Group_descrip_lin2.R

daitu

Wed Jun 22 09:55:38 2016

```
## 2016年暑期课程设计
## 问题：Grupo Bimbo Inventory Demand
##  宾堡集团的库存需求
## 最大限度地提高销售和最大限度地减少烘焙食品的退回
## Daitu
## start:2016.06.21
## 参考借鉴kaggle上的公开程序


setwd("/Users/Daitu/数据分析/kaggle/Grupo Bimbo")
getwd()
```

```
## [1] "/Users/daitu/数据分析/kaggle/Grupo Bimbo"
```

```
## 加载包

library(data.table)
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.2.4
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:data.table':
##
##     between, last
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(treemap)
```

```
## Warning: package 'treemap' was built under R version 3.2.4
```

```
## 读取数据####
## 1:读取训练集
system.time({
  traindata <- fread("train.csv",sep=",",header = TRUE)
})
```

```
##
Read 0.0% of 74180464 rows
Read 4.2% of 74180464 rows
Read 8.4% of 74180464 rows
Read 12.6% of 74180464 rows
Read 16.9% of 74180464 rows
Read 21.2% of 74180464 rows
Read 25.4% of 74180464 rows
Read 29.7% of 74180464 rows
Read 33.9% of 74180464 rows
Read 38.1% of 74180464 rows
Read 42.3% of 74180464 rows
Read 46.4% of 74180464 rows
Read 50.5% of 74180464 rows
Read 54.6% of 74180464 rows
Read 58.8% of 74180464 rows
Read 63.0% of 74180464 rows
Read 67.3% of 74180464 rows
Read 71.5% of 74180464 rows
Read 75.7% of 74180464 rows
Read 79.8% of 74180464 rows
Read 84.0% of 74180464 rows
Read 88.2% of 74180464 rows
Read 92.5% of 74180464 rows
Read 96.7% of 74180464 rows
Read 74180464 rows and 11 (of 11) columns from 2.980 GB file in 00:00:31
```

```
##    user  system elapsed
##  27.424   2.848  33.182
```

```
head(traindata)
```

```
##    Semana Agencia_ID Canal_ID Ruta_SAK Cliente_ID Producto_ID
## 1:      3       1110        7     3301      15766        1212
## 2:      3       1110        7     3301      15766        1216
## 3:      3       1110        7     3301      15766        1238
## 4:      3       1110        7     3301      15766        1240
## 5:      3       1110        7     3301      15766        1242
## 6:      3       1110        7     3301      15766        1250
##    Venta_uni_hoy Venta_hoy Dev_uni_proxima Dev_proxima Demanda_uni_equil
## 1:             3     25.14               0           0                 3
## 2:             4     33.52               0           0                 4
## 3:             4     39.32               0           0                 4
## 4:             4     33.52               0           0                 4
## 5:             3     22.92               0           0                 3
## 6:             5     38.20               0           0                 5
```

```
## 2:读取客户名单数据
cliente_tabla <- fread("cliente_tabla.csv",sep=",",header = TRUE)
head(cliente_tabla)
```

```
##    Cliente_ID                            NombreCliente
## 1:          0                               SIN NOMBRE
## 2:          1                          OXXO XINANTECATL
## 3:          2                               SIN NOMBRE
## 4:          3                                EL MORENO
## 5:          4 SDN SER  DE ALIM  CUERPO SA CIA  DE INT
## 6:          4    SDN SER DE ALIM CUERPO SA CIA DE INT
```

```
## 3:读取产品名单数据
producto_tabla <- fread("producto_tabla.csv",sep=",",header = TRUE)
head(producto_tabla)
```

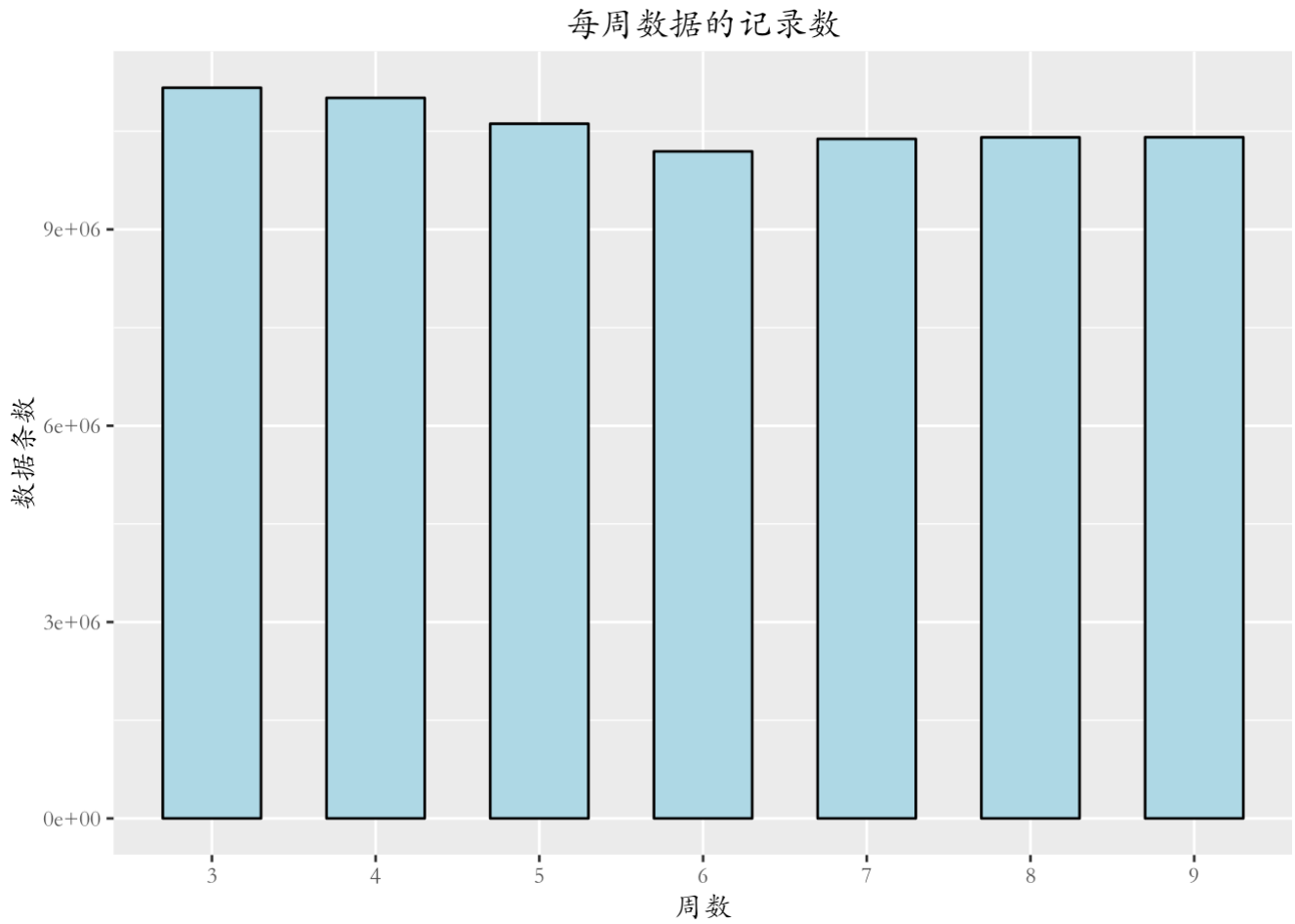
```
##    Producto_ID                          NombreProducto
## 1:           0                     NO IDENTIFICADO 0
## 2:           9              Capuccino Moka 750g NES 9
## 3:          41 Bimbollos Ext sAjonjoli 6p 480g BIM 41
## 4:          53         Burritos Sincro 170g CU LON 53
## 5:          72    Div Tira Mini Doradita 4p 45g TR 72
## 6:          73      Pan Multigrano Linaza 540g BIM 73
```

```
## 4:读取城镇和国家（州）数据
town_state <- fread("town_state.csv",sep=",",header = TRUE)
head(town_state)
```

```
##    Agencia_ID                  Town            State
## 1:       1110    2008 AG. LAGO FILT     MÉXICO, D.F.
## 2:       1111 2002 AG. AZCAPOTZALCO     MÉXICO, D.F.
## 3:       1112   2004 AG. CUAUTITLAN ESTADO DE MÉXICO
## 4:       1113    2008 AG. LAGO FILT     MÉXICO, D.F.
## 5:       1114  2029 AG.IZTAPALAPA 2     MÉXICO, D.F.
## 6:       1116  2011 AG. SAN ANTONIO     MÉXICO, D.F.
```

```
## 数据的描述统计####
```

```
## 1:分析数据的周数：Semana
Semana <- data.frame(table(traindata$Semana))
colnames(Semana) <- c("Semana","Freq")
# 3        4        5        6        7        8        9
# 11165207 11009593 10615397 10191837 10382849 10406868 10408713
## 条形图
ggplot(data = Semana,aes(Semana,Freq)) +
  geom_bar(stat = "identity", width = 0.6,fill = "lightblue",colour = "black") +
  theme_grey(base_family = "STKaiti") +
  scale_y_continuous() +
  labs(x="周数",y="数据条数",title = "每周数据的记录数")
```

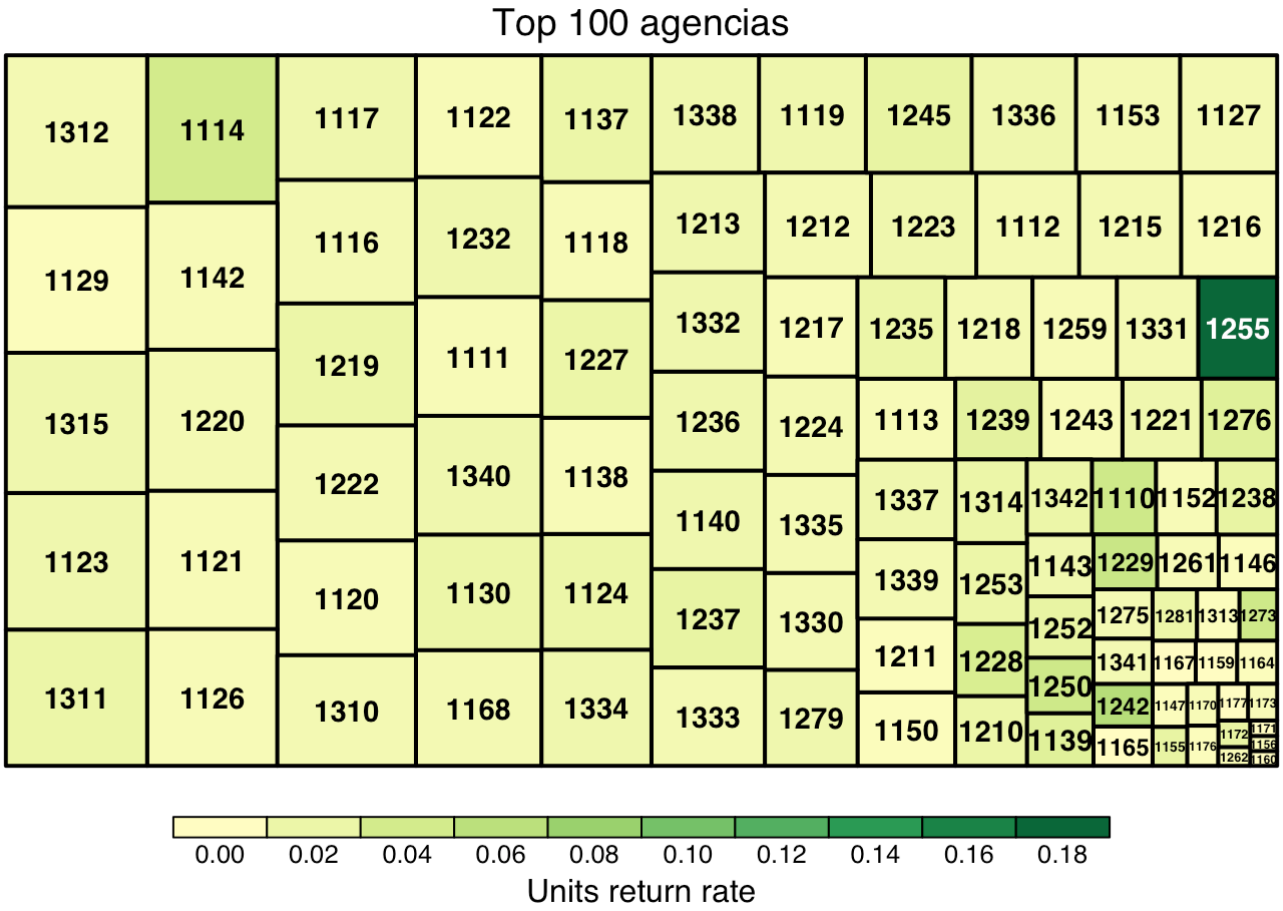



```
## 销售站的数据分析#####
## 2 ：销售站Agencia 和 州State
agencias <- traindata %>%
  group_by(Agencia_ID) %>%          # 数据按照销售战进行分组统计
  summarise(Units = sum(Venta_uni_hoy), # 总结多个值为一个值，units：本销售站的销量和
            Pesos = sum(Venta_hoy),  # 本周的销售量（比索）之和
            Return_Units = sum(Dev_uni_proxima),  # 下星期的返回量之和
            Return_Pesos = sum(Dev_proxima),  # 下星期的返回量（比索）之和
            Net = sum(Demanda_uni_equil)) %>%    # 调整后的需求和
  mutate(Net_Pesos = Pesos - Return_Pesos,  # mutate:添加新的变量
         Return_Rate = Return_Units / (Units+Return_Units)) %>%  # 添加变量退货比率
  arrange(desc(Units)) %>%      # 将数据按照变量Units的降序排列
  inner_join(town_state, by="Agencia_ID")   # 按照变量Agencia_ID，连接两个表，return all
 rows from x
head(agencias)
```

```
##   Agencia_ID   Units    Pesos Return_Units Return_Pesos     Net Net_Pesos
## 1       1110  877675  9274674        39900     214072.8  874523   9060601
## 2       1111 2720400 24070592        25231     264672.4 2701427  23805919
## 3       1112 1959534 16591688        23924     231897.4 1942114  16359791
## 4       1113 1442999 12094484        11865     117754.4 1434414  11976730
## 5       1114 3498170 62420320       150779    2480404.7 3363796  59939915
## 6       1116 3120201 27454358        37022     377100.6 3093985  27077257
##   Return_Rate                  Town            State
## 1 0.043484184    2008 AG. LAGO FILT     MÉXICO, D.F.
## 2 0.009189509 2002 AG. AZCAPOTZALCO     MÉXICO, D.F.
## 3 0.012061763   2004 AG. CUAUTITLAN ESTADO DE MÉXICO
## 4 0.008155401    2008 AG. LAGO FILT     MÉXICO, D.F.
## 5 0.041321213  2029 AG.IZTAPALAPA 2     MÉXICO, D.F.
## 6 0.011726128  2011 AG. SAN ANTONIO     MÉXICO, D.F.
```

```
## 可视化x：每天销量，y：销售站的数量
ggplot(agencias, aes(x=Units/7))+
  geom_histogram(fill="red", color="gray", binwidth=10000)+ #条形图的宽度为10000
  theme_bw(base_family = "STKaiti") +
  scale_x_continuous(labels=function(x)paste(x/1000, "k"))+
  labs(x = "每天的平均销量",y = "销售站数量",title = "销售站的销量")
```

