

How to Use The Sedentary Profiles

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Introduction

The main purpose of this vignette is to show you how to use the sedentary profiles. I have tried to write it as non-technically as possible, in recognition that most people are not R programmers, and many are not coders at all. That said, the profiles were created in R, and they need to be implemented in R. So I will not be able to avoid technical talk altogether. If you feel anything could be clearer, you are probably not alone. Please reach out on the Issues page (<https://github.com/paulhibbing/SBprofiles/issues>) and let me know what doesn't work or doesn't make sense. Others will thank you, and I will too!

Before you proceed with the vignette, you will need to install the following free programs, if you haven't already:

1. R (<https://www.r-project.org/>)
 - This is the R programming language
2. RStudio (<https://rstudio.com/products/rstudio/download/#download>)
 - This is technically optional, but **strongly** recommended. It is a program that enhances R by allowing you to work more interactively (type, point, click etc). It makes R into more of a “program” in the familiar sense.

You can also set up a profile on GitHub (<https://github.com/join>). This is optional unless you want to communicate on the SBprofiles web page (<https://github.com/paulhibbing/SBprofiles>), e.g., by posting an Issue.

Setting up the Code

Once you have R, you need to get a copy of the SBprofiles code. You can do that in several ways, but I am going to focus on the easiest one. Simply open RStudio, paste the below code into your console, and press enter. If the code doesn't work, let me know. The most likely causes are 1) failure of dependencies to install, or 2) poor cross-platform coding. (The package was written using Windows 10 and may run into issues on other operating systems.) There's also a chance your system won't like this vignette, which gets lumped into the installation with all the code and everything else. Regardless, please let me know so I can find a solution.

```
if (!"remotes" %in% installed.packages()) install.packages("remotes")
remotes::install_github("paulhibbing/SBprofiles")
```

```
## If the above doesn't work, try the below. One or both of these extra arguments might help

remotes::install_github(
  repo = "paulhibbing/SBprofiles",
  dependencies = FALSE,
  build_vignettes = FALSE
)
```

Using the Code

To use the code, you need some accelerometer data. For now, let's start with the built in example data. Use this code to load it:

```
data(example_data, package = "SBprofiles")

## If you want a sense of how the data are structured,
## un-comment and run the below. It will show you a few rows of data.

# head(example_data)
```

Before we go further, you may want to familiarize yourself with the main functions available in the SBprofiles package. Use the below code to look at the help pages. Don't worry if you find them unhelpful right now – It's just good to know they are there. If you get stuck in the future, you can come back to them, and they may make more sense over time.

```
?SBprofiles::sb_bout_dist
?SBprofiles::get_profile
?SBprofiles::nhanes_wear
```

From here, let's see how we would determine the sedentary profile for the data we loaded earlier. It ends up being fairly easy. All we have to do is run the following command:

```
SBprofiles::get_profile(
  object = example_data, ## Give it the data you want to evaluate
  method = "both", ## Can be 'decisionTree', 'randomForest', or 'both'
  id = NULL, ## This could name a stratifying variable if applicable
  counts = "PAXINTEN", ## Name the activity counts variable
  sb = 100, ## Provide the SB cut point
  min_bout = 1, ## Minimum bout length. Must be 1 or 5
  valid_indices = NULL ## Optional vector of indices that meet wear time criteria
)
#>   decisionTree randomForest
#> 1 Intermediate Intermediate
```

Let's change the settings to illustrate how else this could work.

```
## Randomly sample 8000 row numbers to use as "valid indices". In a real
## analysis, you might use this approach to specify which rows occurred on days
## that have 10+ hours of wear time. (Notably, the `get_profile` function does
```

```
## test for wear time internally, but it does not check for the extra criteria
## like daily wear requirements)

valid_indices <- sample(
  seq(nrow(example_data)), 8000
)

SBprofiles::get_profile(
  object = example_data,
  method = "decisionTree",
  id = "PAXDAY", ## Stratifying by day, just for illustration
  counts = "PAXINTEN",
  sb = 100,
  min_bout = 5,
  valid_indices = valid_indices
)

#> PAXDAY decisionTree
#> 1      1 Interrupted
#> 2      2 Interrupted
#> 3      3 Interrupted
#> 4      4 Interrupted
#> 5      5 Interrupted
#> 6      6 Interrupted
#> 7      7 Interrupted
```

