Bellabeat

SM

2025-07-08

– # r setup

Introduction

This case study analyzes smart device usage data for Bellabeat, a wellness technology company for women. The goal is to uncover trends in user activity and sleep habits and provide actionable marketing recommendations for the **Leaf** wellness tracker.

Data Sources

The analysis uses Fitbit Fitness Tracker Data (public domain) containing daily activity and minute-level sleep records for 30 users.

- **dailyActivity_merged.csv**
- **minuteSleep_merged.csv**

```r
# Load data
activity <- read.csv("dailyActivity_merged.csv")
sleep <- read.csv("minuteSleep_merged.csv")

# Inspect
str(activity)
```

```
## 'data.frame':    457 obs. of  15 variables:
##  $ Id                      : num  1.5e+09 1.5e+09 1.5e+09 1.5e+09 1.5e+09 ...
##  $ ActivityDate            : chr  "3/25/2016" "3/26/2016" "3/27/2016" "3/28/2016" ...
##  $ TotalSteps              : int  11004 17609 12736 13231 12041 10970 12256 12262 11248 10016 ...
##  $ TotalDistance           : num  7.11 11.55 8.53 8.93 7.85 ...
##  $ TrackerDistance         : num  7.11 11.55 8.53 8.93 7.85 ...
##  $ LoggedActivitiesDistance: num  0 0 0 0 0 0 0 0 0 0 ...
##  $ VeryActiveDistance      : num  2.57 6.92 4.66 3.19 2.16 ...
##  $ ModeratelyActiveDistance: num  0.46 0.73 0.16 0.79 1.09 ...
##  $ LightActiveDistance     : num  4.07 3.91 3.71 4.95 4.61 ...
##  $ SedentaryActiveDistance : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ VeryActiveMinutes       : int  33 89 56 39 28 30 33 47 40 15 ...
##  $ FairlyActiveMinutes     : int  12 17 5 20 28 13 12 21 11 30 ...
##  $ LightlyActiveMinutes    : int  205 274 268 224 243 223 239 200 244 314 ...
##  $ SedentaryMinutes        : int  804 588 605 1080 763 1174 820 866 636 655 ...
##  $ Calories                : int  1819 2154 1944 1932 1886 1820 1889 1868 1843 1850 ...
```

```r
str(sleep)
```

```
## 'data.frame':    198559 obs. of  4 variables:
```

```
##  $ Id   : num  1.5e+09 1.5e+09 1.5e+09 1.5e+09 1.5e+09 ...
##  $ date : chr  "3/13/2016 2:39:30 AM" "3/13/2016 2:40:30 AM" "3/13/2016 2:41:30 AM" "3/13/2016 2:42:3
##  $ value: int  1 1 1 1 1 1 2 2 1 1 ...
##  $ logId: num  1.11e+10 1.11e+10 1.11e+10 1.11e+10 1.11e+10 ...
```