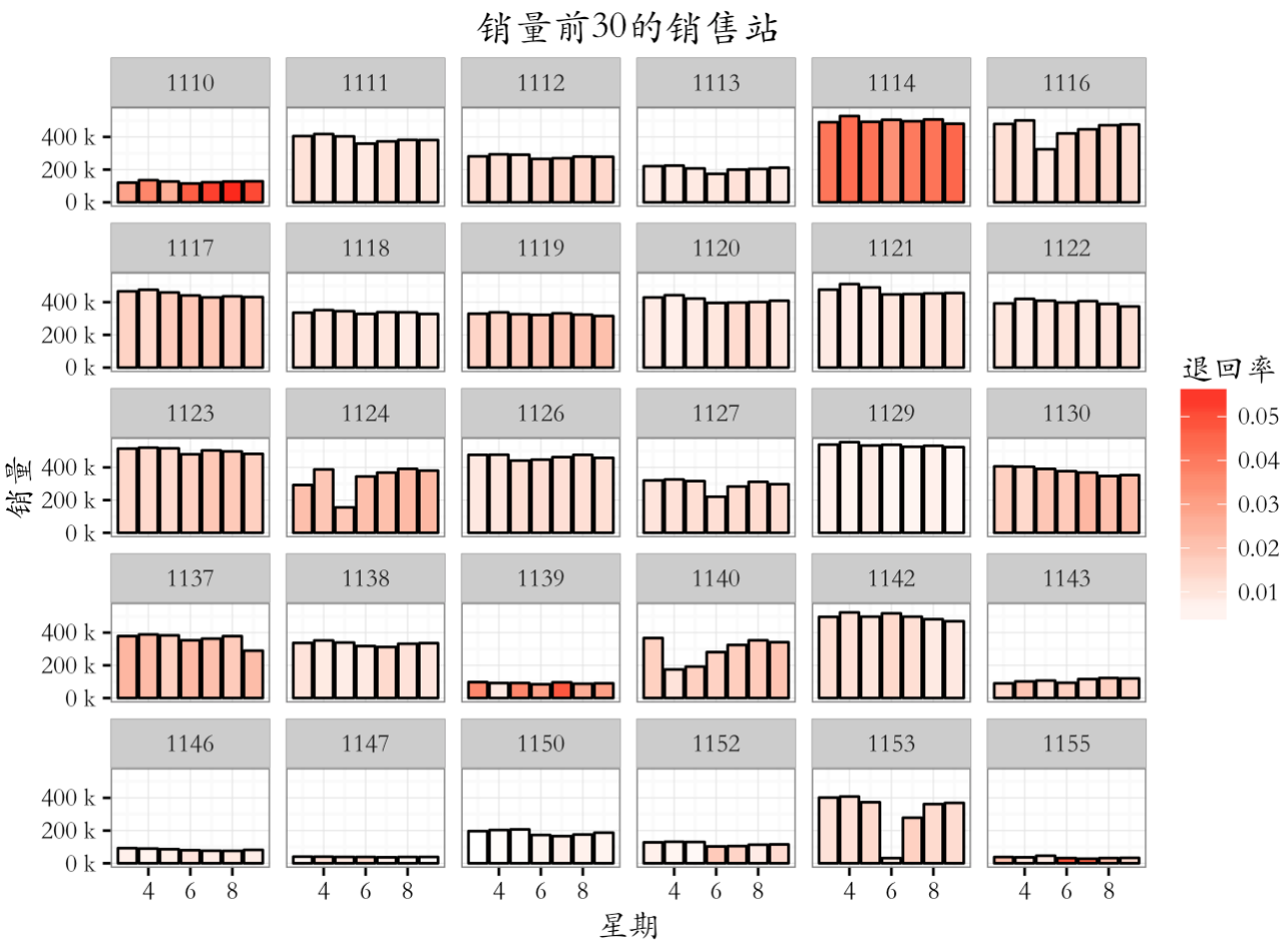

```
## 前100的销售站的销量树图
treemap(agencias[1:100, ],
        index=c("Agencia_ID"), vSize="Units", vColor="Return_Rate",
        type="value", title.legend="Units return rate", title="Top 100 agencias")
```




```
## 销售站的历史数据分析
agencias_history <- traindata %>%
  group_by(Agencia_ID, Semana) %>%  # 数据按照销售站、星期数，进行分组统计
  summarise(Units = sum(Venta_uni_hoy),  # 总结多个值为一个值，units：销量和
            Pesos = sum(Venta_hoy),
            Return_Units = sum(Dev_uni_proxima),
            Return_Pesos = sum(Dev_proxima),
            Net = sum(Demanda_uni_equil)) %>%
  mutate(Net_Pesos = Pesos - Return_Pesos,
         Avg_Pesos = Pesos / Units,
         Return_Rate = Return_Units / (Units+Return_Units)) %>%
  arrange(Agencia_ID, Semana) %>% # 将数据按照变量 销售站、星期数的降序排列
  inner_join(town_state, by="Agencia_ID")
head(agencias_history)
```

```
##   Agencia_ID Semana  Units   Pesos Return_Units Return_Pesos    Net
## 1       1110      3 120285 1296739          3577     29712.03 119951
## 2       1110      4 135788 1385112          5260     29932.82 135327
## 3       1110      5 127420 1345680          3342     26249.25 127077
## 4       1110      6 115255 1239051          5721     26595.87 114865
## 5       1110      7 122955 1297072          6950     34845.26 122513
## 6       1110      8 127277 1345696          8030     35157.98 126735
##   Net_Pesos Avg_Pesos Return_Rate                Town        State
## 1   1267027  10.78055  0.02887891 2008 AG. LAGO FILT MÉXICO, D.F.
## 2   1355179  10.20055  0.03729227 2008 AG. LAGO FILT MÉXICO, D.F.
## 3   1319431  10.56098  0.02555788 2008 AG. LAGO FILT MÉXICO, D.F.
## 4   1212456  10.75052  0.04729037 2008 AG. LAGO FILT MÉXICO, D.F.
## 5   1262227  10.54916  0.05350064 2008 AG. LAGO FILT MÉXICO, D.F.
## 6   1310538  10.57297  0.05934652 2008 AG. LAGO FILT MÉXICO, D.F.
```

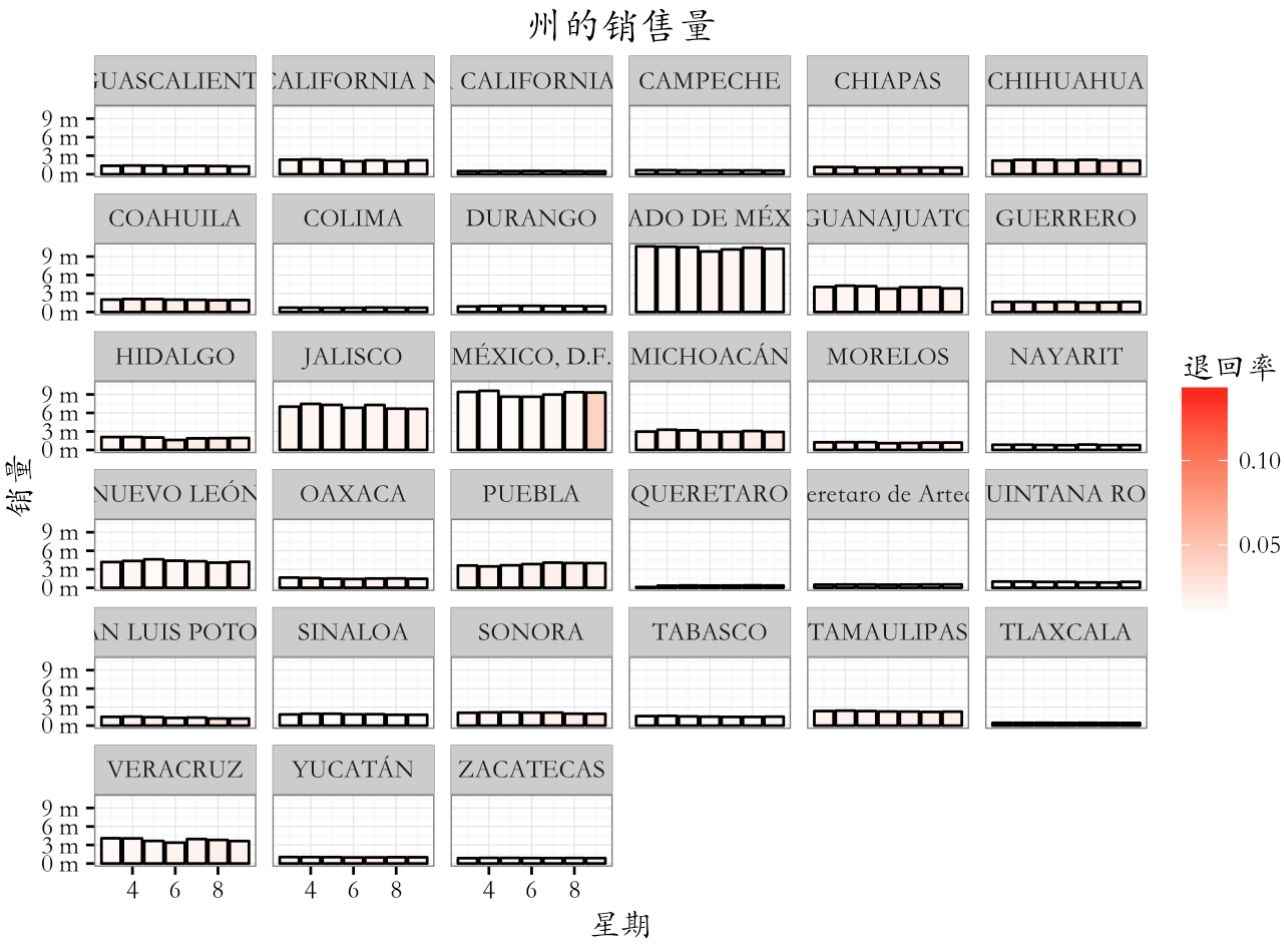
```
## 取出销售量前30的销售站ID
top30agencias <- agencias$Agencia_ID[1:30]

## 销量前30的销售站每周的销量和退货率图
ggplot(agencias_history %>% filter(Agencia_ID %in% top30agencias))+
  geom_bar(aes(x=Semana, y=Units, fill=Return_Rate), stat="identity", color="black")+
  theme_bw(base_family = "STKaiti") +
  facet_wrap(~Agencia_ID)+   # 按照销售站划分成子图
  scale_y_continuous(labels=function(x)paste(x/1000, "k"))+
  scale_fill_gradient(name="退回率", low="white", high="red")+
  ggtitle("销量前30的销售站") + ylab("销量") +xlab("星期")
```



```
## 每个州的销售数据的分析
states <- agencias_history %>%
  group_by(State, Semana) %>%     #数据按照州和星期分组
  summarise(Units = sum(Units),
            Pesos = sum(Pesos),
            Return_Units = sum(Return_Units),
            Return_Pesos = sum(Return_Pesos),
            Net = sum(Net)) %>%
  mutate(Avg_Pesos = Pesos / Units,
         Return_Rate = Return_Units / (Units+Return_Units)) %>%
  arrange(desc(Units))   # 数据按照销量排列
head(states)
```

```
##              State Semana    Units     Pesos Return_Units Return_Pesos
## 1 ESTADO DE MÉXICO      3 10653345 103437148       154026      1510612
## 2 ESTADO DE MÉXICO      4 10584696 100758414       148409      1484139
## 3 ESTADO DE MÉXICO      5 10523973  99693511       144172      1449122
## 4 ESTADO DE MÉXICO      8 10422406  98640885       168741      1600855
## 5 ESTADO DE MÉXICO      9 10252045  98114659       160559      1523816
## 6 ESTADO DE MÉXICO      7 10156108  96457302       175260      1698870
##        Net Avg_Pesos Return_Rate
## 1 10552261  9.709359  0.01425194
## 2 10489671  9.519254  0.01382722
## 3 10424028  9.472992  0.01351425
## 4 10310433  9.464310  0.01593227
## 5 10144764  9.570252  0.01541968
## 6 10040746  9.497467  0.01696387
```