So there you go! You have now determined the sedentary profile for one participant (or several, if you have cleverly used the `id` argument). You can close this vignette if that's all you need. However, there are a few other topics you may find useful for supplementary analysis and work. That's what the rest of the vignette will cover.

Retrieving the bout distribution

When we used the `get_profile` function, R took care of the whole profiling process for us under the hood. That means it pulled out the participant's bout distribution and analyzed it. If we want to see the distribution for ourselves, we can use the `sb_bout_dist` function in one of two ways:

1) By directly providing information for one person

```
SBprofiles::sb_bout_dist(
  is_sb = example_data$PAXINTEN <= 100, ## SB cut point
  is_wear = SBprofiles::nhanes_wear(example_data$PAXINTEN) ## Choi non-wear algorithm
)

#> total_weartime_min n_SB_bouts min_bout_threshold total_SB_min Q10_bout
#> 1      5356      157      5      1502      5
#> Q20_bout Q25_bout Q30_bout Q40_bout Q50_bout Q60_bout Q70_bout Q75_bout
#> 1      5      6      6      6      7      8      10      11
#> Q80_bout Q90_bout IQR IDR SB_perc bout_frequency
#> 1      12      16  5  11 0.2804332      1.758775
```

2) By providing data frame input and setting up a stratified analysis (much like we did for `get_profile`)

```
SBprofiles::sb_bout_dist(
  df = example_data,
  min_bout = 1,
  id = "PAXDAY",
  counts = "PAXINTEN",
  sb = 100
)
```

#>	PAXDAY	total_wear_time_min	n_SB_bouts	min_bout_threshold	total_SB_min	Q10_bout
#> 1	1	783	60	1	182	1
#> 2	2	840	106	1	350	1
#> 3	3	774	89	1	417	1
#> 4	4	743	77	1	457	1
#> 5	5	617	67	1	351	1
#> 6	6	874	118	1	367	1
#> 7	7	725	84	1	222	1

#>	Q20_bout	Q25_bout	Q30_bout	Q40_bout	Q50_bout	Q60_bout	Q70_bout	Q75_bout
#> 1	1	1	1.0	1.0	2	3.0	3.3	4.00
#> 2	1	1	1.0	2.0	2	3.0	3.0	3.75
#> 3	1	1	2.0	2.2	3	4.0	5.0	5.00
#> 4	1	1	1.8	2.0	3	5.0	6.0	8.00
#> 5	1	1	1.0	2.0	3	4.0	5.0	6.00
#> 6	1	1	1.0	2.0	2	2.2	3.0	4.00
#> 7	1	1	1.0	1.0	2	2.0	3.0	3.00

#>	Q80_bout	Q90_bout	IQR	IDR	SB_perc	bout_frequency
#> 1	5.0	6.0	3.00	5.0	0.2324393	4.597701
#> 2	4.0	7.0	2.75	6.0	0.4166667	7.571429
#> 3	6.4	10.2	4.00	9.2	0.5387597	6.899225
#> 4	9.0	15.2	7.00	14.2	0.6150740	6.218035
#> 5	6.0	10.4	5.00	9.4	0.5688817	6.515397
#> 6	4.0	7.3	3.00	6.3	0.4199085	8.100686
#> 7	4.0	5.7	2.00	4.7	0.3062069	6.951724