Data Cleaning

```
# Convert dates
activity <- activity %>% mutate(ActivityDate = mdy(ActivityDate))
sleep <- sleep %>% mutate(date = mdy_hms(date))

# Aggregate sleep to daily totals
sleep_daily <- sleep %>%
  mutate(SleepDate = as_date(date)) %>%
  group_by(Id, SleepDate) %>%
  summarise(MinutesAsleep = sum(value), .groups = 'drop')

# Join activity & sleep
activity_sleep <- activity %>%
  inner_join(sleep_daily, by = c("Id" = "Id", "ActivityDate" = "SleepDate"))

# Check cleaned data
head(activity_sleep)
```

```
##           Id ActivityDate TotalSteps TotalDistance TrackerDistance
## 1 1503960366   2016-03-25      11004          7.11            7.11
## 2 1503960366   2016-03-26      17609         11.55           11.55
## 3 1503960366   2016-03-27      12736          8.53            8.53
## 4 1503960366   2016-03-28      13231          8.93            8.93
## 5 1503960366   2016-03-29      12041          7.85            7.85
## 6 1503960366   2016-03-31      12256          7.86            7.86
##   LoggedActivitiesDistance VeryActiveDistance ModeratelyActiveDistance
## 1                        0               2.57                     0.46
## 2                        0               6.92                     0.73
## 3                        0               4.66                     0.16
## 4                        0               3.19                     0.79
## 5                        0               2.16                     1.09
## 6                        0               2.29                     0.49
##   LightActiveDistance SedentaryActiveDistance VeryActiveMinutes
## 1                4.07                       0                33
## 2                3.91                       0                89
## 3                3.71                       0                56
## 4                4.95                       0                39
## 5                4.61                       0                28
## 6                5.04                       0                33
##   FairlyActiveMinutes LightlyActiveMinutes SedentaryMinutes Calories
## 1                  12                  205              804     1819
## 2                  17                  274              588     2154
## 3                   5                  268              605     1944
## 4                  20                  224             1080     1932
## 5                  28                  243              763     1886
## 6                  12                  239              820     1889
##   MinutesAsleep
```
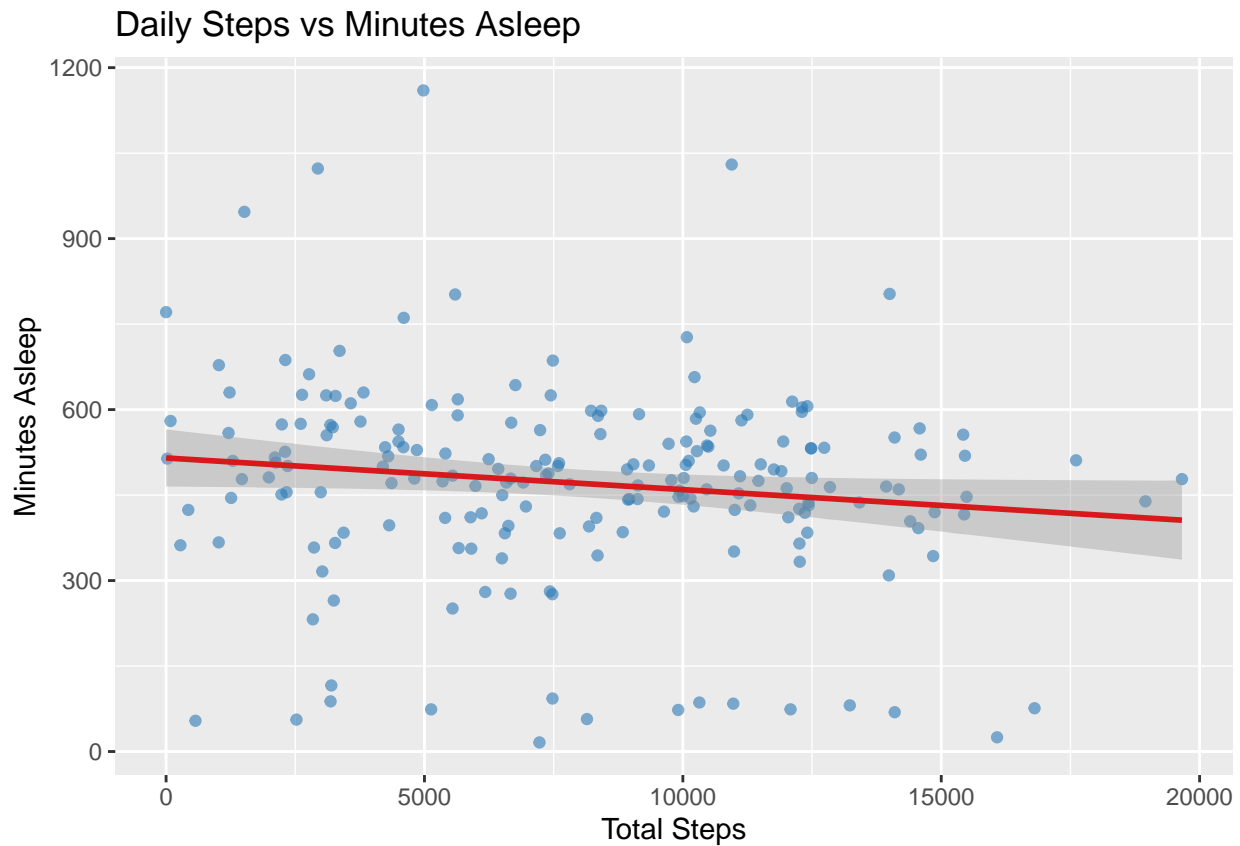
```
## 1          424
## 2          511
## 3          533
## 4           81
## 5          411
## 6          365
```