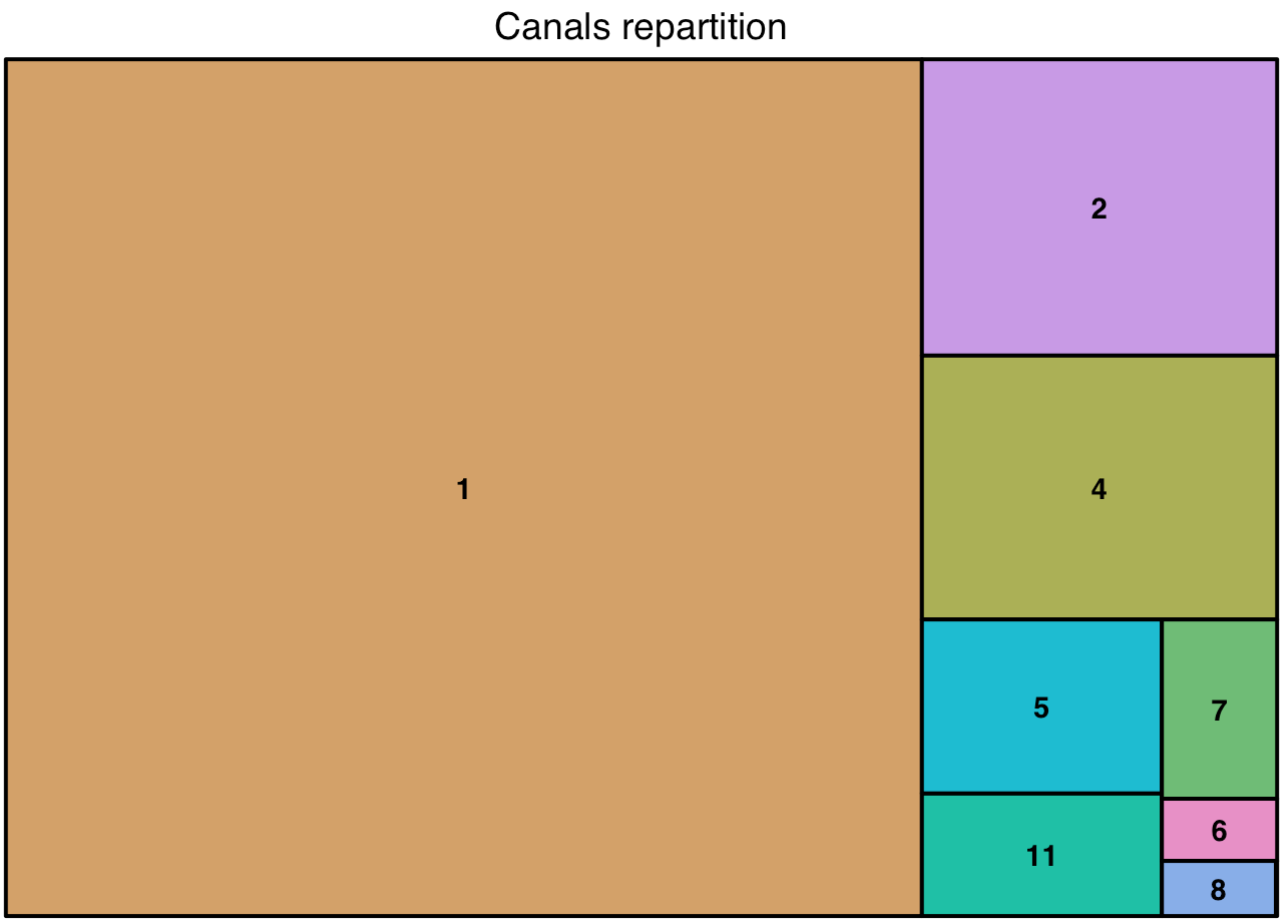
```
## 地点--星期 --退回百分比 图像可视化
ggplot(states)+
  geom_bar(aes(x=Semana, y=Units, fill=Return_Rate), stat="identity", color="black")+
  theme_bw(base_family = "STKaiti") +
  facet_wrap(~State)+
  scale_y_continuous(labels=function(x)paste(x/1e6, "m"))+
  scale_fill_gradient(name="退回率", low="white", high="red")+
  ggtitle("州的销售量")+ ylab("销量") +xlab("星期")
```



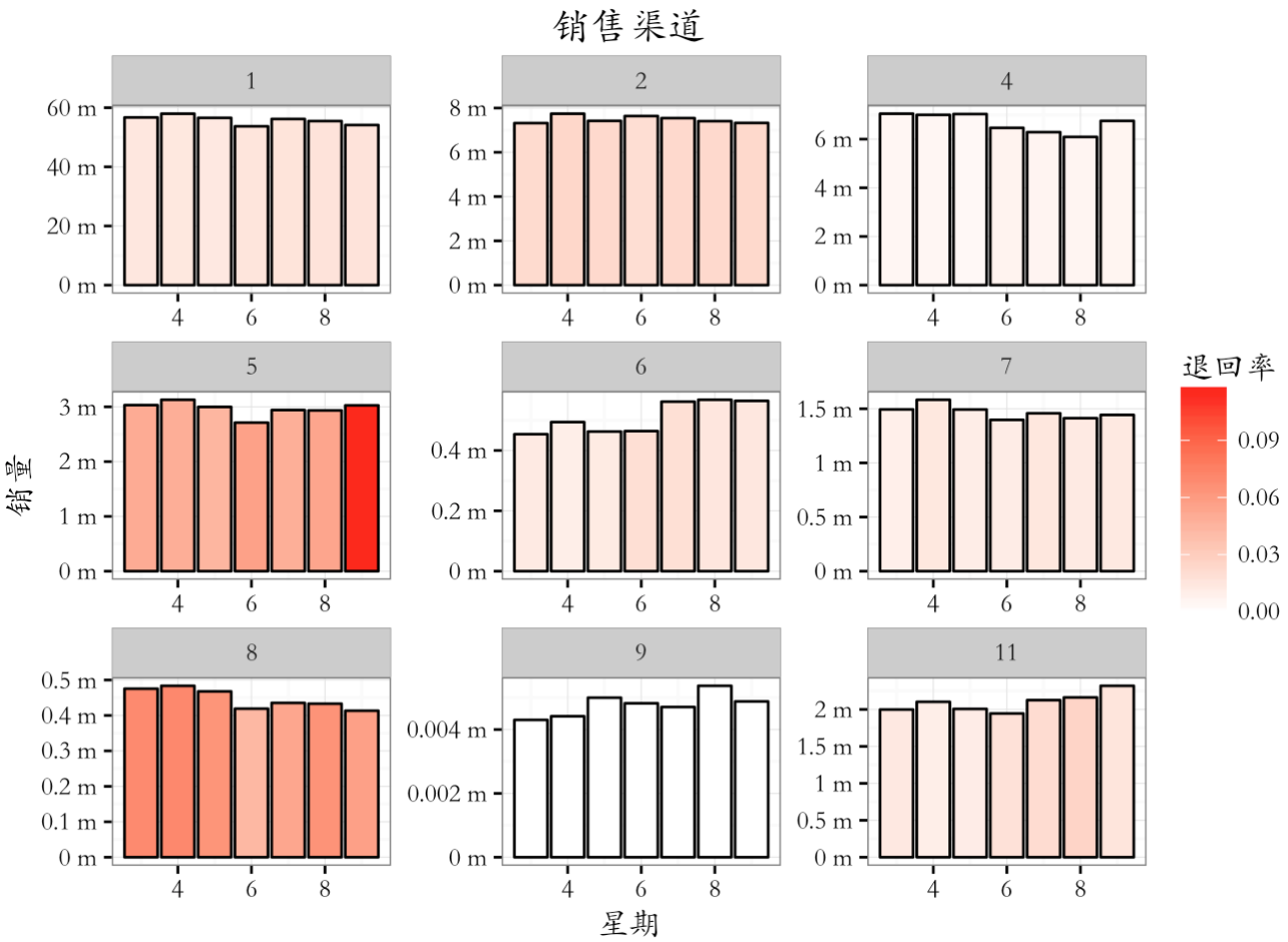

```
## 销售渠道的分析####

canals <- traindata %>%
  group_by(Canal_ID, Semana) %>%  #根据销售渠道和星期进行分组
  summarise(Units = sum(Venta_uni_hoy),
            Pesos = sum(Venta_hoy),
            Return_Units = sum(Dev_uni_proxima),
            Return_Pesos = sum(Dev_proxima),
            Net = sum(Demanda_uni_equil)) %>%
  mutate(Net_Pesos = Pesos - Return_Pesos,
         Avg_Pesos = Pesos / Units,
         Return_Rate = Return_Units / (Units+Return_Units)) %>%
  arrange(desc(Units))
head(canals)
```

```
##   Canal_ID Semana    Units     Pesos Return_Units Return_Pesos      Net
## 1        1      4 57970962 469960421       839777      7536925 57415516
## 2        1      3 56697977 472277894       835051      7612406 56154862
## 3        1      5 56565253 450590664       798399      7198662 56026267
## 4        1      7 56188416 444780203       942701      8242810 55557236
## 5        1      8 55482753 441614833       957245      8294457 54845666
## 6        1      9 54142315 437679187       932279      7972306 53522411
##   Net_Pesos Avg_Pesos Return_Rate
## 1 462423496  8.106825  0.01427931
## 2 464665489  8.329713  0.01451429
## 3 443392001  7.965856  0.01391820
## 4 436537393  7.915870  0.01650066
## 5 433320376  7.959497  0.01696040
## 6 429706881  8.083865  0.01692757
```

```
# 销售渠道1占据主要的销量
treemap(canals, index=c("Canal_ID"), vSize="Units", type="index",
        title="Canals repartition")
```



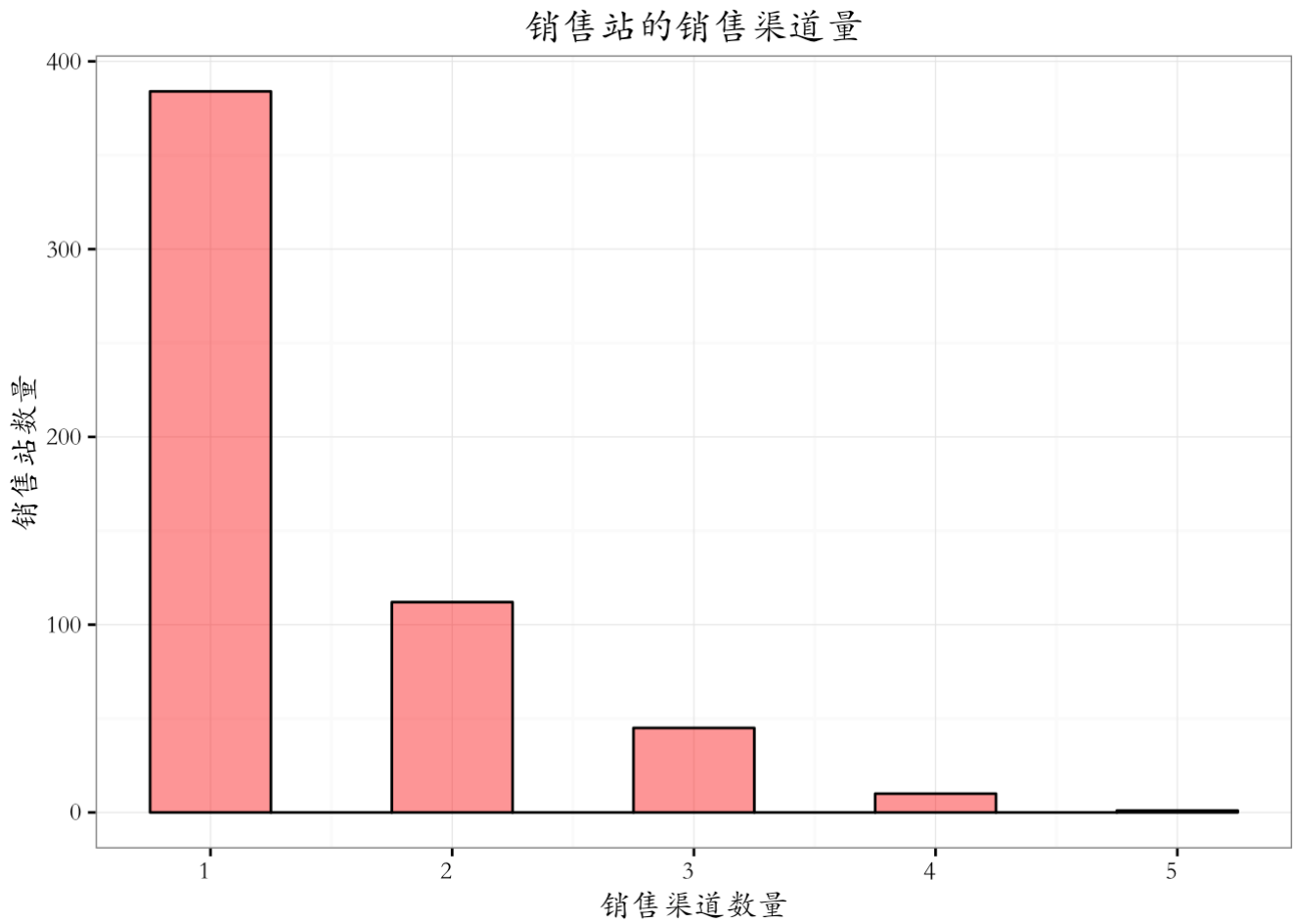

```
## 销售渠道的销量和星期和退货率
ggplot(canals)+
  geom_bar(aes(x=Semana, y=Units, fill=Return_Rate), stat="identity", color="black")+
  theme_bw(base_family = "STKaiti") +
  facet_wrap(~Canal_ID, scale="free")+
  scale_y_continuous(labels=function(x)paste(x/1e6, "m"))+
  scale_fill_gradient(name="退回率", low="white", high="red")+
  ggtitle("销售渠道")+ ylab("销量") +xlab("星期")
```




```
## 销售渠道和销售站分析####
agencias_canals <- traindata %>%
  group_by(Agencia_ID) %>%
  summarise(n_canals = n_distinct(Canal_ID)) #添加该销售渠道有多少销售站
head(agencias)
```

```
##   Agencia_ID   Units    Pesos Return_Units Return_Pesos     Net Net_Pesos
## 1       1110  877675  9274674        39900     214072.8  874523   9060601
## 2       1111 2720400 24070592        25231     264672.4 2701427  23805919
## 3       1112 1959534 16591688        23924     231897.4 1942114  16359791
## 4       1113 1442999 12094484        11865     117754.4 1434414  11976730
## 5       1114 3498170 62420320       150779    2480404.7 3363796  59939915
## 6       1116 3120201 27454358        37022     377100.6 3093985  27077257
##   Return_Rate                  Town            State
## 1 0.043484184    2008 AG. LAGO FILT     MÉXICO, D.F.
## 2 0.009189509 2002 AG. AZCAPOTZALCO     MÉXICO, D.F.
## 3 0.012061763   2004 AG. CUAUTITLAN ESTADO DE MÉXICO
## 4 0.008155401    2008 AG. LAGO FILT     MÉXICO, D.F.
## 5 0.041321213  2029 AG.IZTAPALAPA 2     MÉXICO, D.F.
## 6 0.011726128  2011 AG. SAN ANTONIO     MÉXICO, D.F.
```

