Currently, Rfast has 6 functions related to robust statistics, colMads, med, rowMedians, colMedians, spat.med and rmdp. The first refers to the mean absolute deviation of each variable when a matrix is given, whereas the next three refer to the medians. Med calculates the median of a vector, whereas rowMedians and colMedians to the row-wise and column-wise medians of a matrix. The spatial median (for multivariate data) is obtained via spat.med and multivariate outliers in high dimensional data using a high dimensional MCD algorithm are detected via rmdp.

Below are some time measurements using a desktop with Intel(R) Core it-4690K at 3.50 GHz and 32 GB RAM. We used the packages matrixStats and ICSNP.

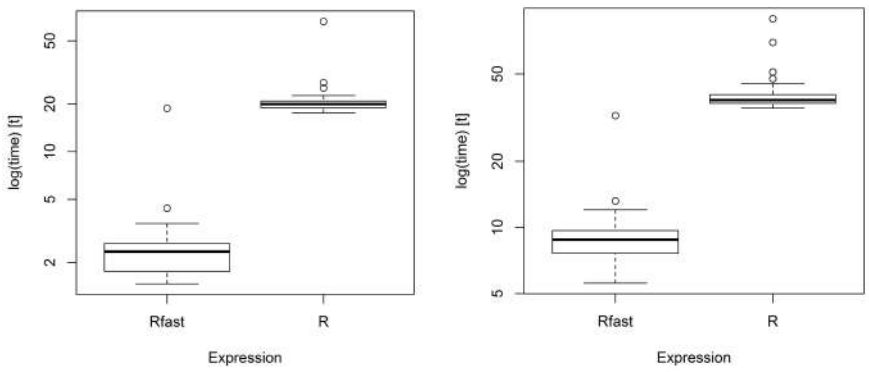

Figure 1: Box plots of time required by Rfast::med and stats::median to calculate the median of a vector with 100 (left) and 1000 (right) values.

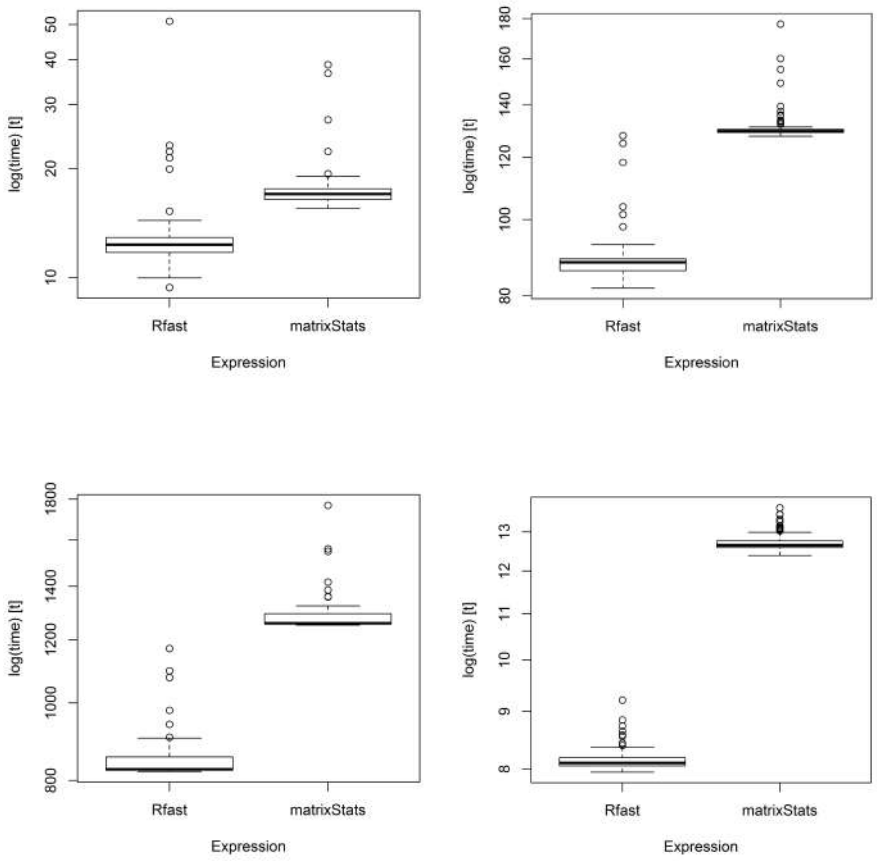

Figure 2: Box plots of time required by Rfast::colMedians and matrixStats::colMedians to calculate the column-wise medians of a matrix with dimensions 100x10 (upper left), 1000x10 (upper right), 1000x100 (lower left) and 10000x100 (lower right).