Exploratory Data Analysis

Steps vs Sleep

```
ggplot(activity_sleep, aes(x = TotalSteps, y = MinutesAsleep)) +
  geom_point(alpha = 0.6, color = "#2C7BB6") +
  geom_smooth(method = "lm", se = TRUE, color = "#D7191C") +
  labs(title = "Daily Steps vs Minutes Asleep",
       x = "Total Steps",
       y = "Minutes Asleep")
```
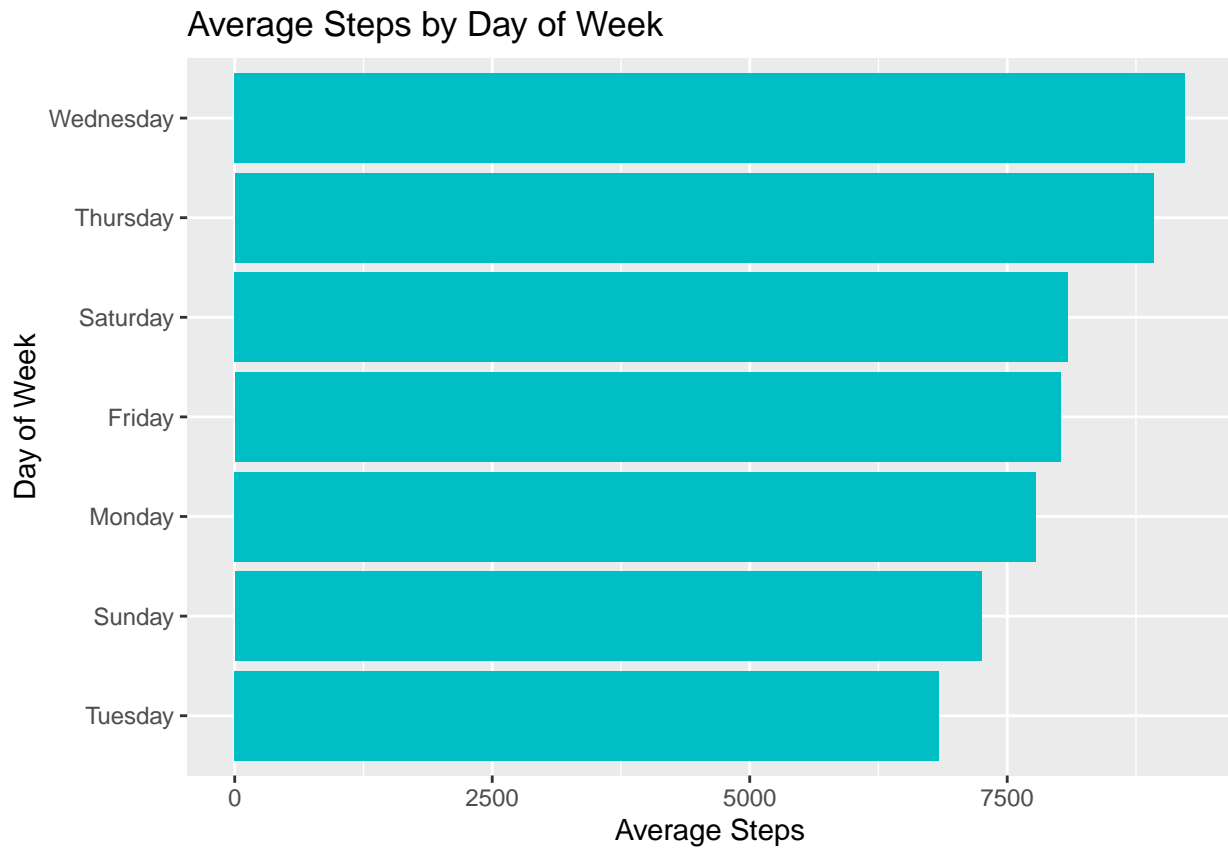
```
## `geom_smooth()` using formula = 'y ~ x'
```


Steps by Day of Week

```
activity_sleep %>%
  mutate(weekday = weekdays(ActivityDate)) %>%
  group_by(weekday) %>%
  summarise(avg_steps = mean(TotalSteps)) %>%
```

```
ggplot(aes(x = reorder(weekday, avg_steps), y = avg_steps)) +
geom_col(fill = "#00BFC4") +
coord_flip() +
labs(title = "Average Steps by Day of Week",
     x = "Day of Week",
     y = "Average Steps")
```


