1, max = quart2),
              fill = 'grey90') +
  geom_line(size=0.3) +
  geom_point(data = mins, col = 'red') +
  geom_point(data = maxs, col = 'blue') +
  geom_text(data = mins, aes(label = Sales), vjust = -1) +
  geom_text(data = maxs, aes(label = Sales), vjust = 2.5) +
  geom_text(data = ends, aes(label = Sales), hjust = 0, nudge_x = 0.5) +
  geom_text(data = ends, aes(label = Product), hjust = 0, nudge_x = 1) +
  expand_limits(x = max(sales_report$Month) +
                  (0.25 * (max(sales_report$Month) - min(sales_report$Month)))) +
  scale_x_continuous(breaks = seq(1, 12, 1)) +
  scale_y_continuous(expand = c(0.1, 0)) +
  theme_tufte(base_size = 3, base_family = "Helvetica") +
  theme(axis.title=element_blank(), axis.text.y = element_blank(),
        axis.ticks = element_blank(), strip.text = element_blank())
```

sparklines in ggplot2

The output



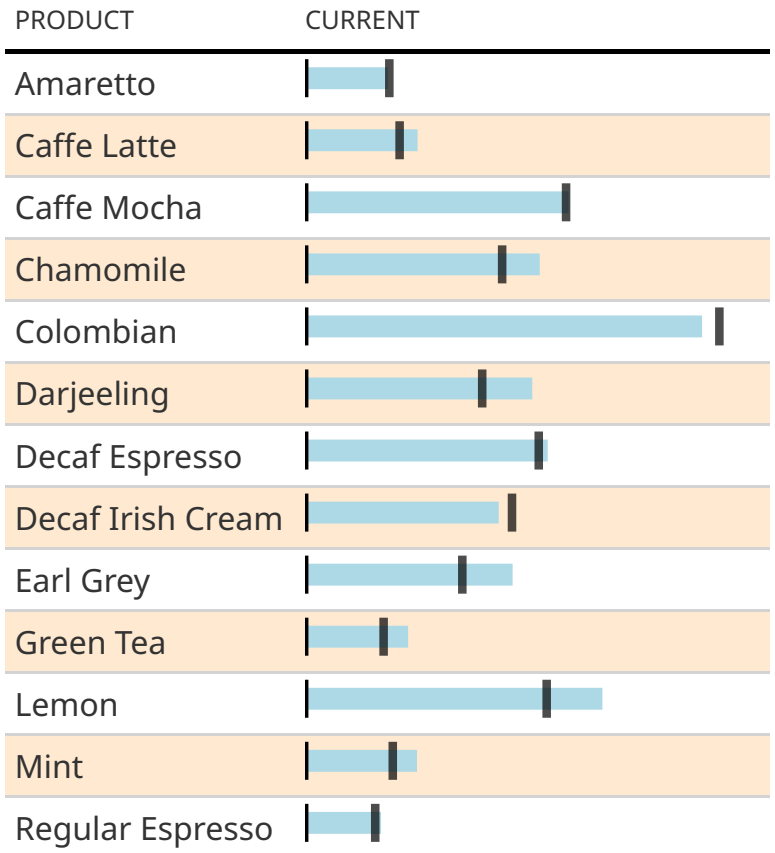
Static Information Dashboard Design: gt and gtExtras methods

In this section, you will learn how to create static information dashboard by using gt and gtExtras packages. Before getting started, it is highly recommended for you to visit the webpage of these two packages and review all the materials provided on the webpages at least once. You done not have to understand and remember everything provided but at least have an overview of the purposes and functions provided by them.

Plotting a simple bullet chart

In this section, you will learn how to prepare a bullet chart report by using functions of gt and gtExtras packages.

```
product %>%
  gt::gt() %>%
  gt_plt_bullet(column = current,
                target = target,
                width = 60,
                palette = c("lightblue",
                            "black")) %>%
  gt_theme_538()
```



sparklines: gtExtras method

Before we can prepare the sales report by product by using gtExtras functions, code chunk below will be used to prepare the data.

```
report <- coffeechain %>%
  mutate(Year = year(Date)) %>%
  filter(Year == "2013") %>%
  mutate (Month = month(Date,
                        label = TRUE,
                        abbr = TRUE)) %>%
  group_by(Product, Month) %>%
  summarise(Sales = sum(Sales)) %>%
  ungroup()
```

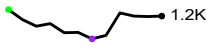
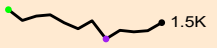
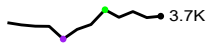
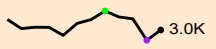
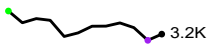
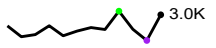
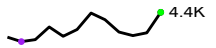
It is important to note that one of the requirement of gtExtras functions is that almost exclusively they require you to pass data.frame with list columns. In view of this, code chunk below will be used to convert the report data.frame into list columns.