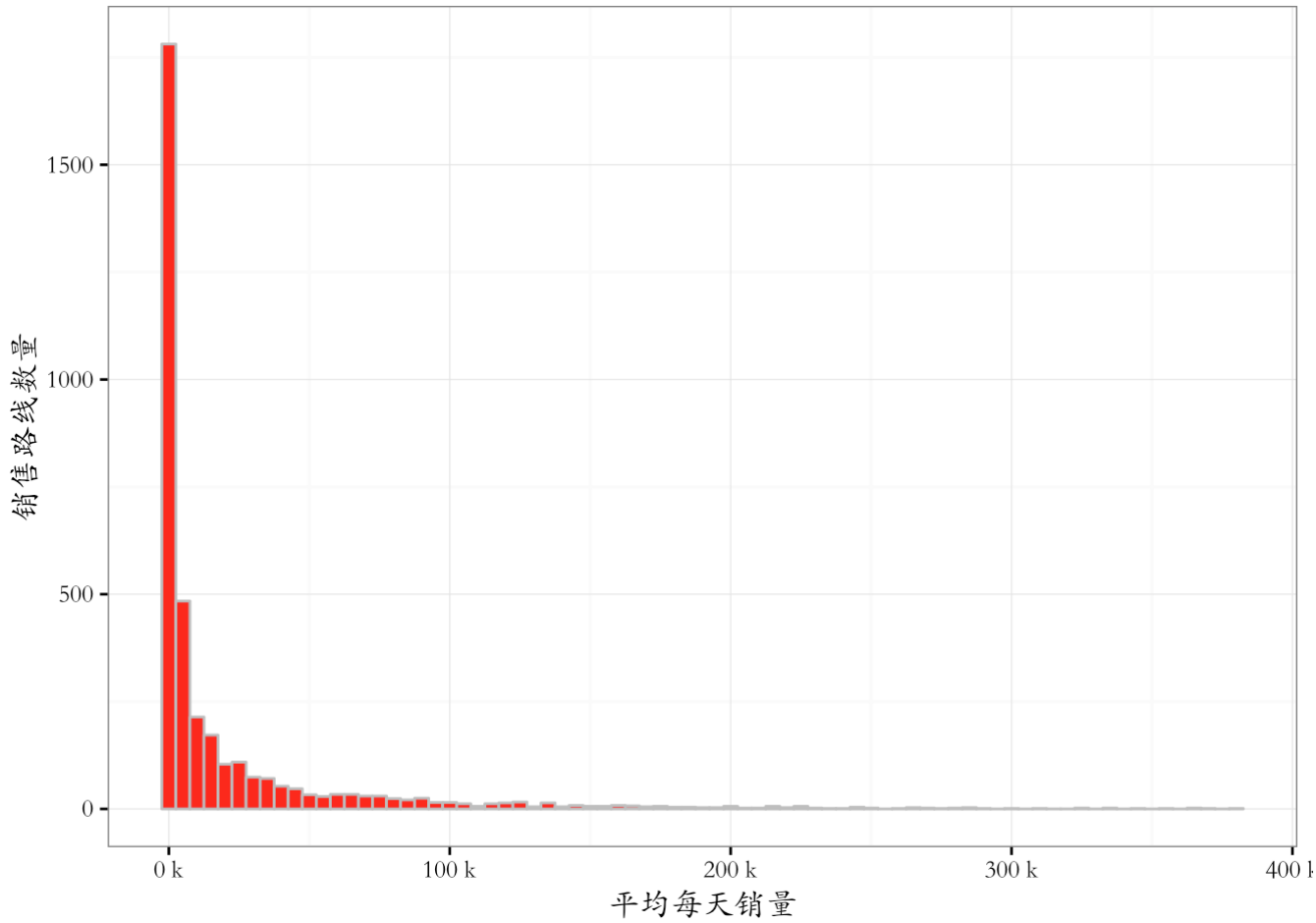
```
## 销售渠道有多少销售站可视化
ggplot(agencias_canals)+
  geom_histogram(aes(x=n_canals), fill="red", color="black", alpha="0.5", binwidth=0.
5)+
  theme_bw(base_family = "STKaiti") +
  scale_x_continuous(breaks=1:5)+
  scale_y_continuous()+
  theme(axis.text.x=element_text(hjust=1)) +
  labs(x = "销售渠道数量",y = "销售站数量",title = "销售站的销售渠道量")
```




```
# 大部分销售站有1条销售渠道，只有很少的销售站有超过三条的销售渠道

## 销售路线的分析####
routes <- traindata %>% group_by(Ruta_SAK) %>%
  summarise(n_Agencias = n_distinct(Agencia_ID), #销售路线有多少销售站
            n_Clients = n_distinct(Cliente_ID), #销售路线有多少客户
            Units=sum(Venta_uni_hoy),  #销售路线的销售量
            Return_Units = sum(Dev_uni_proxima)) %>%  #销售路线的销售量退货量
  mutate(Return_Rate = Return_Units / (Units+Return_Units)) %>% # 添加退货率变量
  arrange(desc(Units))   # 按照销量排序
head(routes)
```

```
##   Ruta_SAK n_Agencias n_Clients   Units Return_Units Return_Rate
## 1     1101         82      5404 2645921        30981 0.011573453
## 2     6601         80      1104 2577239        10601 0.004096467
## 3     1102         82      5670 2571009        36771 0.014100499
## 4     1103         79      5434 2568287        37902 0.014543074
## 5     3001         49        20 2481974       402419 0.139516009
## 6     3002         49        25 2405887       125932 0.049739733
```

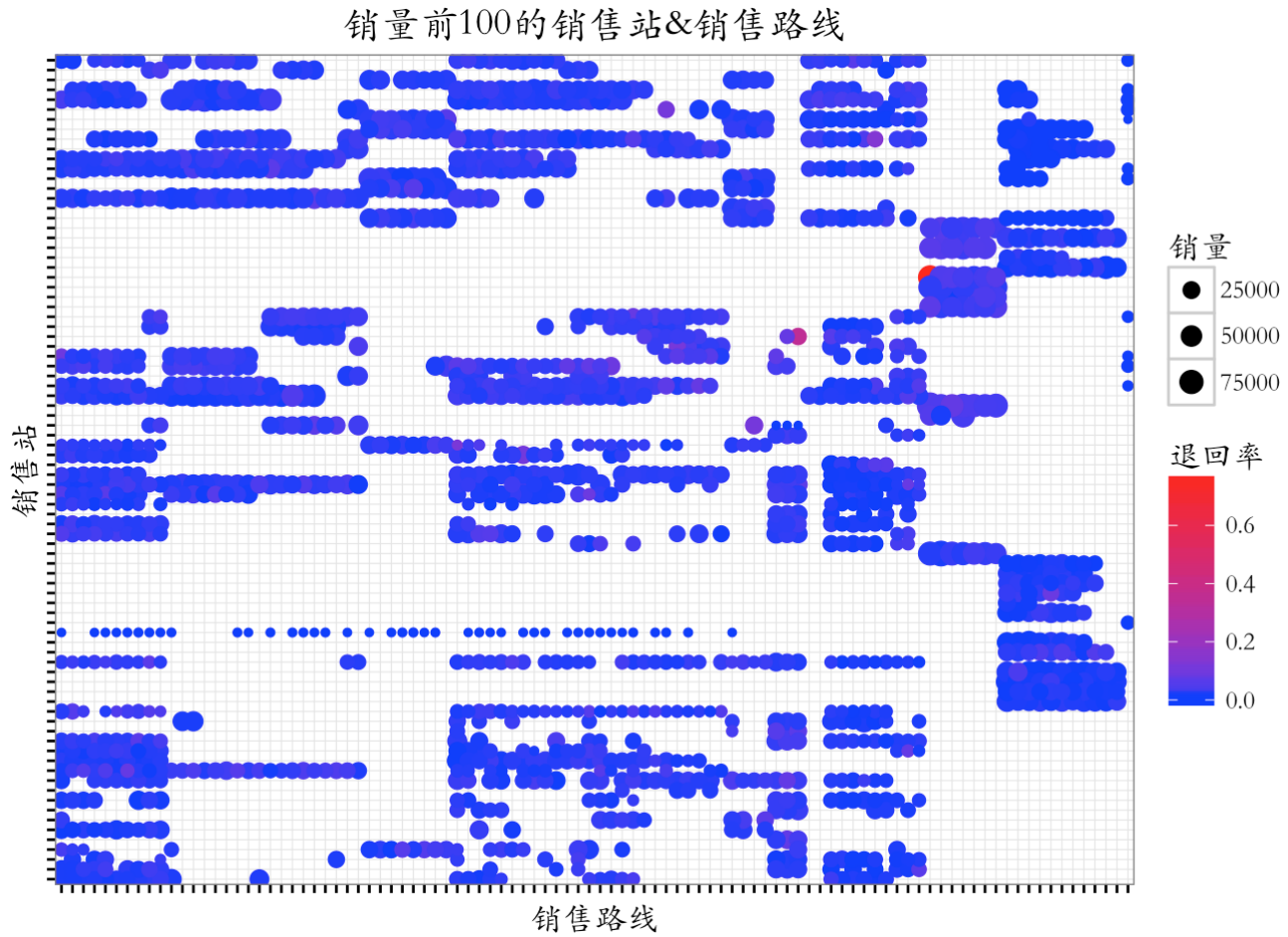
```
ggplot(routes, aes(x=Units/7))+
  geom_histogram(fill="red", color="gray", binwidth=5000)+
  theme_bw(base_family = "STKaiti") +
  scale_x_continuous(labels=function(x)paste(x/1000, "k"))+
  scale_y_continuous()+
  labs(x = "平均每天销量",y = "销售路线数量")
```



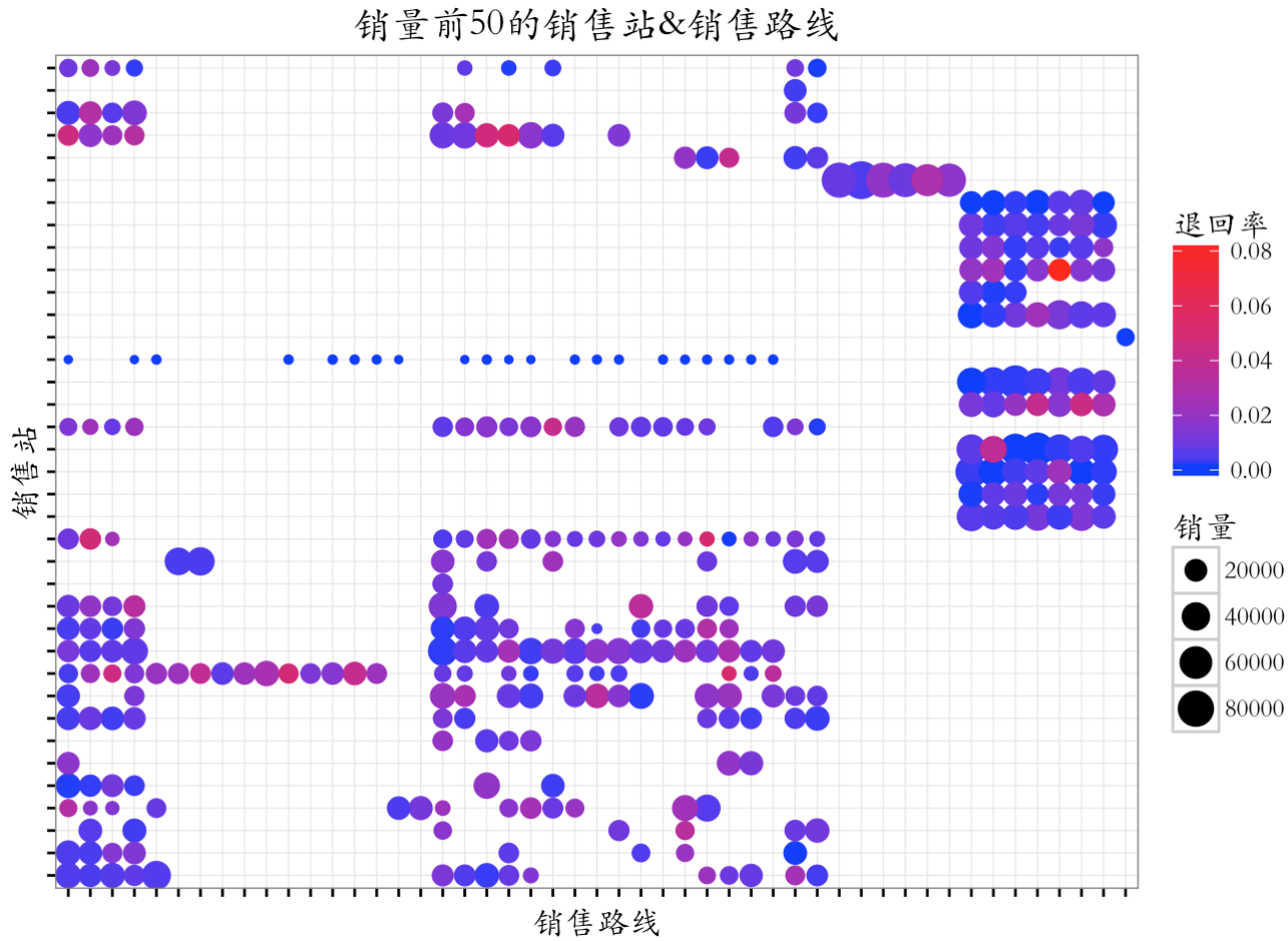

```
## 大部分的销售路线的销售量并不多，超过2/3的销售路线每天的销售量不超过10千


## 销售路线和销售站#####
routes_agencias <- traindata %>% group_by(Ruta_SAK, Agencia_ID) %>%
  summarise(count=n(),      #当前分组的观测数
            n_Clients = n_distinct(Cliente_ID), # 客户数量
            Units=sum(Venta_uni_hoy),  #销售量求和
            Return_Units = sum(Dev_uni_proxima)) %>%
  mutate(Return_Rate = Return_Units / (Units+Return_Units)) %>%
  arrange(desc(Units))
head(routes_agencias)
```

```
##   Ruta_SAK Agencia_ID count n_Clients  Units Return_Units  Return_Rate
## 1      900      22362  6953         9 201679            0 0.000000e+00
## 2        3       1142   773         1 163195            0 0.000000e+00
## 3      900      22560  2744         5 148973            0 0.000000e+00
## 4        1       1168   748         1 145380            8 5.502517e-05
## 5        8       1114   736         1 125192          174 1.387936e-03
## 6      900      22090  5043         6 111042            0 0.000000e+00
```

```
top100routes <- routes$Ruta_SAK[1:100]  # 销量前100的路线
top100agencias <- agencias$Agencia_ID[1:100] # 销量前100的销售站
## 可视化
ggplot(routes_agencias %>%
         filter(Ruta_SAK %in% top100routes, Agencia_ID %in% top100agencias))+
  geom_point(aes(x=as.character(Ruta_SAK),
                 y=as.character(Agencia_ID),
                 size=Units, color=Return_Rate))+
  theme_bw(base_family = "STKaiti") +
  scale_color_gradient(name="退回率", low="blue", high="red")+
  scale_size_continuous(name = "销量",range = c(1,4)) +
  theme(axis.line=element_blank(),
        axis.text.x=element_blank(),
        axis.text.y=element_blank()) +
  labs(x = "销售路线",y = "销售站",title = "销量前100的销售站&销售路线")
```



```
top50routes <- routes$Ruta_SAK[1:50]  # 销量前50的路线
top50agencias <- agencias$Agencia_ID[1:50] # 销量前50的销售站
## 可视化
ggplot(routes_agencias %>%
         filter(Ruta_SAK %in% top50routes, Agencia_ID %in% top50agencias))+
  geom_point(aes(x=as.character(Ruta_SAK),
                 y=as.character(Agencia_ID),
                 size=Units, color=Return_Rate))+
  theme_bw(base_family = "STKaiti") +
  scale_color_gradient(name="退回率", low="blue", high="red")+
  scale_size_continuous(name = "销量",range = c(1,6)) +
  theme(axis.line=element_blank(),
        axis.text.x=element_blank(),
        axis.text.y=element_blank()) +
  labs(x = "销售路线",y = "销售站",title = "销量前50的销售站&销售路线")
```