Average Steps by Day of Week

Calories vs Steps

```
ggplot(activity_sleep, aes(x = TotalSteps, y = Calories)) +
  geom_point(alpha = 0.5, color = "#7B3294") +
  geom_smooth(method = "lm", color = "#008837") +
  labs(title = "Total Steps vs Calories Burned",
       x = "Total Steps",
       y = "Calories")
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

Total Steps vs Calories Burned
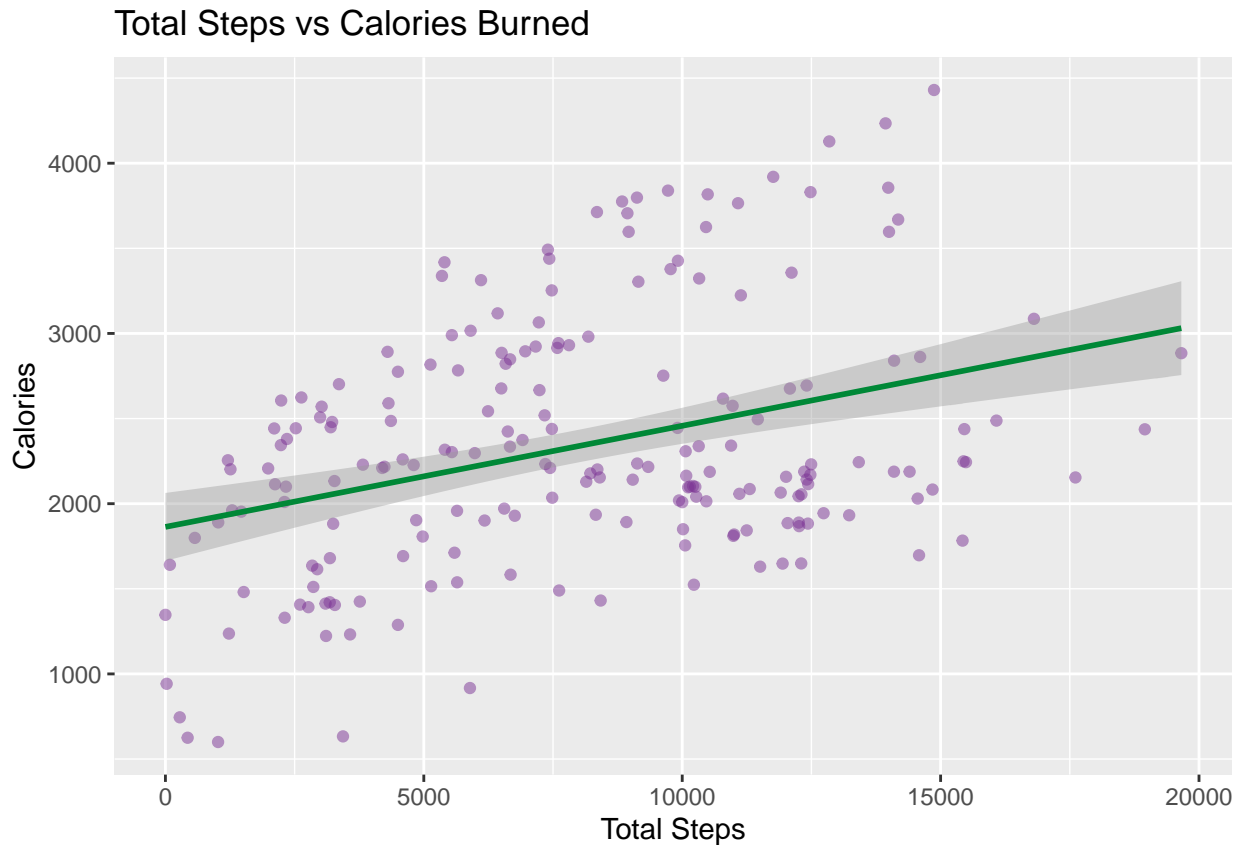
Key Findings

1. **More steps lead to more calories burned:**
   The first scatter plot shows a positive linear relationship between daily steps and calories burned —
   meaning Bellabeat users who walk more burn more energy. This confirms that the device accurately
   captures active calorie expenditure.

2. **More steps, slightly less sleep:**
   The second plot suggests a mild negative correlation between daily steps and minutes asleep. This
   could mean that on more active days, users sleep a bit less — possibly due to busier schedules or higher
   activity levels that don't guarantee longer sleep.

3. **Weekday activity patterns vary:**
   The bar chart reveals that Wednesday and Thursday have the highest average step counts, while
   Tuesday and Sunday show the lowest. This suggests that users are more active mid-week and less so
   early in the week and on weekends.

Recommendations

1. **Encourage consistent activity on low-step days:**
   Use personalized reminders and in-app challenges to motivate users on historically low-activity days like
   Tuesday and Sunday. For example, Bellabeat could push motivational messages: "Keep your momentum
   going this Tuesday — aim for 2,000 more steps today!"

2. **Promote balanced wellness, not just activity:**
   Since higher activity may correlate with slightly reduced sleep, Bellabeat should highlight the importance

of rest and recovery. The app can recommend mindfulness and sleep coaching through the Leaf tracker and Bellabeat membership to help users maintain good sleep even on active days.

3. **Highlight accurate calorie tracking:**
   Use the clear positive link between steps and calories burned to market the Leaf as a reliable fitness and calorie tracker. Campaigns can emphasize that Bellabeat devices help users visualize the real impact of daily movement on calorie burn — encouraging healthier choices.

Conclusion

This analysis demonstrates how Bellabeat can leverage smart device data to better understand user behavior. By connecting activity, sleep, and calorie trends, the marketing team can design targeted messages and personalized features for the Leaf wellness tracker and Bellabeat app.
Encouraging consistent movement, supporting balanced sleep habits, and showcasing accurate calorie tracking will strengthen customer engagement and position Bellabeat as a trusted partner in women's daily wellness.