```
report %>%
  group_by(Product) %>%
  summarize('Monthly Sales' = list(Sales),
            .groups = "drop")
```

```
## # A tibble: 13 × 2
##    Product           `Monthly Sales`
##    <chr>             <list>
##  1 Amaretto          <dbl [12]>
##  2 Caffe Latte       <dbl [12]>
##  3 Caffe Mocha       <dbl [12]>
##  4 Chamomile         <dbl [12]>
##  5 Colombian         <dbl [12]>
##  6 Darjeeling        <dbl [12]>
##  7 Decaf Espresso    <dbl [12]>
##  8 Decaf Irish Cream <dbl [12]>
##  9 Earl Grey         <dbl [12]>
```

Plotting Coffechain Sales report

```
report %>%
  group_by(Product) %>%
  summarize('Monthly Sales' = list(Sales),
            .groups = "drop") %>%
   gt() %>%
   gt_plt_sparkline('Monthly Sales')
```

Product	Monthly Sales
Amaretto	
Caffe Latte	
Caffe Mocha	
Chamomile	
Colombian	
Darjeeling	
Decaf Espresso	
Decaf Irish Cream	
Earl Grey	
Green Tea	
Lemon	
Mint	
Regular Espresso	

Adding statistics

First, calculate summary statistics by using the code chunk below.

```
report %>%
  group_by(Product) %>%
  summarise("Min" = min(Sales, na.rm = T),
            "Max" = max(Sales, na.rm = T),
            "Average" = mean(Sales, na.rm = T)
            ) %>%
  gt() %>%
  fmt_number(columns = 4,
    decimals = 2)
```

pull-right[

```
report %>%
  group_by(Product) %>%
  summarise("Min" = min(Sales, na.rm = T),
            "Max" = max(Sales, na.rm = T),
            "Average" = mean(Sales, na.rm = T)
            ) %>%
  gt() %>%
  fmt_number(columns = 4,
    decimals = 2)
```

]

Combining the data.frame

.pull-left[Next, use the code chunk below to add the statistics on the table.

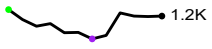
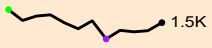
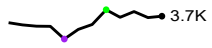
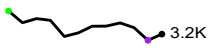
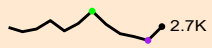
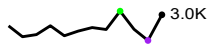
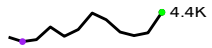
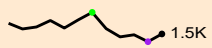
```
spark <- report %>%
  group_by(Product) %>%
  summarize('Monthly Sales' = list(Sales),
            .groups = "drop")
```

```
sales <- report %>%
  group_by(Product) %>%
  summarise("Min" = min(Sales, na.rm = T),
            "Max" = max(Sales, na.rm = T),
            "Average" = mean(Sales, na.rm = T)
            )
```

```
sales_data = left_join(sales, spark)
```

Plotting the updated data.table

```
sales_data %>%
  gt() %>%
  gt_plt_sparkline('Monthly Sales')
```

Product	Min	Max	Average	Monthly Sales
Amaretto	1016	1210	1119.000	
Caffe Latte	1398	1653	1528.333	
Caffe Mocha	3322	3828	3613.917	
Chamomile	2967	3395	3217.417	
Colombian	5132	5961	5457.250	
Darjeeling	2926	3281	3112.667	
Decaf Espresso	3181	3493	3326.833	
Decaf Irish Cream	2463	2901	2648.250	
Earl Grey	2730	3005	2841.833	
Green Tea	1339	1476	1398.750	
Lemon	3851	4418	4080.833	
Mint	1388	1669	1519.167	
Regular Espresso	890	1218	1023.417	

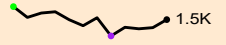
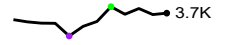
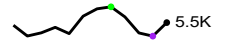
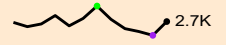
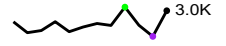
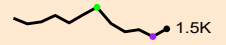
Combining bullet chart and sparklines

Similarly, we can combining the bullet chart and sparklines using the steps below.

