CMPS Package

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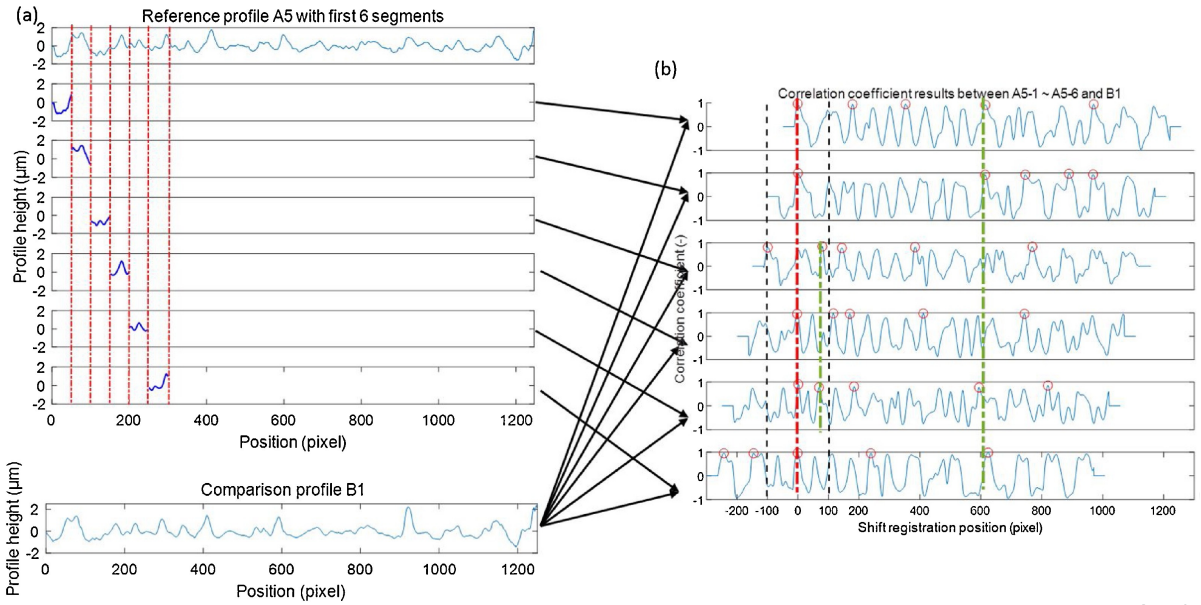
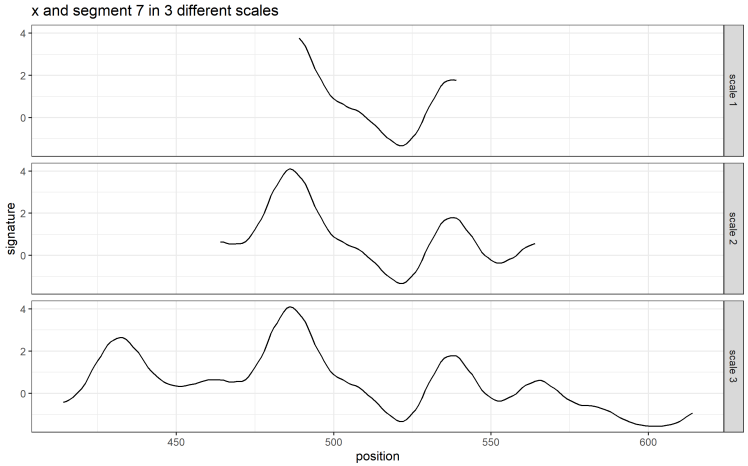
Overview

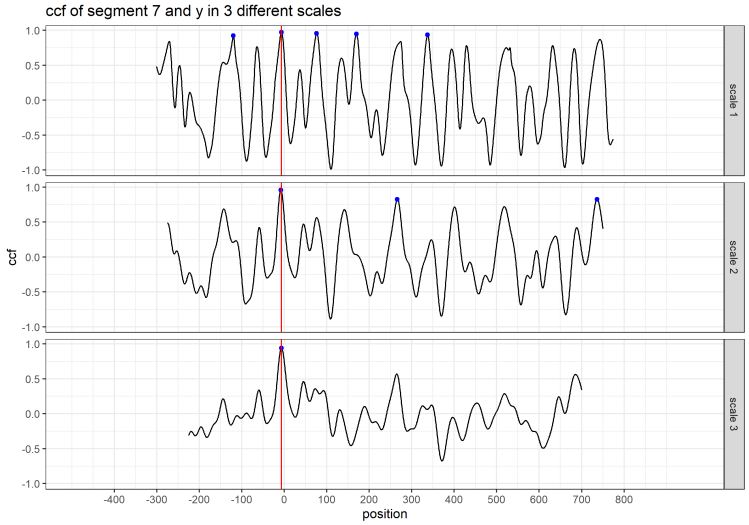
- Congruent Matching Profile Segments (CMPS) algorithm (Chen et al. 2019)