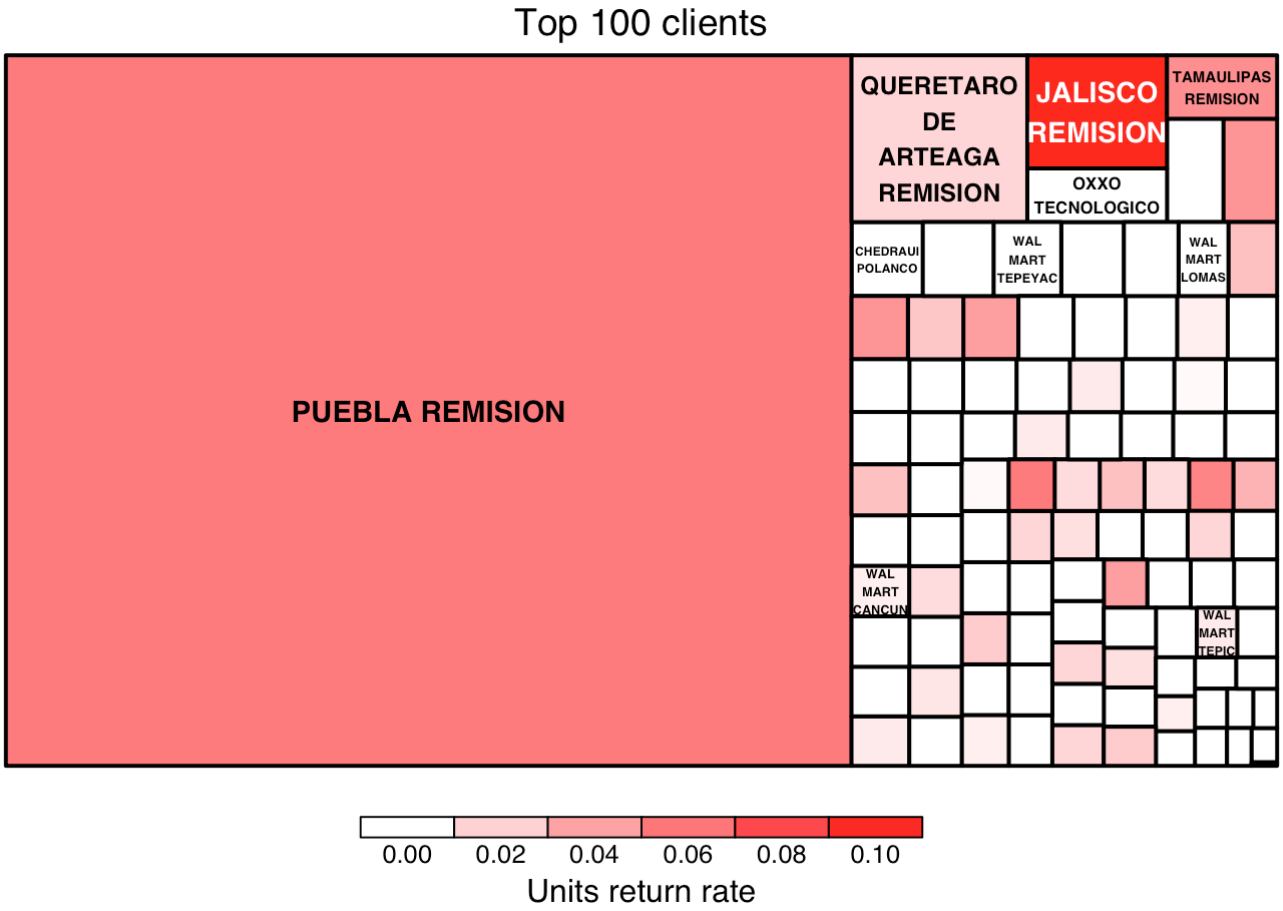
```
## 对客户数据进行分析#####
sales <- traindata %>%     #客户数据
  group_by(Cliente_ID) %>%   # 按照客户id分组
  summarise(Units = sum(Venta_uni_hoy),
            Pesos = sum(Venta_hoy),  # 本周销售金额
            Return_Units = sum(Dev_uni_proxima),
            Return_Pesos = sum(Dev_proxima),  # 下星期的退回金额
            Net = sum(Demanda_uni_equil)) %>%
  mutate(Return_Rate = Return_Units / (Units+Return_Units),
         Avg_Pesos = Pesos / Units) %>%    # 单价
  mutate(Net_Pesos = Pesos - Return_Pesos) %>%  # 实际销售金额
  inner_join(cliente_tabla, by="Cliente_ID") %>%
  arrange(desc(Pesos))  # 本周销售金额排序
head(sales)
```

```
##   Cliente_ID    Units     Pesos Return_Units Return_Pesos      Net
## 1     653378 18650001 154662268      1131794   7367474.15 17866224
## 2     653039   909671   7697623        16642    143066.78   893756
## 3     827594    69264   4814696            0         0.00    69264
## 4     652850   490617   4018867        59664    495570.18   440039
## 5    1216931   232517   3325557           49       395.64   232472
## 6    5903732   162633   2931618            0         0.00   162633
##    Return_Rate Avg_Pesos Net_Pesos
## 1 0.0572139182  8.292883 147294794
## 2 0.0179658496  8.461986   7554557
## 3 0.0000000000 69.512248   4814696
## 4 0.1084246049  8.191454   3523296
## 5 0.0002106929 14.302425   3325161
## 6 0.0000000000 18.025974   2931618
##                                   NombreCliente
## 1                                PUEBLA REMISION
## 2                  QUERETARO DE ARTEAGA REMISION
## 3                  MC DONALDS ANTONIO CUAUTITLAN
## 4                               JALISCO REMISION
## 5                               OXXO TECNOLOGICO
## 6 WAL MART SUPER CENTER DOMINGO DIEZ CUERNAVACA
```

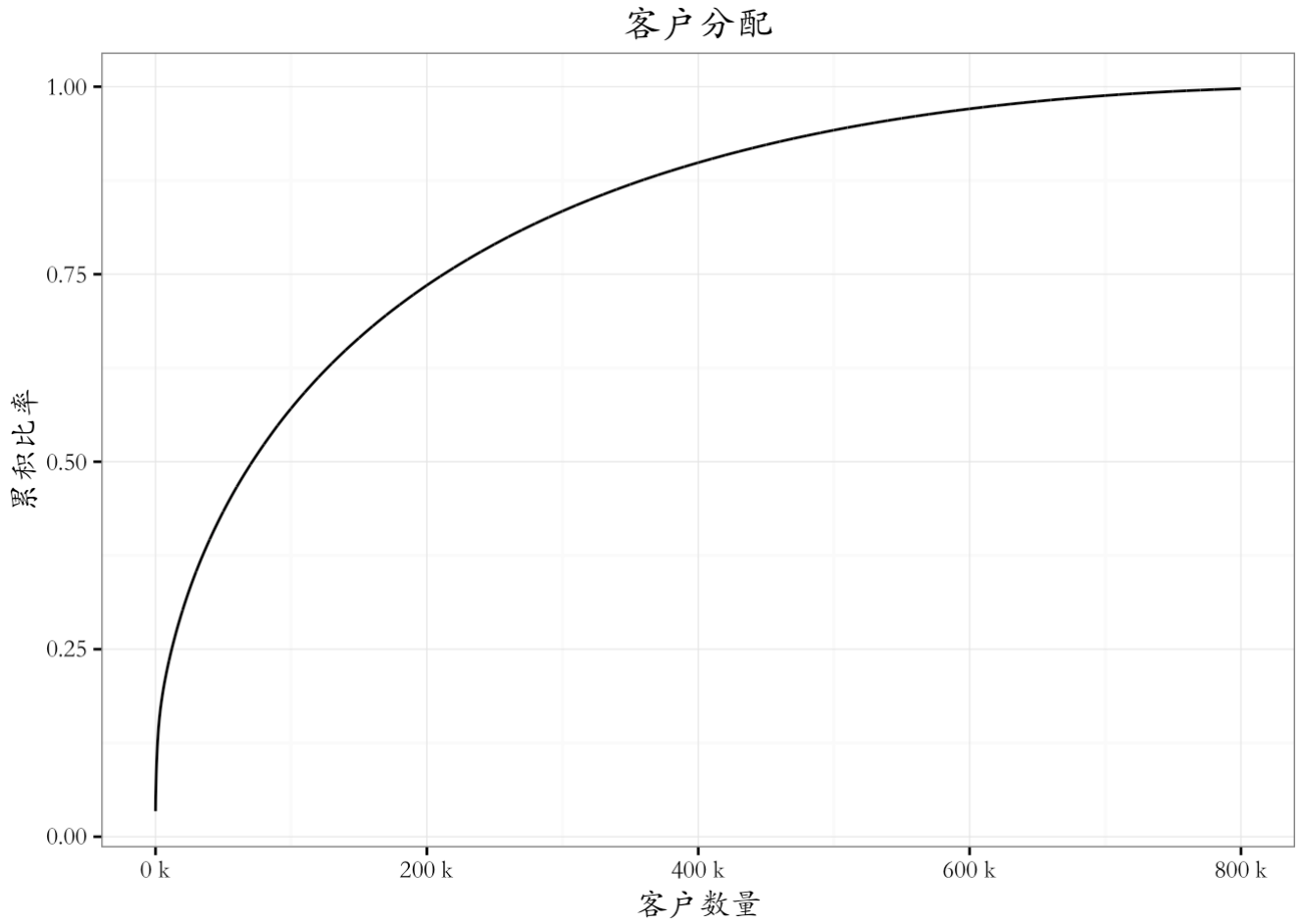
```
dim(sales)
```

```
## [1] 885416     10
```

```
# 花费量前100个客户的树形图
# 可见有一个大客户：Puebla Remision
treemap(sales[1:100, ],
        index=c("NombreCliente"), vSize="Units", vColor="Return_Rate",
        palette=c("#FFFFFF","#FFFFFF","#FF0000"),
        type="value", title.legend="Units return rate", title="Top 100 clients")
```




```
## 客户的累积消耗量
sales$Cum_Units <- cumsum(sales$Units) / sum(sales$Units)  # 累积百分比
s <- seq(1, 800000, 100)   # 约有80万个客户
ggplot()+geom_line(aes(x=s, y=sales$Cum_Units[s]))+
  theme_bw(base_family = "STKaiti") +
  scale_x_continuous(labels=function(x) paste(x/1000, "k"))+
  ggtitle("客户分配")+ xlab("客户数量")+ylab("累积比率")
```




```
## 前20万客户约贡献了75%的销售量



## 客户和销售站分析####
agencias_by_client <- traindata %>%
  group_by(Cliente_ID) %>%  #按照客户id分组
  summarise(n_agencias = n_distinct(Agencia_ID)) %>% #多少个销售站
  inner_join(cliente_tabla, by="Cliente_ID")
head(agencias_by_client)
```

```
##   Cliente_ID n_agencias                    NombreCliente
## 1         26          2 BODEGA COMERCIAL MEXICANA TOLUCA
## 2         60          2                  SAMS CLUB TOLUCA
## 3         65          2                 WAL MART METEPEC
## 4        101          1                  WAL MART TOLUCA
## 5        105          1   SUPER KOMPRAS SAN BUENAVENTURA
## 6        106          1                         ISSSTE 21
```

```
dim(agencias_by_client)
```

```
## [1] 885416      3
```

```
# 单个客户使用销售站的数量
# 大部分的客户只从一个销售站购买，只有几个客户购买狗的销售站 >= 5
table(agencias_by_client$n_agencias)
```

```
##
##      1      2      3      4      5      9     62
## 844113  37510   3771     19      1      1      1
```

```
## 使用销售站多的客户信息
agencias_by_client %>% filter(n_agencias %in% c(5, 9, 62))  #返回符合条件的行
```

```
## Source: local data table [3 x 3]
##
##   Cliente_ID n_agencias                       NombreCliente
##        (int)      (int)                               (chr)
## 1     188391          9                 DESAYUNOS ESCOLARES
## 2     653378         62                     PUEBLA REMISION
## 3    1274327          5 COMERCIALIZADORA LA PUERTA DEL SOL
```

```
# Cliente_ID n_agencias                       NombreCliente
# (int)      (int)                               (chr)
# 1     188391          9                 DESAYUNOS ESCOLARES
# 2     653378         62                     PUEBLA REMISION
# 3    1274327          5 COMERCIALIZADORA LA PUERTA DEL SOL

##  客户和购买渠道分析#####
clients_canals <- traindata %>%
group_by(Cliente_ID) %>%
  summarise(n_canals = n_distinct(Canal_ID))

## 大多数客户只有一个购买渠道。不同的销售渠道可以为一个客户提供服务。
table(clients_canals$n_canals)
```

```
##
##      1      2      3      4
## 874022   6516     65      1
```

```
# 1      2      3      4
# 874022   6516     65      1

# 很少有销售站有同一个客户通过多个渠道。
clients_agencies_canals <- traindata %>%
  group_by(Cliente_ID, Agencia_ID) %>%
  summarise(n_canals = n_distinct(Canal_ID))

table(clients_agencies_canals$n_canals)
```

```
##
##      1      2      3
## 922108   3271      3
```

```
## 客户和路线分析#####
clients_routes <- traindata %>%
  group_by(Cliente_ID) %>%
  summarise(n_routes = n_distinct(Ruta_SAK))
head(clients_routes)
```

```
##   Cliente_ID n_routes
## 1      15766        1
## 2      22926        2
## 3      24080        1
## 4      24695        1
## 5      50379        1
## 6      50395        1
```