```
bullet <- coffeechain %>%
  filter(Date >= "2013-01-01") %>%
  group_by(`Product`) %>%
  summarise(`Target` = sum(`Budget Sales`),
            `Actual` = sum(`Sales`)) %>%
  ungroup()
```

```
sales_data = sales_data %>%
  left_join(bullet)
```

```
sales_data %>%
  gt() %>%
  gt_plt_sparkline('Monthly Sales') %>%
  gt_plt_bullet(column = Actual,
                target = Target,
                width = 28,
                palette = c("lightblue",
                            "black")) %>%
  gt_theme_538()
```

PRODUCT	MIN	MAX	AVERAGE	MONTHLY SALES	ACTUAL
Amaretto	1016	1210	1119.000		
Caffe Latte	1398	1653	1528.333		
Caffe Mocha	3322	3828	3613.917		
Chamomile	2967	3395	3217.417		
Colombian	5132	5961	5457.250		
Darjeeling	2926	3281	3112.667		
Decaf Espresso	3181	3493	3326.833		
Decaf Irish Cream	2463	2901	2648.250		
Earl Grey	2730	3005	2841.833		
Green Tea	1339	1476	1398.750		
Lemon	3851	4418	4080.833		
Mint	1388	1669	1519.167		
Regular Espresso	890	1218	1023.417		

Interactive Information Dashboard Design: reactable and reactablefmtr methods

In this section, you will learn how to create interactive information dashboard by using reactable and reactablefmtr packages. Before getting started, it is highly recommended for you to visit the webpage of these two packages and review all the materials provided on the webpages at least once. You done not have to understand and remember everything provided but at least have an overview of the purposes and functions provided by them.

]

pull-right[In order to build an interactive sparklines, we need to install dataui R package by using the code chunk below.

```
remotes::install_github("timelyportfolio/dataui")
```

Next, you all need to load the package onto R environment by using the code chunk below.

```
library(dataui)
```

Plotting interactive sparklines

Similar to gtExtras, to plot an interactive sparklines by using reactablefmtr package we need to prepare the list field by using the code chunk below.

```
report <- report %>%
  group_by(Product) %>%
  summarize(`Monthly Sales` = list(Sales))
```

Next, react_sparkline will be to plot the sparklines as shown below.

