hw1

Areg Amirjanyan

2024-02-28

From the list of the best inventions of 2023 I have chosen Apple Vision Pro. For a lookalike innovation I have selected previously made AR glasses without a specified brand. I found the dataset in statista.com and it features the number of AR glasses sold worldwide from 2017-2027 (Later in my R code i have removed the the years after 2024, as the dataset also contained predictions for the future). I selected this dataset because it contains information about the sales of products which are very similar to Vision pro. WIth the help of this data, the following code will try to make predictions of the diffusuion of innovation.

Reading the data

```
file_path <- "revenue.xlsx"
revenue_data <- read_excel(file_path, sheet = 2)
```

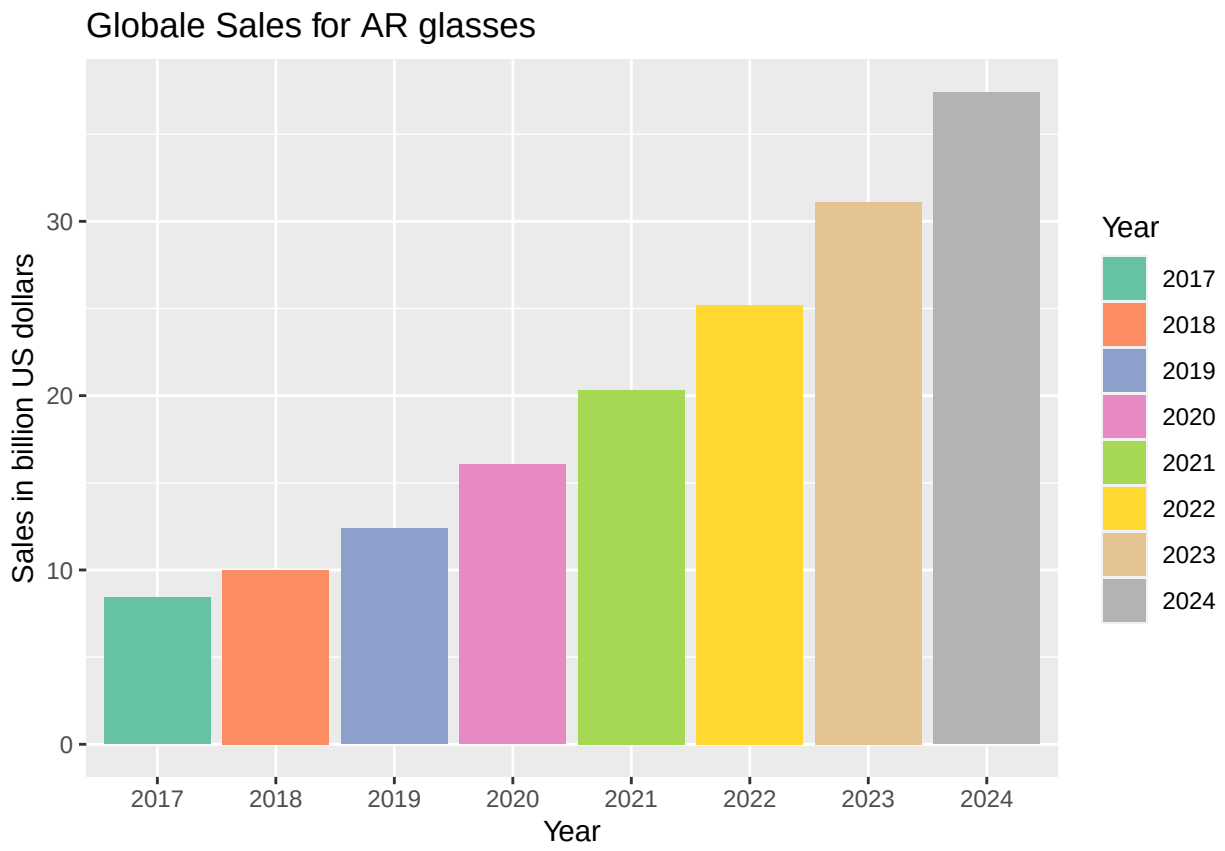
Making adjustments on the data

```
df <- revenue_data[3:10,]

colnames(df) <- c("year", "revenue")
colnames(df)
```

```
## [1] "year"    "revenue"
```

Visualization of sales

```
sales_graph <- ggplot(data = df, aes(x = year, y = revenue, fill = factor(year))) +
  labs(x='Year', y = "Sales in billion US dollars", fill = 'Year') +
  geom_bar(stat = 'identity') +
  ggtitle('Globale Sales for AR glasses') +
  scale_fill_brewer(palette = 'Set2')

sales_graph
```



Bass Model parameters

```
bass.f <- function(t,p,q){
  ((p+q)^2/p)*exp(-(p+q)*t)/
    (1+(q/p)*exp(-(p+q)*t))^2
}

bass.F <- function(t,p,q){
  (1-exp(-(p+q)*t))/
    (1+(q/p)*exp(-(p+q)*t))
}
```