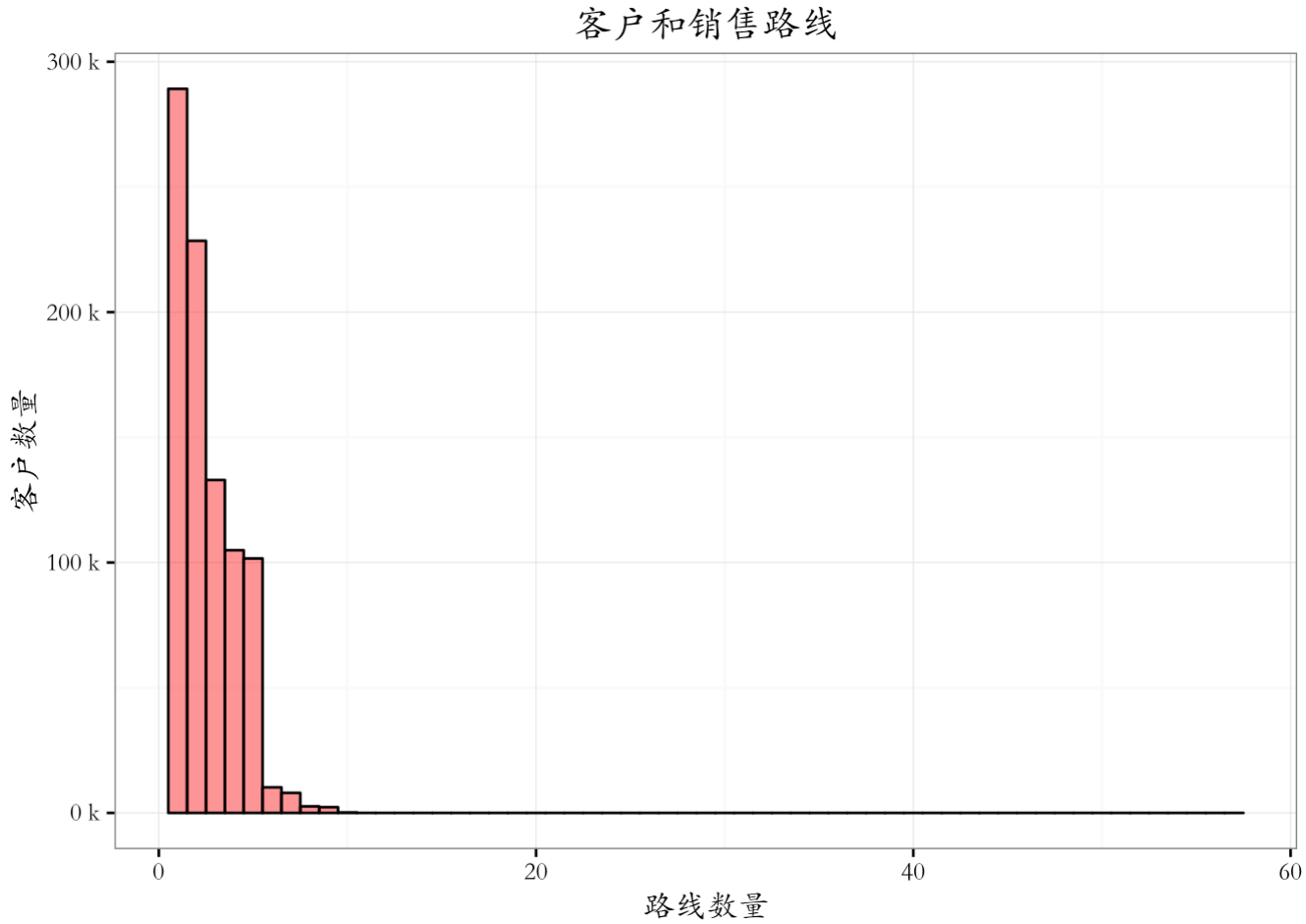
```
dim(clients_routes)
```

```
## [1] 880604      2
```

```
## 大多数客户只有不到5个仓库的交货，但超过240个客户的工作与10个仓库或更多。
sum(clients_routes$n_routes >= 10)
```

```
## [1] 242
```

```
ggplot(clients_routes)+
  geom_histogram(aes(x=n_routes), fill="red", color="black", alpha="0.5",
binwidth=1)+
  theme_bw(base_family = "STKaiti") +
  scale_y_continuous(labels=function(x) paste(x/1000, "k"))+
  ggtitle("客户和销售路线")+ xlab("路线数量")+ylab("客户数量")
```



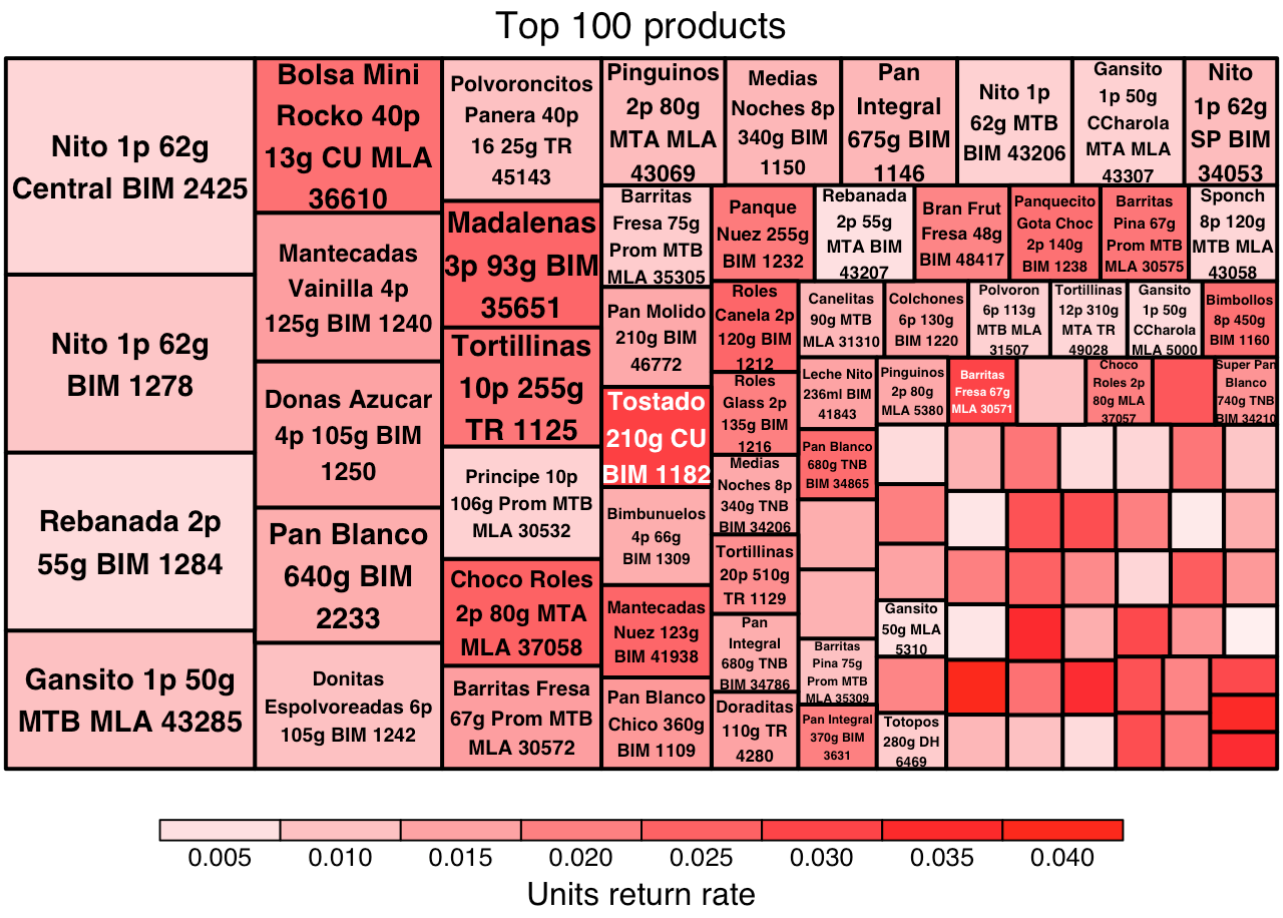

```
## 对集团销售的产品进行分析#####

products <- traindata %>% group_by(Producto_ID) %>%  #根据生产的产品进行分组
  summarise(Units = sum(Venta_uni_hoy),  # 销量
            Pesos = sum(Venta_hoy),    # 卖出的总钱数
            Return_Units = sum(Dev_uni_proxima),  # 被退回的总量
            Return_Pesos = sum(Dev_proxima),  #备退回的总钱数
            Net = sum(Demanda_uni_equil)) %>%  #调整后的我总需求
  mutate(Avg_Pesos = Pesos / Units,  # 每种产品的单价
         Return_Rate = Return_Units / (Units+Return_Units)) %>%  # 退货率
  filter(!is.nan(Avg_Pesos)) %>% #剔除没有单价的商品
  inner_join(producto_tabla, by="Producto_ID") %>%
  arrange(desc(Units))
head(products)
```

```
##   Producto_ID    Units      Pesos Return_Units Return_Pesos      Net
## 1        2425 23860309 107365673       170005     765022.5 23728674
## 2        1278 19660667  88448180       178937     805123.9 19536596
## 3        1284 19625219  59297775       122273     387284.7 19539579
## 4       43285 15259454  80239869       158415     834036.1 15157951
## 5       36610 12836368   9884190       297745     229263.6 12680243
## 6        1240 12313013 104695281       195520    1800498.9 12167245
##   Avg_Pesos Return_Rate                          NombreProducto
## 1 4.4997604 0.007074606          Nito 1p 62g Central BIM 2425
## 2 4.4987375 0.009019182                  Nito 1p 62g BIM 1278
## 3 3.0215089 0.006191824              Rebanada 2p 55g BIM 1284
## 4 5.2583709 0.010274766          Gansito 1p 50g MTB MLA 43285
## 5 0.7700145 0.022669593 Bolsa Mini Rocko 40p 13g CU MLA 36610
## 6 8.5028157 0.015630930  Mantecadas Vainilla 4p 125g BIM 1240
```

```
dim(products)  # 产品数量
```

```
## [1] 1719    9
```

```
products$NombreProducto <- factor(as.character(products$NombreProducto), levels=produ
cts$NombreProducto)

# 销量前100的产品树图
treemap(products[1:100, ],
        index=c("NombreProducto"), vSize="Units", vColor="Return_Rate",
        palette=c("#FFFFFF","#FFFFFF","#FF0000"),
        type="value", title.legend="Units return rate", title="Top 100 products")
```

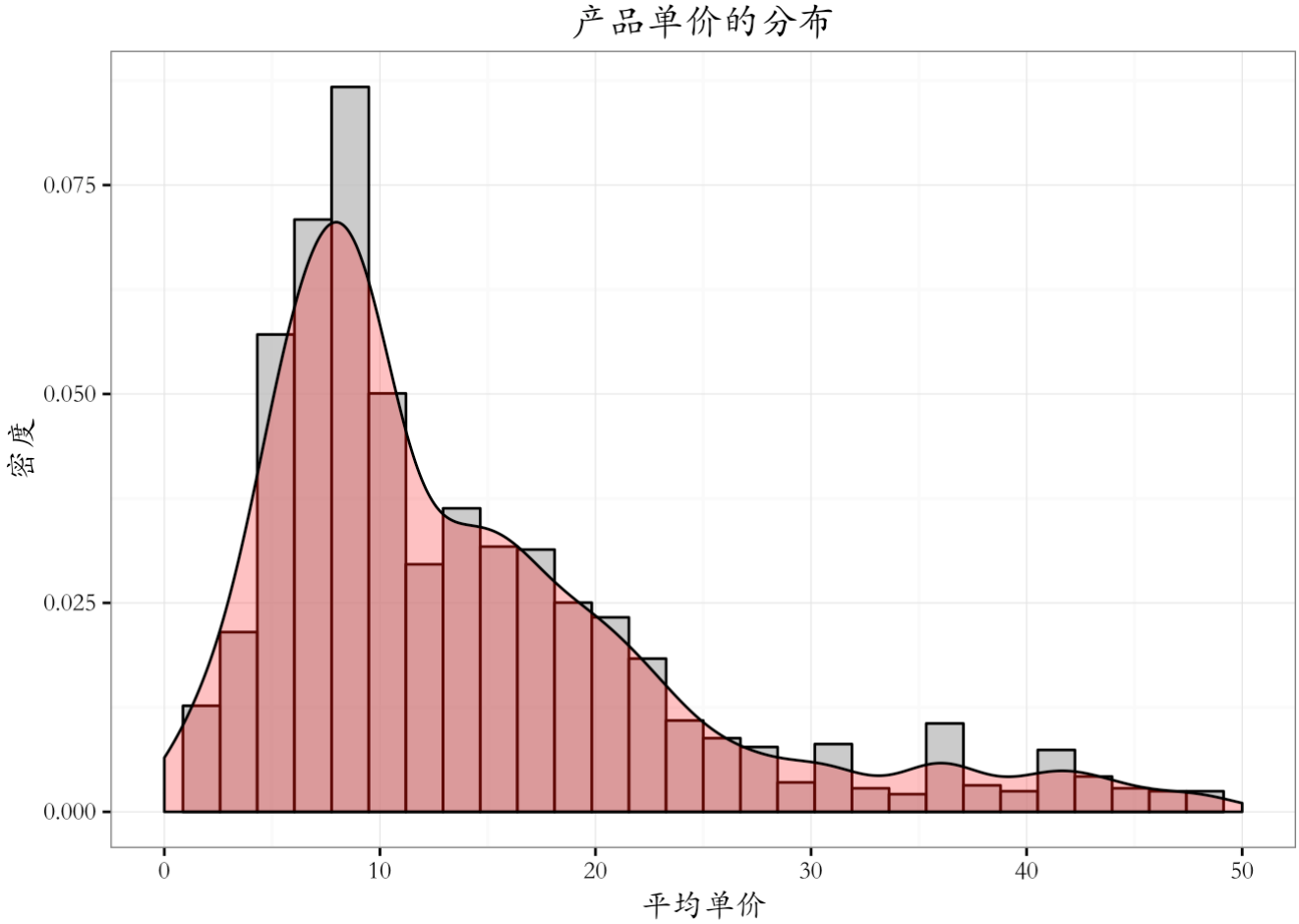


```
## 产品的家的密度分布
ggplot(products, aes(x=Avg_Pesos))+
  geom_histogram(aes(y=..density..), fill="gray", color="black", alpha="0.8")+
  geom_density(fill="red", alpha="0.3")+
  theme_bw(base_family = "STKaiti") +
  scale_x_continuous(lim=c(0, 50))+
  ggtitle("产品单价的分布")+ xlab("平均单价")+ylab("密度")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 74 rows containing non-finite values (stat_bin).
```

```
## Warning: Removed 74 rows containing non-finite values (stat_density).
```