```
reactable(
  report,
  columns = list(
    Product = colDef(maxWidth = 200),
    `Monthly Sales` = colDef(
      cell = react_sparkline(report)
    )
  )
)
```

Product	Monthly Sales
Amaretto	
Caffe Latte	
Caffe Mocha	
Chamomile	
Colombian	
Darjeeling	
Decaf Espresso	
Decaf Irish Cream	
Earl Grey	
Green Tea	

1–10 of 13 rows Previous **1** 2 Next

Changing the pagesize

By default the pagesize is 10. In the code chunk below, arguments defaultPageSize is used to change the default setting.

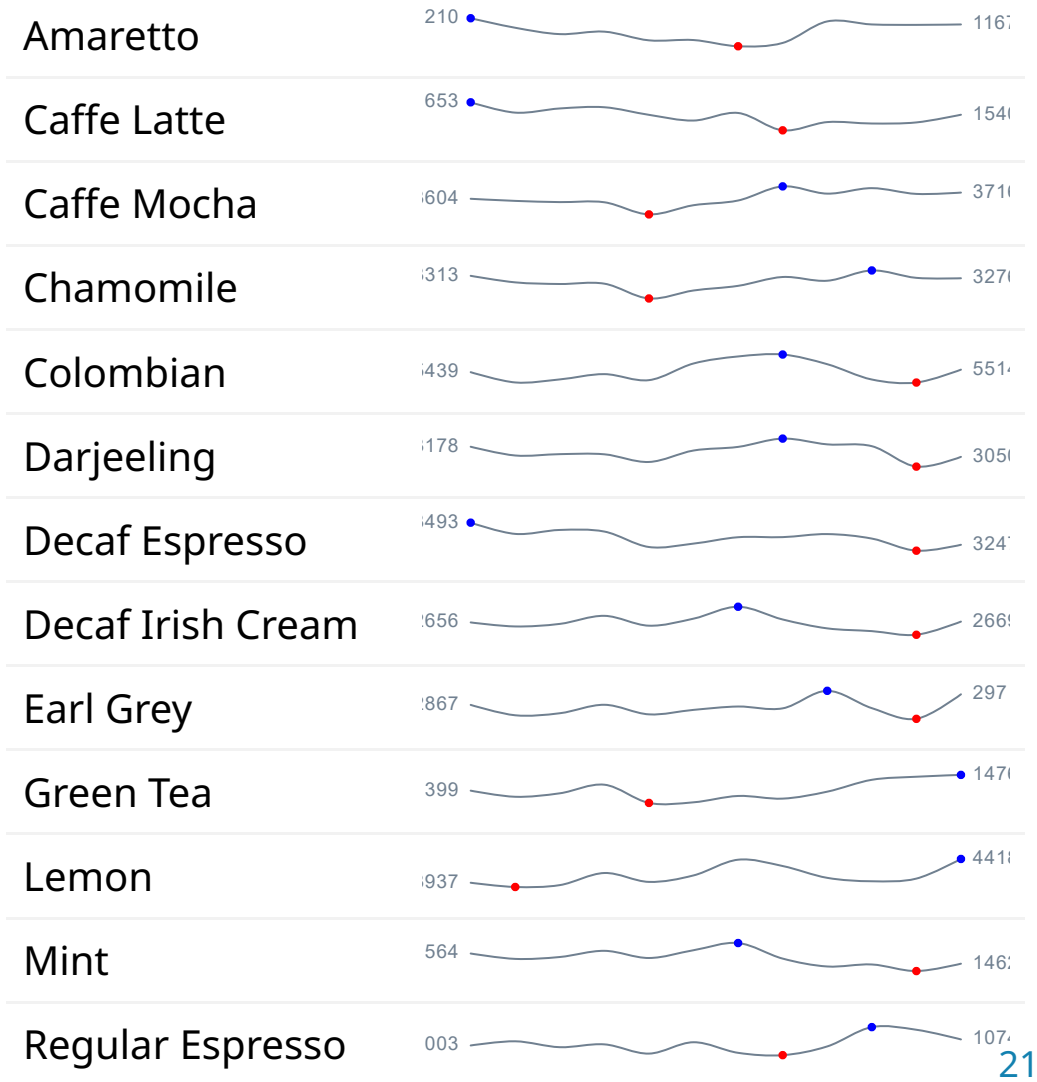
```
reactable(
  report,
  defaultPageSize = 13,
  columns = list(
    Product = colDef(maxWidth = 200),
    `Monthly Sales` = colDef(
      cell = react_sparkline(report)
    )
  )
)
```

Product	Monthly Sales
Amaretto	
Caffe Latte	
Caffe Mocha	
Chamomile	
Colombian	
Darjeeling	
Decaf Espresso	
Decaf Irish Cream	
Earl Grey	
Green Tea	
Lemon	
Mint	
Regular Espresso	

Adding pointa and labels

In the code chunk below `highlight_points` argument is used to show the minimum and maximum values points and `label` argument is used to label first and last values.

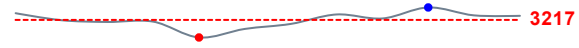
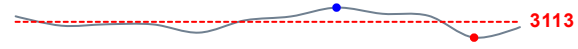
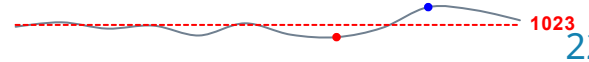
```
reactable(
  report,
  defaultPageSize = 13,
  columns = list(
    Product = colDef(maxWidth = 200),
    `Monthly Sales` = colDef(
      cell = react_sparkline(
        report,
        highlight_points = highlight_points(
          min = "red", max = "blue"),
        labels = c("first", "last")
        )
    )
  )
)
```



Adding reference line

In the code chunk below `statline` argument is used to show the mean line.

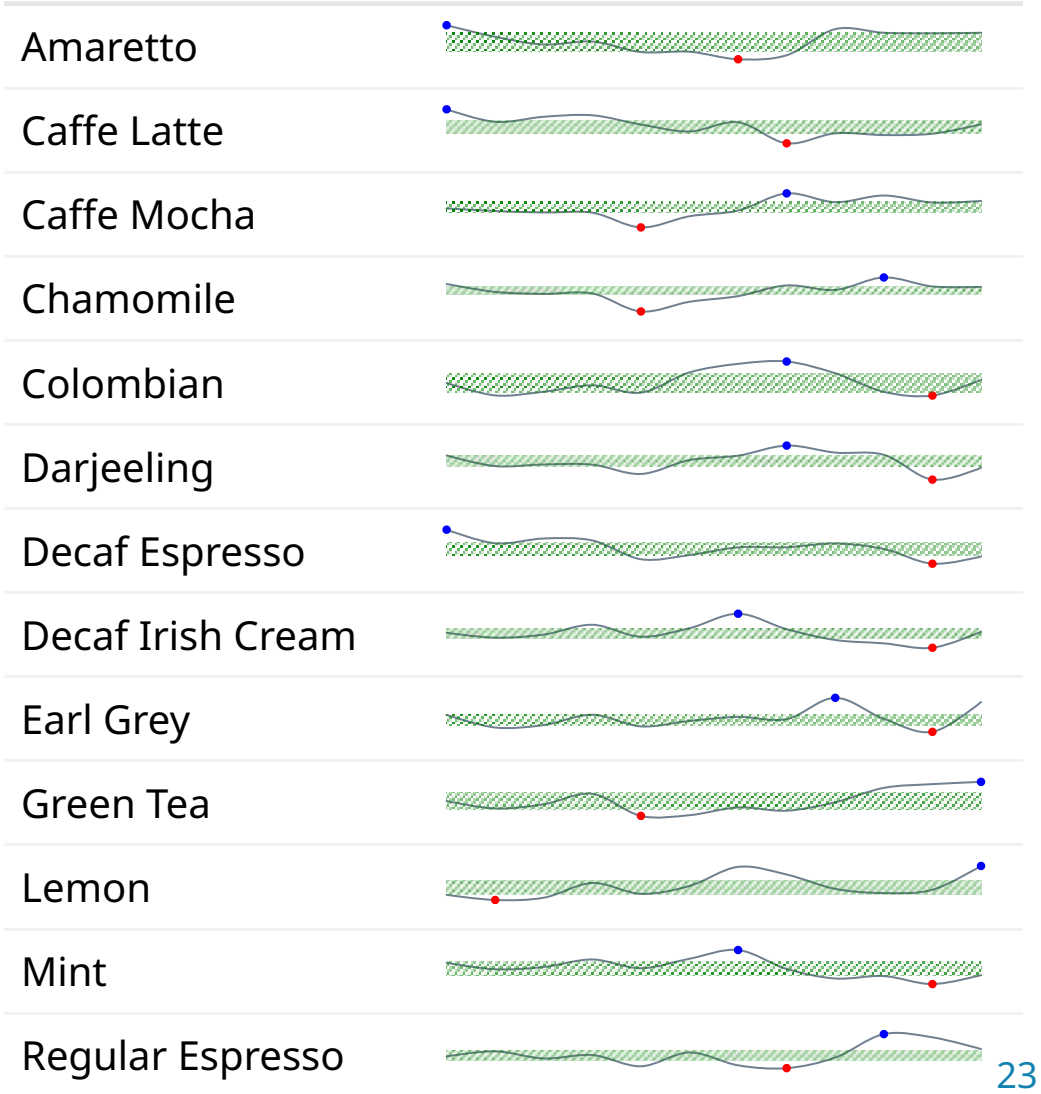
```
reactable(
  report,
  defaultPageSize = 13,
