treecm: an introduction

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1 Examples

1.1 Plot centre of mass

We will make use of the data set bundled in the package to plot a basic view of masses of branches and logs of a stone pine sampled by the author:

```
> library(treecm)
> data(treeData)
> print(treeData)
```

```
$fieldData
    azimuth dBase dTip length tipD height tilt toBePruned    biomass
L1      275    73   41   10.2 2.50   0.00   80      FALSE 1740.88372
L2      275    41   16    3.9 2.75  10.20   80      FALSE  183.92713
B1      190    15    0     NA 7.95  10.10    0      FALSE  119.69839
B2      200    22    0     NA 7.95  10.40    0      FALSE  246.69214
B3      230    15    0     NA 7.95  10.40    0      FALSE  119.69839
B4      200    18    0     NA 7.95  11.15    0      FALSE  168.88783
B5      180     7    0     NA 7.95  11.30    0      FALSE   28.38618
B6      150     6    0     NA 7.95  11.30    0      FALSE   21.21769
B7      340    16    0     NA 3.95  11.30    0      FALSE  135.21104
B8      220    13    0     NA 7.95  11.80    0      FALSE   91.35675
B9      165    19    0     NA 7.95  11.80    0      FALSE  187.04037
B10     280     8    0     NA 3.95  11.90    0      FALSE   36.52644
B11     170     9    0     NA 7.95  11.90    0      FALSE   45.62402
B12     265     8    0     NA 7.95  12.20    0      FALSE   36.52644
B13      75     6    0     NA 3.95  12.20    0      FALSE   21.21769
B14     180     6    0     NA 7.95  12.20    0      FALSE   21.21769
B15     170     6    0     NA 7.95  12.60    0      FALSE   21.21769
B16     120     5    0     NA 7.95  12.60    0      FALSE   15.03793
B17      10    14    0     NA 3.95  13.00    0      FALSE  105.07799
B18     180    13    0     NA 7.95  13.00    0      FALSE   91.35675
B19     260    13    0     NA 7.95  13.20    0      FALSE   91.35675
B20      75     6    0     NA 3.95  13.20    0      FALSE   21.21769
```

```
B21      75    10    0     NA 3.95  13.75    0      FALSE   55.66636
B22     215     7    0     NA 7.95  13.75    0      FALSE   28.38618
B23     140     7    0     NA 7.95  13.75    0      FALSE   28.38618
C       275    16    0    3.0 3.00  14.10   80      FALSE  135.21104

$density
[1] 620

$allometryFUN
function (x, diameter)
{
    a <- 0.7201
    b <- 1.8882
    powerEquation(a, b, as.real(x[diameter]))
}

$branchesCM
[1] 1
```

This data set has been collected for a 17.1 metres tall stone pine whose stem was tilted approx. 20° from the vertical plane (or 80° from the horizonatal plane). The stem has been sectioned in two logs (`L1` and `L2`), and a final branch (`C`). The crown was made up of 23 branches (`B1-B23`), all of them horizontal (ie tilted 0°). The package recognizes rows as branches because their diameter at tip is 0.

Please notice that some rules have to be followed in order to record sound data in the field:

- the diameter of the tip of `L1` is equal to the diameter of the base of `L2`. `L2` tip diameter is, in turn, equal to `C` base diameter. Height figures must match as well as diameter measures
- the distance of the tip of the branch (`tipD`) is not the length of the branch but the distance between tree base (the origin of the cartesian plot) and branch tip
- note that only the `length` of `C` branch has been recorded as it is the only branch not being horizontal. Non horizontal branches affect tree CM z-coordinate. When non-horizontal branches are present, and if one is interested in the z-coordinate of CM, than one should record branch length and its angle from the horizonatl plane (`tilt`). Otherwise branch `length` is not needed.

Let's get going and compute the centre of mass of this pine:

```
> vectors  <- treeVectors(treeData)
> CM       <- centreOfMass(vectors)
> summary(CM)
```

```
Coordinates of the centre of mass:
Cartesian (x/m, y/m, z/m): -2.09 , -1.98 , 7.70
Polar (angle/degrees, distance/m, height/m): 226 , 2.88 , 7.70
```

The core of the package is the `summary` method for CM object. The centre of mass for this stone pine lies 2.88 metres South-West of tree base (226° from magnetic North), 7.70 metres above ground. Cartesian coordinates are provided as well, though not so usefull as polar ones.

A simple visualization of tree centre of mass and its logs and branches is achieved simply by:

```
> plot.vectors(vectors,
+   CM = CM,
+   main = "A stone pine centre of mass"
+ )
```