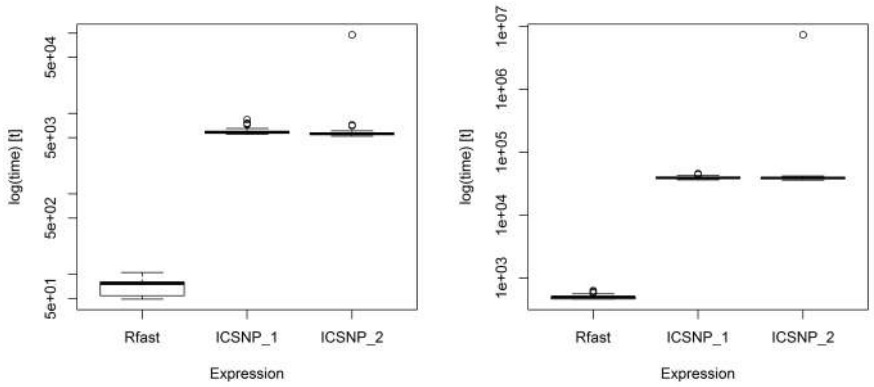

Figure 3: Box plots of time required by Rfast::spat.med(x) and ICSNP::spatial.median to calculate the spatial median of a matrix with dimensions 100x10 (left), 1000x10 (right). Each graph contains two evaluations of the spatial median using the ICSNP package. The first is when no initial values are given and the second is when the column-wise medians calculated by Rfast are supplied.

The R codes that produced these plots are given below.

```
x <- rnorm(100)  ## median of a vector with 100 values

mb <- microbenchmark(Rfast = med(x), R = median(x))

boxplot(mb)
```

```
x <- rnorm(1000)  ## median of a vector with 1000 values

mb <- microbenchmark(Rfast = med(x), R = median(x))

boxplot(mb)
```

```
x <- matrix(rnorm(100*10),ncol=10)  ## colMedians

mb <- microbenchmark(Rfast = Rfast::colMedians(x), matrixStats = matrixStats::colMedians(x))

boxplot(mb)
```

```
x <- matrix(rnorm(1000*10),ncol=10) )  ## colMedians

mb <- microbenchmark(Rfast = Rfast::colMedians(x), matrixStats = matrixStats::colMedians(x))
```

```
boxplot(mb)


x <- matrix(rnorm(1000*100),ncol=100) )  ## colMedians

mb <- microbenchmark(Rfast = Rfast::colMedians(x), matrixStats = matrixStats::colMedians(x))

boxplot(mb)


x <- matrix(rnorm(10000*100),ncol=100) )  ## colMedians

mb <- microbenchmark(Rfast = Rfast::colMedians(x), matrixStats = matrixStats::colMedians(x))

boxplot(mb)


x <- matrix(rnorm(100*10),ncol=10)  ## spat.med

mb <- microbenchmark(Rfast = spat.med(x),

ICSNP_1 = spatial.median(x, init = NULL, maxiter = 500, eps = 1e-09, print.it = FALSE, na.action = na.fail),

ICSNP_2 = spatial.median(x, init = colMedians(x), maxiter = 500, eps = 1e-09, print.it = FALSE, na.action = na.fail) )

boxplot(mb)


x <- matrix(rnorm(1000*10),ncol=10)  ## spat.med

mb <- microbenchmark(Rfast = spat.med(x),

ICSNP_1 = spatial.median(x, init = NULL, maxiter = 500, eps = 1e-09, print.it = FALSE, na.action = na.fail),

ICSNP_2 = spatial.median(x, init = colMedians(x), maxiter = 500, eps = 1e-09, print.it = FALSE, na.action = na.fail) )

boxplot(mb)
```