Overview

- Multi Segment Lengths





Install

- Since the package is not on CRAN yet, users can install the development version:

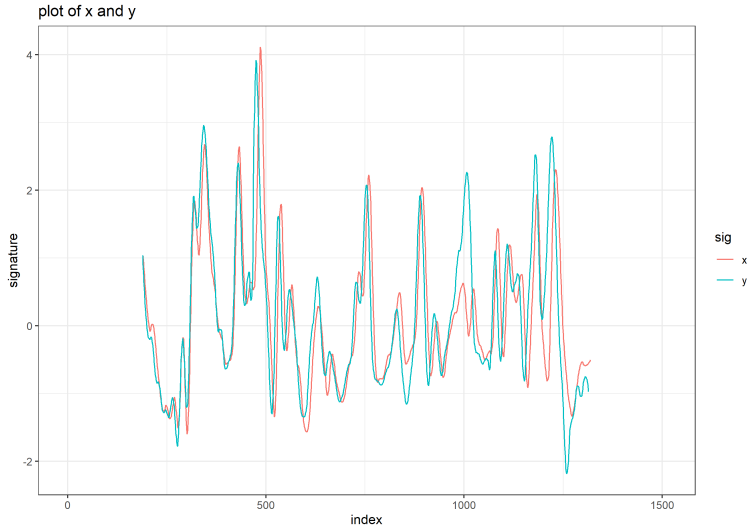
```
install.packages("devtools")
devtools::install_github("willju-wangqian/CMPS")
```

- The website of the package: https://willju-wangqian.github.io/CMPS/

- Chen, Zhe, Wei Chu, Johannes A Soons, Robert M Thompson, John Song, and Xuezeng Zhao. 2019. “Fired Bullet Signature Correlation Using the Congruent Matching Profile Segments (CMPS) Method.” Forensic Science International, December, #109964. https://doi.org/10.1016/j.forsciint.2019.109964

Input

- x, y are numeric vectors
  - x is the vector of the reference bullet signature/profile that will be divided into basis segments
  - y is the vector of the comparison bullet signature/profile
- if we plot profiles x and y, we have



  - In this example, x and y are profiles of a Known Matching comparison

The Main Function

```
library(CMPS)

cmps_result <- extract_feature_cmps(x, y)

## this comment shows default values of different arguments
## for more information, use ?extract_feature_cmps
# extract_feature_cmps(
#   x,
#   y,
#   seg_length = 50,
#   seg_scale_max = 3,
#   Tx = 25,
#   npeaks.set = c(5, 3, 1),
#   full_result = FALSE
# )
```

```
cmps_result
```

```
## [1] 14
```

- The output of the function (by default) is the CMPS score of this comparison

Multi segment lengths

- "multi-peak inspection" (the basic version)
  - `seg_scale_max = 1, npeaks.set = c(5)`
  - faster in running speed

```
extract_feature_cmps(x, y,
                     seg_scale_max = 1, npeaks.set = c(5))
```

- "multi-peak inspection at different segment scales" (multi segment length)
  - `seg_scale_max = 3, npeaks.set = c(5, 3, 1)`
  - detect 5 peaks at scale one; 3 peaks at scale two; 1 peak at scale three
  - default setting

```
extract_feature_cmps(x, y,
                     seg_scale_max = 3, npeaks.set = c(5, 3, 1))
```

Full Comparison of Two Bullets

- The bullet examples are coming from Hamby252; the URL of these bullets are stored in **`bullets$source`**

```
library(CMPS)
data("bullets")

bullets$source
```

- we have two bullets, and each bullet has 6 lands (6 bullet signatures/profiles)
- in total, we have 36 comparisons, and 6 of them are Known Matching comparisons

Full Comparison of Two Bullets

- present the CMPS score in a matrix form

```
full_comparison.matrix
```

```
##      1-1 1-2 1-3 1-4 1-5 1-6
## 2-1    2   5   3   4   3   2
## 2-2    2   2  13   1   1   1
## 2-3    1   1   2  11   2   2
## 2-4    2   1   1   1  10   1
## 2-5    1   2   1   2   2  15
## 2-6   14   2   2   2   1   1
```

- $CMPS_{max} = 15$

Thank you