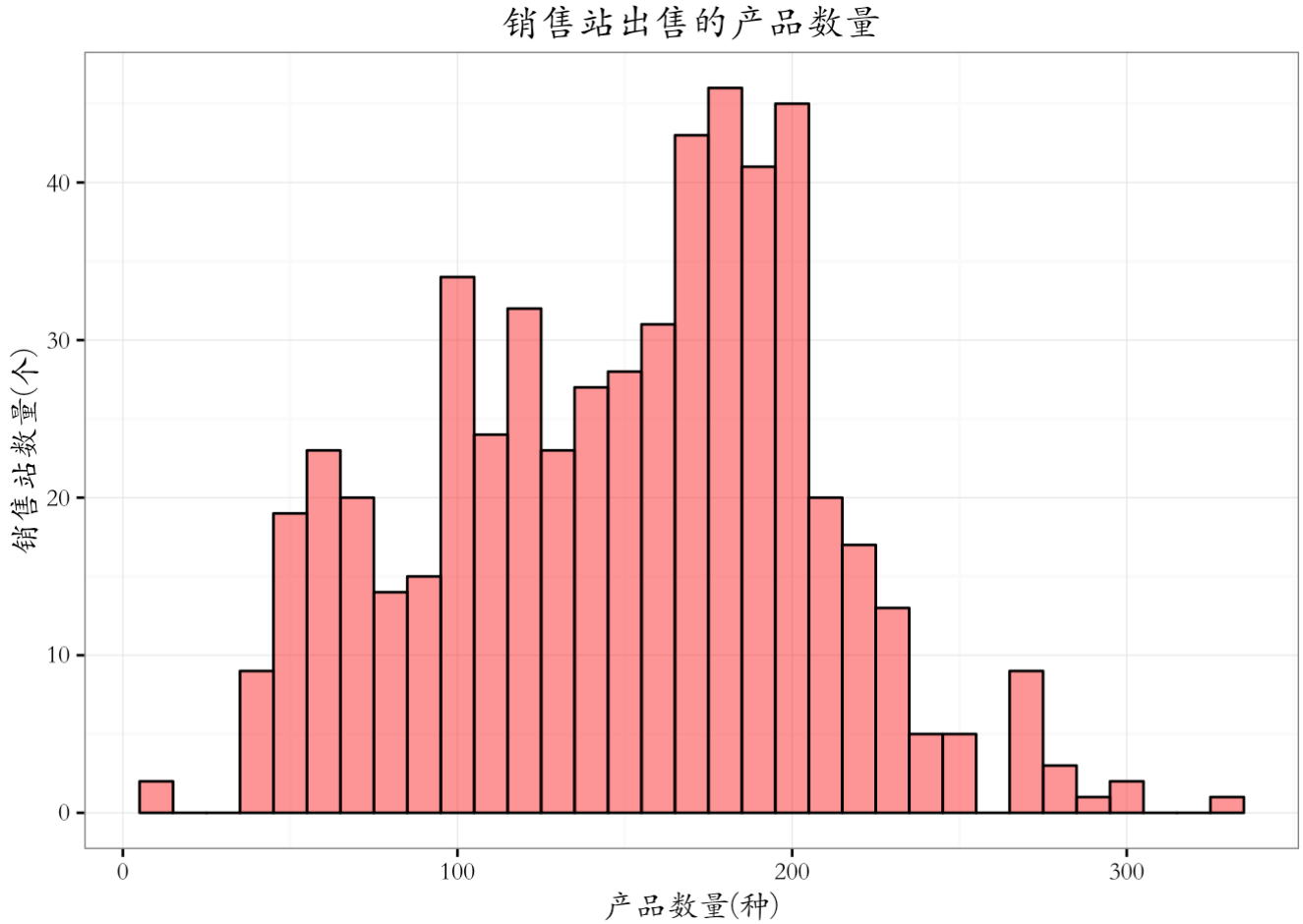

```
## 产品和销售站
products_agencies <- traindata %>% group_by(Agencia_ID) %>%
  summarise(n_products = n_distinct(Producto_ID))
head(products_agencies)
```

```
##   Agencia_ID n_products
## 1       1110        214
## 2       1111        208
## 3       1112        199
## 4       1113        202
## 5       1114        222
## 6       1116        200
```

```
dim(products_agencies)
```

```
## [1] 552   2
```

```
## 大多数销售站会卖100～200种产品
ggplot(products_agencies)+
  geom_histogram(aes(x = n_products), fill="red", color="black", alpha="0.5", binwidt
h=10)+
  theme_bw(base_family = "STKaiti") +
  ggtitle("销售站出售的产品数量")+ xlab("产品数量(种)")+ylab("销售站数量(个)")
```

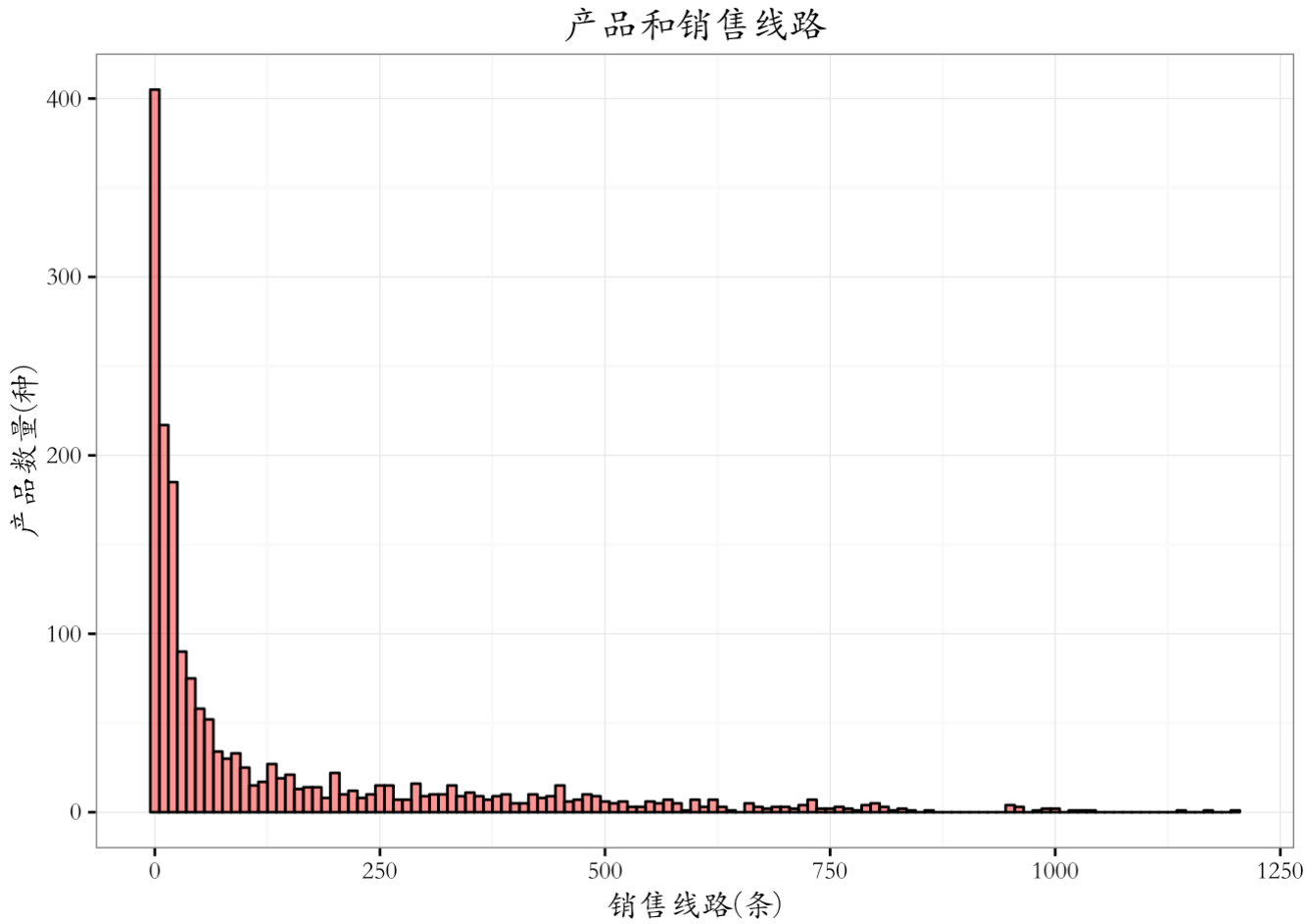



```
## 产品和销售路线
routes_products <- traindata %>% group_by(Producto_ID) %>%
  summarise(n_routes = n_distinct(Ruta_SAK))
table(routes_products$n_routes)
```

```
##
##    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15
##  155   87   67   40   56   36   26   19   16   15   26   14   16   34   15
##   16   17   18   19   20   21   22   23   24   25   26   27   28   29   30
##   18   21   46   14   23   13   13   12   14   11    6   12    5   13    8
##   31   32   33   34   35   36   37   38   39   40   41   42   43   44   45
##   10    9    6    9   12    4    8    5    7    5    7   11    7   11   10
##   46   47   48   49   50   51   52   53   54   55   56   57   58   59   60
##    9   14    4    5    3    5    5    4    6    3    6    8    7    3    5
##   61   63   64   65   66   67   68   69   70   71   72   73   74   75   76
##    7    7    4    5    1    5    2    2    8    4    3    2    4    3    4
##   77   78   79   80   82   83   84   85   86   87   88   89   90   91   92
##    1    2    3    2    2    4    5    7    2    5    2    3    4    5    5
##   93   94   95   96   97   98   99  100  101  102  103  104  105  106  108
##    1    2    4    5    3    2    2    2    1    2    2    3    3    2    1
##  109  111  113  114  115  116  117  118  119  122  123  124  125  126  127
##    2    3    2    3    2    4    1    2    2    1    1    1    5    3    2
##  128  129  130  131  132  133  134  135  136  137  138  139  140  141  142
##    2    1    4    3    3    5    1    3    1    2    1    2    1    1    4
##  143  144  145  146  147  148  149  150  151  152  153  154  155  156  157
##    1    5    1    2    2    2    1    2    3    1    3    2    3    2    1
##  158  160  161  162  164  167  168  169  170  171  173  174  177  178  179
##    4    2    1    1    2    3    1    2    3    2    2    1    1    2    4
##  181  182  183  184  185  186  190  192  193  194  195  196  197  198  200
##    2    2    1    1    1    1    1    2    2    1    1    2    4    4    1
##  201  202  203  204  205  206  208  209  213  214  215  216  217  218  219
##    2    2    1    4    2    1    2    3    2    1    1    1    2    1    3
##  221  223  225  226  227  230  231  235  237  238  239  240  243  245  247
##    1    2    2    1    3    1    1    2    2    3    1    1    2    1    1
##  248  249  251  252  253  254  255  256  257  258  260  261  262  263  264
##    1    1    2    1    2    3    4    1    2    2    2    1    4    2    1
##  266  269  270  273  274  275  276  277  279  283  284  286  287  288  289
##    1    2    1    1    1    1    1    3    1    1    1    1    1    4    2
##  291  292  293  294  297  298  299  300  303  305  306  307  308  312  313
##    2    2    1    3    2    2    1    1    2    1    1    1    1    1    5
##  315  318  320  321  322  325  326  327  328  330  331  332  334  336  337
##    1    2    3    1    1    3    2    3    4    1    1    3    1    1    2
##  340  341  343  345  348  349  351  352  353  354  356  357  358  360  361
##    2    1    2    1    1    1    5    2    1    1    2    1    1    1    1
##  364  365  369  370  372  373  374  375  376  380  381  382  383  385  387
##    1    2    1    1    1    2    1    1    1    2    1    1    2    2    5
##  388  391  392  397  398  400  402  405  408  410  413  415  418  420  421
##    2    2    1    1    1    1    1    1    2    1    1    1    2    2    1
##  423  424  425  428  431  432  433  434  435  437  438  439  442  443  444
##    1    2    2    1    1    2    2    1    1    1    2    1    1    1    1
##  445  446  449  450  451  452  453  454  455  456  459  460  462  463  467
##    2    1    1    1    1    2    2    4    3    1    1    1    1    2    1
##  468  470  471  474  478  479  482  483  485  486  488  490  492  493  494
##    1    1    3    1    2    2    3    2    1    2    1    1    1    2    1
##  495  497  498  499  500  503  504  509  511  515  516  520  521  522  525
##    1    1    1    1    1    1    1    2    1    2    1    2    1    1    1
##  529  535  539  540  541  546  547  549  553  564  565  567  572  574  576
##    1    2    1    1    1    2    2    1    1    2    3    4    2    1    1
##  579  580  582  593  596  598  600  601  602  604  608  615  616  619  621
##    2    1    1    1    1    1    1    2    1    1    2    1    2    1    2
##  622  624  632  635  637  656  658  662  665  669  671  674  680  682  689
##    1    1    1    2    1    1    1    1    2    1    1    1    1    1    1
```

```
##  690  691  696  697  702  707  708  716  719  722  724  729  731  733  735
##    1    1    1    1    1    1    1    1    1    1    1    2    2    1    2
##  736  744  748  756  765  771  773  782  789  791  793  798  799  803  804
##    1    1    2    2    1    1    1    1    2    1    1    2    1    1    1
##  807  811  818  830  832  843  861  947  955  956  957  964  979  991  994
##    1    2    1    1    1    1    1    3    1    1    1    1    1    1    1
##  997 1001 1020 1029 1036 1144 1166 1196
##    1    1    1    1    1    1    1    1
```

```
## 大部分的产品只有几条销售路线，只有几种产品的销售路线很多
ggplot(routes_products)+
  geom_histogram(aes(x=n_routes), fill="red", color="black", alpha="0.5",
binwidth=10)+
  theme_bw(base_family = "STKaiti") +
  ggtitle("产品和销售线路")+ xlab("销售线路(条)")+ylab("产品数量(种)")
```