After retrieving the bout distribution

If we manually run `sb_bout_dist`, we can feed the output directly into `get_profile`. This allows us to look at both the bout distribution and the sedentary profile, although it does mean we have to do two steps instead of one. For right now, this two-step process only works if `sb_bout_dist` is used according to option #1 above. Implementing it with our example data would look like this:

```
bout_info <- SBprofiles::sb_bout_dist(
  is_sb = example_data$PAXINTEN <= 100,
  is_wear = SBprofiles::nhanes_wear(example_data$PAXINTEN)
)

profile <- SBprofiles::get_profile(bout_info)
## (We can get more sophisticated output if we add extra settings
## like we did before, but this is fine for now)
```

```

print(profile)
#> $decisionTree
#> [1] Interrupted
#> Levels: Interrupted Intermediate Prolonged
#>
#> $randomForest
#> [1] Interrupted
#> Levels: Interrupted Intermediate Prolonged

```

Managing your own accelerometer data

Before wrapping up, let's address how you can get your own data into R, and how you can pre-process it so you can apply the SBprofiles code. That will ultimately depend on what type of monitor data you are using. I can't be exhaustive here, but I will give an example that will hopefully help. In the code below, I'll show how you might handle data from an ActiGraph data file. If you use a different monitor, the trick will be finding tools that allow you to use these same concepts on your specific data. In many cases, the tools are probably out there. If not, you might end up being the one to provide them by the time you're finished!

```

## First, make sure you have the right packages installed

packages <- c("AGread", "PhysicalActivity", "magrittr")
invisible(lapply(
  packages, function(x) if (!x %in% installed.packages()) install.packages(x)
))

## Attach the magrittr package (makes code more readable via pipe operators like %>%)

library(magrittr)

## Find an example data file

ag_file <-
  system.file("extdata/example1sec.csv", package = "AGread") %T>%
  {stopifnot(file.exists(.))}

## Process the file using various packages, and
## store the result in an object called AG

AG <-

  ## Read and reintegrate
  AGread::read_AG_counts(ag_file) %>%
  AGread::reintegrate(60, direction = "forwards") %>%

  ## The next part is a hack I've needed in the past in order to get the
  ## non-wear algorithm to work
  within({
    TimeStamp = as.character(TimeStamp)
  }) %>%

```

```

## Now run the algorithm
PhysicalActivity::wearingMarking(
  perMinuteCts = 1, TS = "TimeStamp", cts = "Axis1",
  newcolname = "is_wear", getMinuteMarking = TRUE
) %>%

## Get the sedentary profile
cbind(., SBprofiles::get_profile(
  ., counts = "Axis1", method = "decisionTree"
)) %>%

## Take the `TimeStamp` variable back out
.[ ,names(.) != "TimeStamp"] %>%

## Convert the `is_wear` variable to logical
within({
  is_wear = ifelse(
    as.character(is_wear) == "nw", FALSE, TRUE
  )
}) %>%

## Rename the sedentary profile variable from 'decisionTree' to 'SB_profile'
stats::setNames(., gsub("^decisionTree$", "SB_profile", names(.)))

## View the data

AG
#>
#>      Timestamp      Date      Time Axis1 Axis2 Axis3 Steps Lux
#> 1 2019-02-14 08:58:00 2/14/2019 08:58:00    0    0    0    0    0
#> 2 2019-02-14 08:59:00 2/14/2019 08:59:00  1594  1529  1041    6    0
#> 3 2019-02-14 09:00:00 2/14/2019 09:00:00  9379  6709 11298   30    0
#>   Inclinator.Off Inclinator.Standing Inclinator.Sitting
#> 1              60                0                  0
#> 2              16                24                  0
#> 3               0                59                  1
#>   Inclinator.Lying Vector.Magnitude is_wear weekday days  SB_profile
#> 1              0              0.00  FALSE Thursday    1 Intermediate
#> 2              20             2441.79  FALSE Thursday    1 Intermediate
#> 3              0             16143.76  FALSE Thursday    1 Intermediate

```

That's it! Thanks for following along. Again, let me know on GitHub if there are improvements I can make.