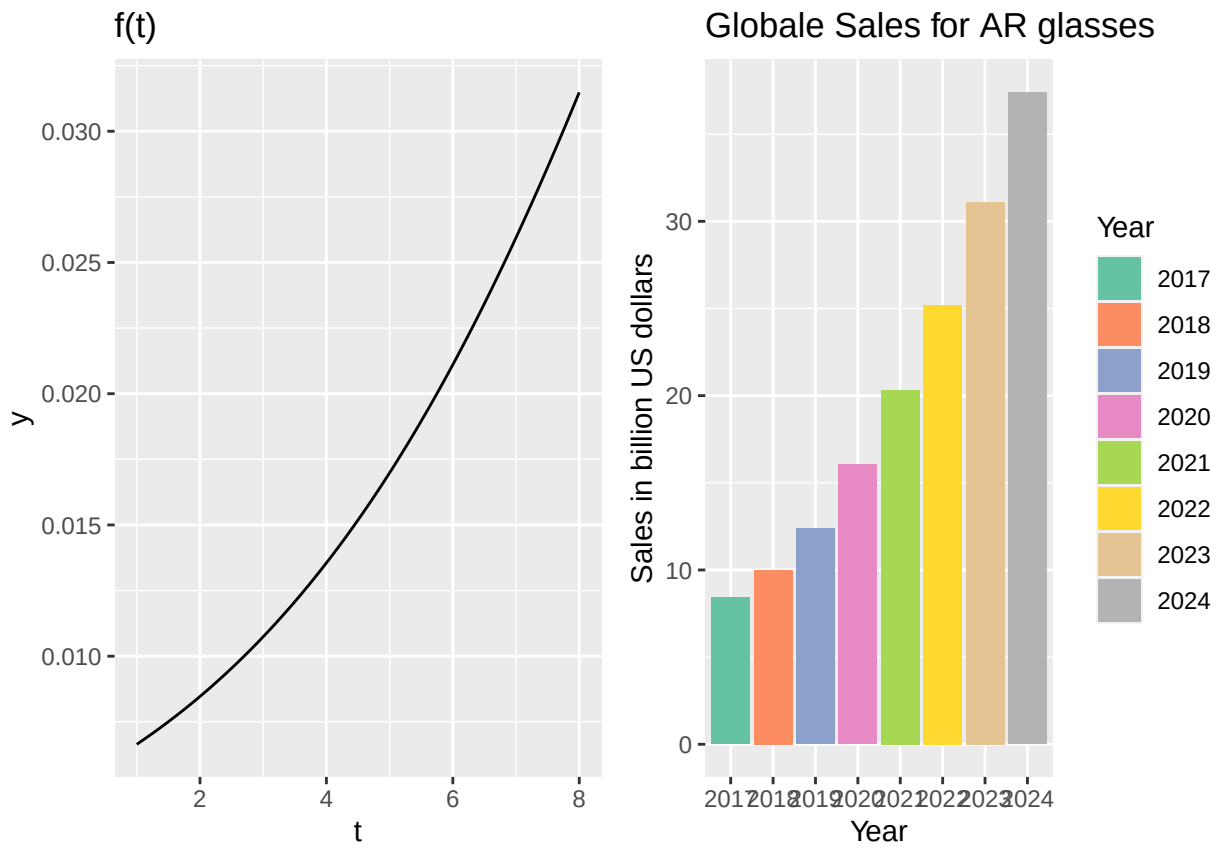
Estimating Bass model parameters for the look-alike innovation.

```
sales <- df$revenue
t <- 1:length(sales)
bass_m = nls(sales ~ m*(((p+q)^2/p)*exp(-(p+q)*t))/
               (1+(q/p)*exp(-(p+q)*t))^2,
             start=c(list(m=sum(sales),p=0.02,q=0.4)))

summary(bass_m)
```

```
##
## Formula: sales ~ m * (((p + q)^2/p) * exp(-(p + q) * t))/(1 + (q/p) *
##     exp(-(p + q) * t))^2
##
## Parameters:
##    Estimate Std. Error t value Pr(>|t|)
## m 1.192e+03  3.292e+02   3.621   0.0152 *
## p 5.196e-03  1.289e-03   4.030   0.0100 *
## q 2.523e-01  1.167e-02  21.619 3.93e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3259 on 5 degrees of freedom
##
## Number of iterations to convergence: 8
## Achieved convergence tolerance: 2.582e-06
```

```r
m <- coef(bass_m)["m"]
p <- coef(bass_m)["p"]
q <- coef(bass_m)["q"]
```

```r
time_ad = ggplot(data.frame(t = c(1:8)), aes(t)) +
  stat_function(fun = bass.f, args = c(p=0.005196044, q=0.252349)) +
  labs(title = 'f(t)')

ggarrange(time_ad, sales_graph)
```



Estimated number of adopters by period

```
df$pred_sales = bass.f(1:8, p = 0.005196044, q = 0.252349)*1191.799

ggplot(data = df, aes(x = year, y = revenue)) +
  geom_bar(stat = 'identity') +
  geom_point(mapping = aes(x=year, y=pred_sales), color = 'red') +
  labs(x = "year", y="sales", title = "Estimated num of adopters by period")
```