  columns = list(
    Product = colDef(maxWidth = 200),
    `Monthly Sales` = colDef(
      cell = react_sparkline(
        report,
        highlight_points = highlight_points(
          min = "red", max = "blue"),
        statline = "mean"
        )
    )
  )
)
```

Product	Monthly Sales
Amaretto	
Caffe Latte	
Caffe Mocha	
Chamomile	
Colombian	
Darjeeling	
Decaf Espresso	
Decaf Irish Cream	
Earl Grey	
Green Tea	
Lemon	
Mint	
Regular Espresso	

Adding bandline

Instead adding reference line, bandline can be added by using the `bandline` argument.

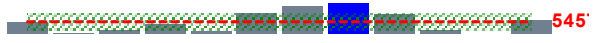
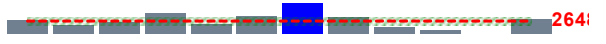
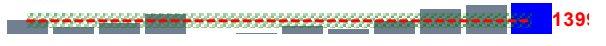
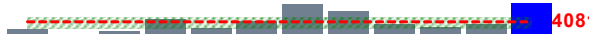
```
reactable(
  report,
  defaultPageSize = 13,
  columns = list(
    Product = colDef(maxWidth = 200),
    `Monthly Sales` = colDef(
      cell = react_sparkline(
        report,
        highlight_points = highlight_points(
          min = "red", max = "blue"),
        line_width = 1,
        bandline = "innerquartiles",
        bandline_color = "green"
        )
    )
  )
)
```



Changing from sparkline to sparkbar

Instead of displaying the values as sparklines, we can display them as sparkbars as shiwn below.

```
reactable(
  report,
  defaultPageSize = 13,
  columns = list(
    Product = colDef(maxWidth = 200),
    `Monthly Sales` = colDef(
      cell = react_sparkbar(
        report,
        highlight_bars = highlight_bars(
          min = "red", max = "blue"),
        bandline = "innerquartiles",
        statline = "mean")
    )
  )
)
```

Product	Monthly Sales
Amaretto	
Caffe Latte	
Caffe Mocha	
Chamomile	
Colombian	
Darjeeling	
Decaf Espresso	
Decaf Irish Cream	
Earl Grey	
Green Tea	
Lemon	
Mint	
Regular Espresso