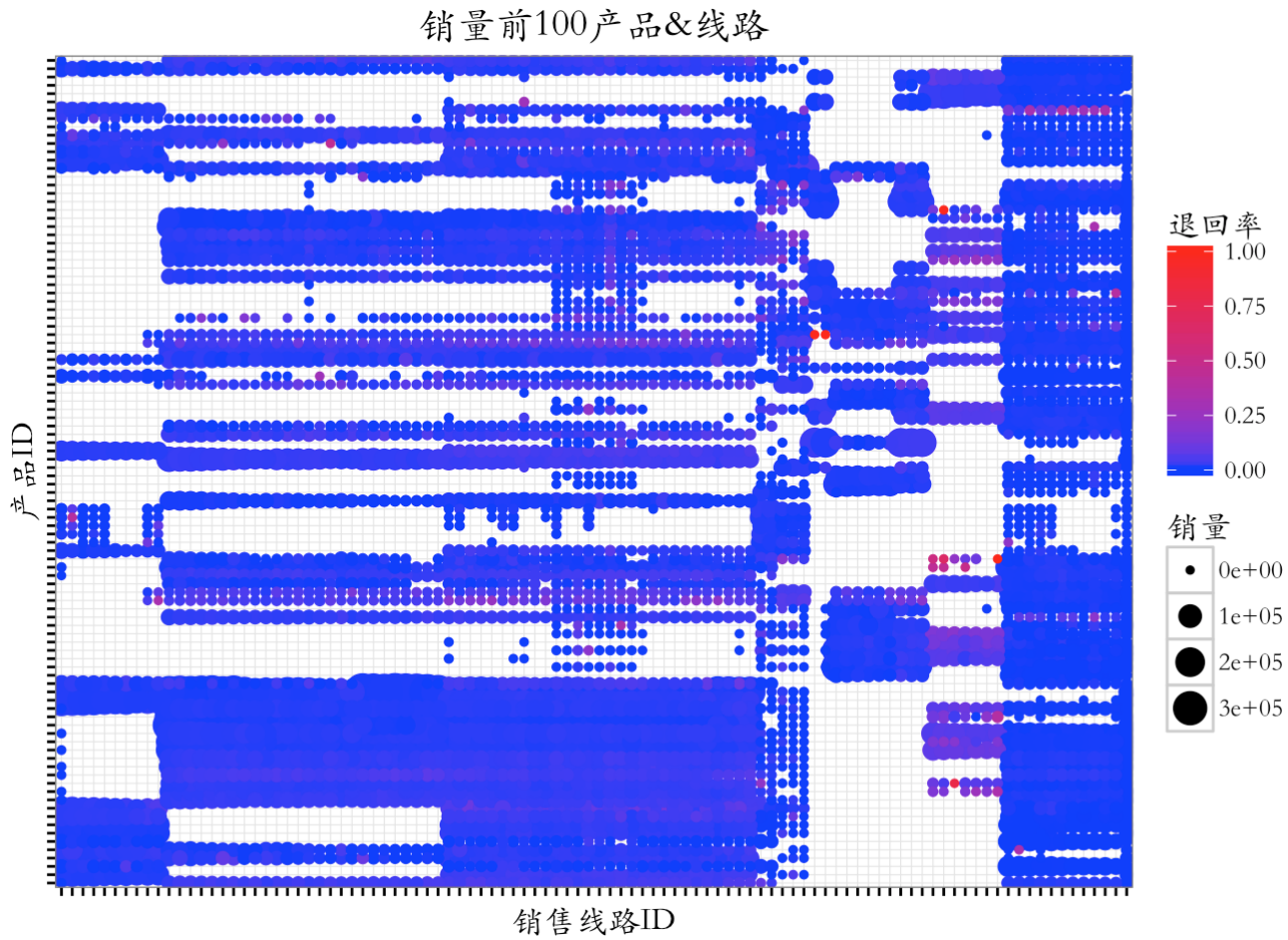

```
## 产品和销售路线 top100
routes.products <- traindata %>% group_by(Ruta_SAK, Producto_ID) %>%
  summarise(count=n(),
            n_Agencias = n_distinct(Agencia_ID),
            n_Clients = n_distinct(Cliente_ID),
            Units=sum(Venta_uni_hoy),
            Return_Units = sum(Dev_uni_proxima)) %>%
  mutate(Return_Rate = Return_Units / (Units+Return_Units)) %>%
  arrange(desc(Units))
head(routes.products)
```

```
##   Ruta_SAK Producto_ID count n_Agencias n_Clients  Units Return_Units
## 1     1154        2425 12062         27      1967 388887         2604
## 2     1151        2425 12759         27      2070 377794         2172
## 3     1155        2425 10914         24      1792 372039         2737
## 4     1152        2425 12196         26      2012 370659         2282
## 5     1156        2425 10844         24      1780 361474         2787
## 6     1153        2425 11219         24      1830 352817         2316
##   Return_Rate
## 1 0.006651494
## 2 0.005716301
## 3 0.007303029
## 4 0.006118930
## 5 0.007651107
## 6 0.006521500
```

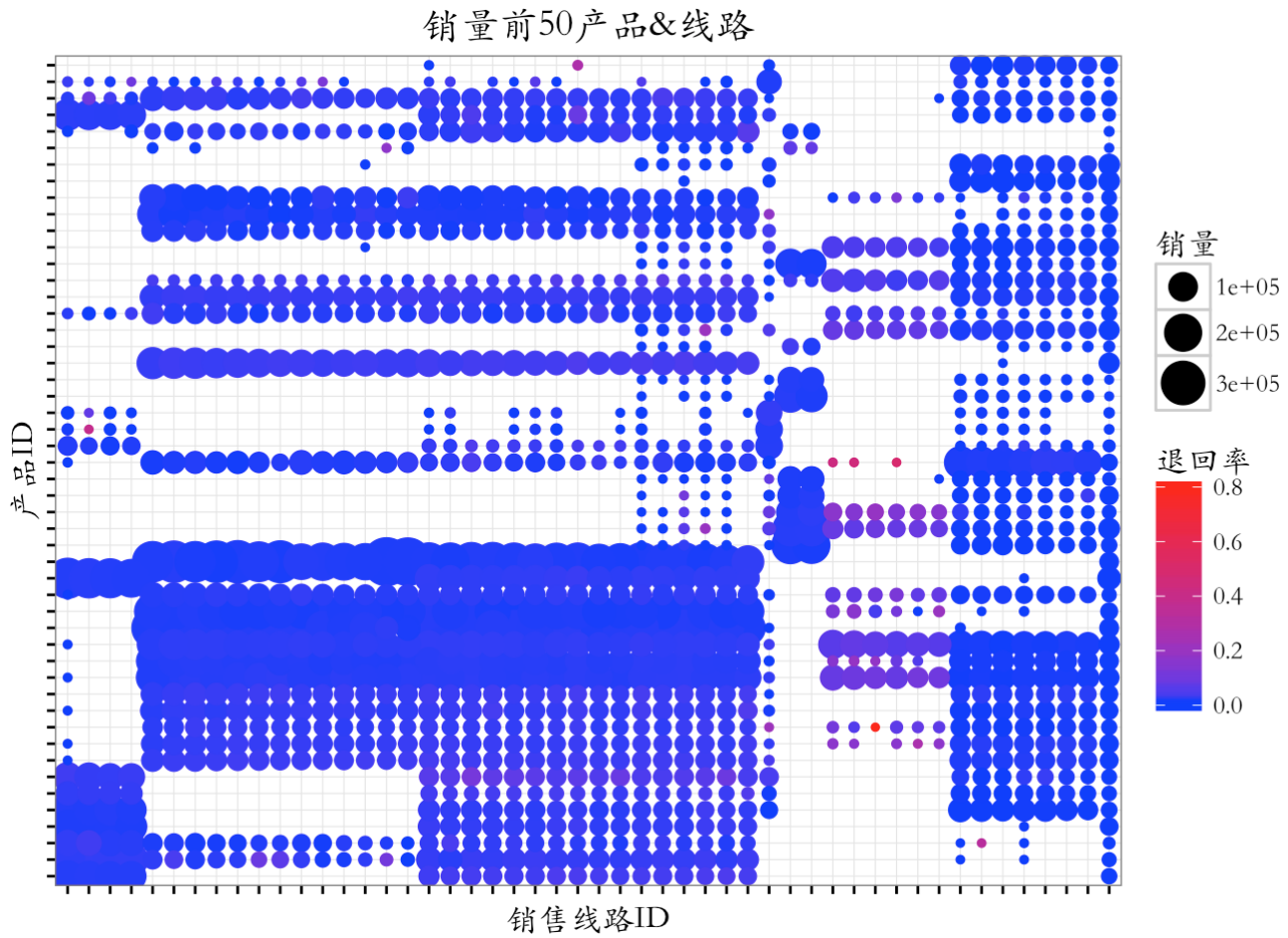
```
dim(routes.products)
```

```
## [1] 250265      8
```

```
top100routes <- routes$Ruta_SAK[1:100]
top100products <- products$Producto_ID[1:100]

ggplot(routes.products %>%
         filter(Ruta_SAK %in% top100routes, Producto_ID %in% top100products))+
  geom_point(aes(x=as.character(Ruta_SAK),
                 y=as.character(Producto_ID),
                 size=Units, color=Return_Rate))+
  theme_bw(base_family = "STKaiti")+
  scale_color_gradient(name="退回率", low="blue", high="red")+
  scale_size_continuous(name = "销量",range = c(1,6)) +
  theme(axis.line=element_blank(),
        axis.text.x=element_blank(),
        axis.text.y=element_blank()) +
  ggtitle("销量前100产品&线路")+ xlab("销售线路ID")+ylab("产品ID")
```




```
## 产品和销售路线 top50
top50routes <- routes$Ruta_SAK[1:50]
top50products <- products$Producto_ID[1:50]

ggplot(routes.products %>%
         filter(Ruta_SAK %in% top50routes, Producto_ID %in% top50products))+
  geom_point(aes(x=as.character(Ruta_SAK),
                 y=as.character(Producto_ID),
                 size=Units, color=Return_Rate))+
  theme_bw(base_family = "STKaiti")+
  scale_color_gradient(name="退回率", low="blue", high="red")+
  scale_size_continuous(name = "销量",range = c(1,8)) +
  theme(axis.line=element_blank(),
        axis.text.x=element_blank(),
        axis.text.y=element_blank()) +
  ggtitle("销量前50产品&线路")+ xlab("销售线路ID")+ylab("产品ID")
```



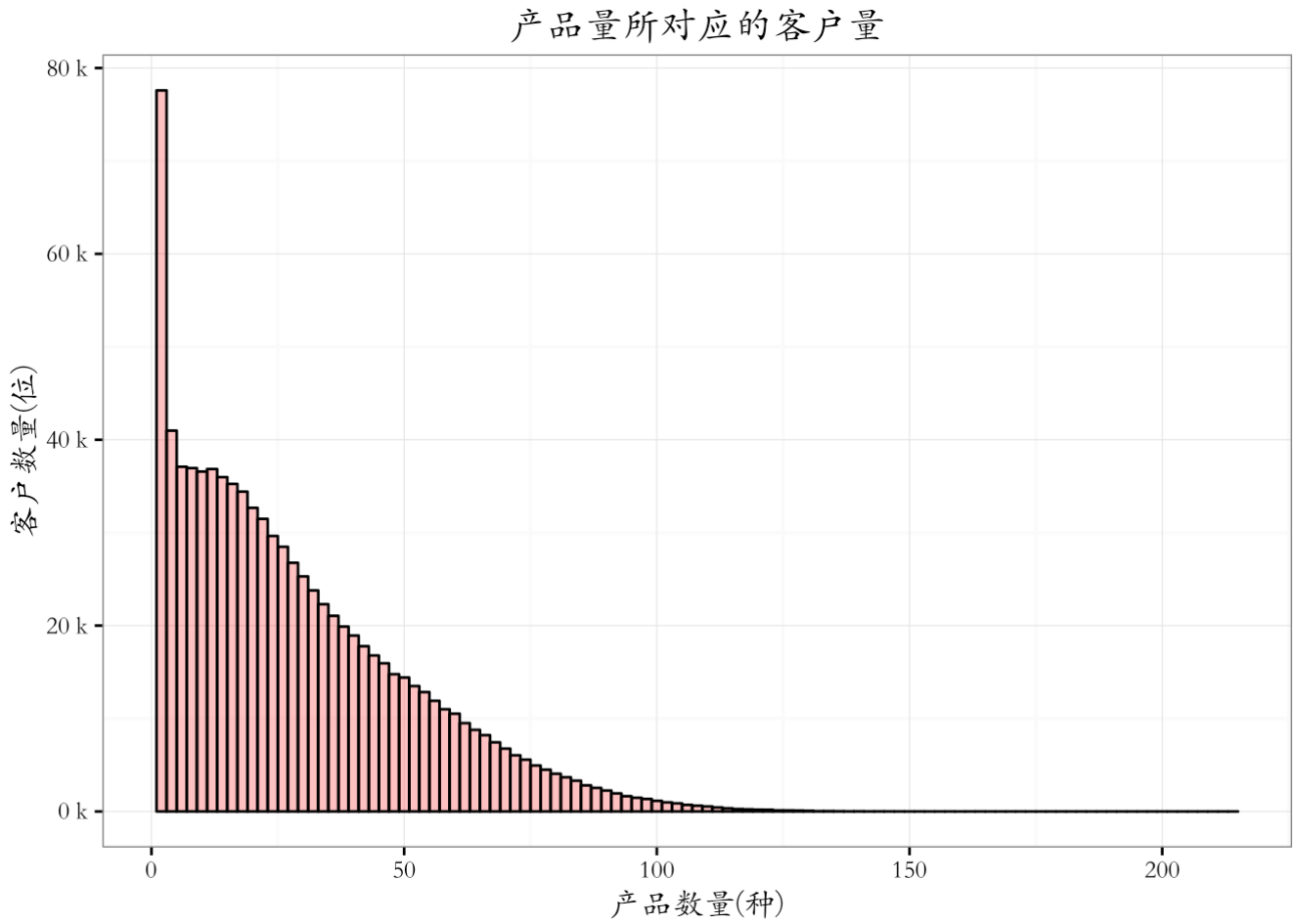

```
##  产品和客户
products_by_client <- traindata %>%
group_by(Cliente_ID) %>%
  summarise(n_products = n_distinct(Producto_ID)) %>%
  inner_join(cliente_tabla, by="Cliente_ID")
head(products_by_client)
```

```
##   Cliente_ID n_products                    NombreCliente
## 1         26         51 BODEGA COMERCIAL MEXICANA TOLUCA
## 2         60         34                 SAMS CLUB TOLUCA
## 3         65        112                 WAL MART METEPEC
## 4        101          4                  WAL MART TOLUCA
## 5        105         72   SUPER KOMPRAS SAN BUENAVENTURA
## 6        106         21                         ISSSTE 21
```

```
dim(products_by_client)
```

```
## [1] 885416      3
```

```
ggplot(products_by_client)+
  geom_histogram(aes(x=n_products), fill="red", color="black", alpha="0.3",
binwidth=2)+
  theme_bw(base_family = "STKaiti")+
  scale_y_continuous(labels=function(x)paste(x/1000, "k"))+
  ggtitle("产品量所对应的客户量")+ xlab("产品数量(种)")+ylab("客户数量(位)")
```


产品量所对应的客户量
80 k
60 k
40 k
20 k
0 k
客户数量(位)
0
50
100
150
200
产品数量(种)