HawkesModel

Fitting Hawkes model to marathon record data

Produce estimates for model, exponential Hawkes process, using MLE: - baseline intensity, - reproduction mean
- exponential fertility function rate

Note: data is in days from the first world record which is set as time 0. The

```
record_table_mod<-read_rds("record_table_mod.rds")

days_between = as.numeric(diff(record_table_mod$Date_ymd))
daysfromstart <- cumsum(days_between)
daysfromstart <- c(0,daysfromstart)  ### get data in terms of days from first record (time 0)

optMarathon<-mle(daysfromstart,"Exponential",40300)  # end date picked number greater than longest time
optMarathon$par
```

```
## [1] 0.0008079562 0.4302863246 0.0014773235
```

```
summary(optMarathon)
```

```
##        Length Class            Mode
## par     3     -none-           numeric
## model   1     Rcpp_Exponential S4
## events 50     -none-           numeric
## end     1     -none-           numeric
## opt    20     nloptr           list
```

```
optMarathon$events
```

```
##  [1]     0   161   203   288   290   403  1753  1772  2319  4412  6289  7651
## [13]  9736  9746  9749  9963 14148 16031 16395 16508 16773 17551 18293 19041
## [25] 19931 20049 20070 20413 20543 20777 21681 22225 22644 23932 25398 26209
## [37] 26798 27848 28029 29122 32930 33329 34232 34764 36227 36591 37683 38418
## [49] 38782 40231
```

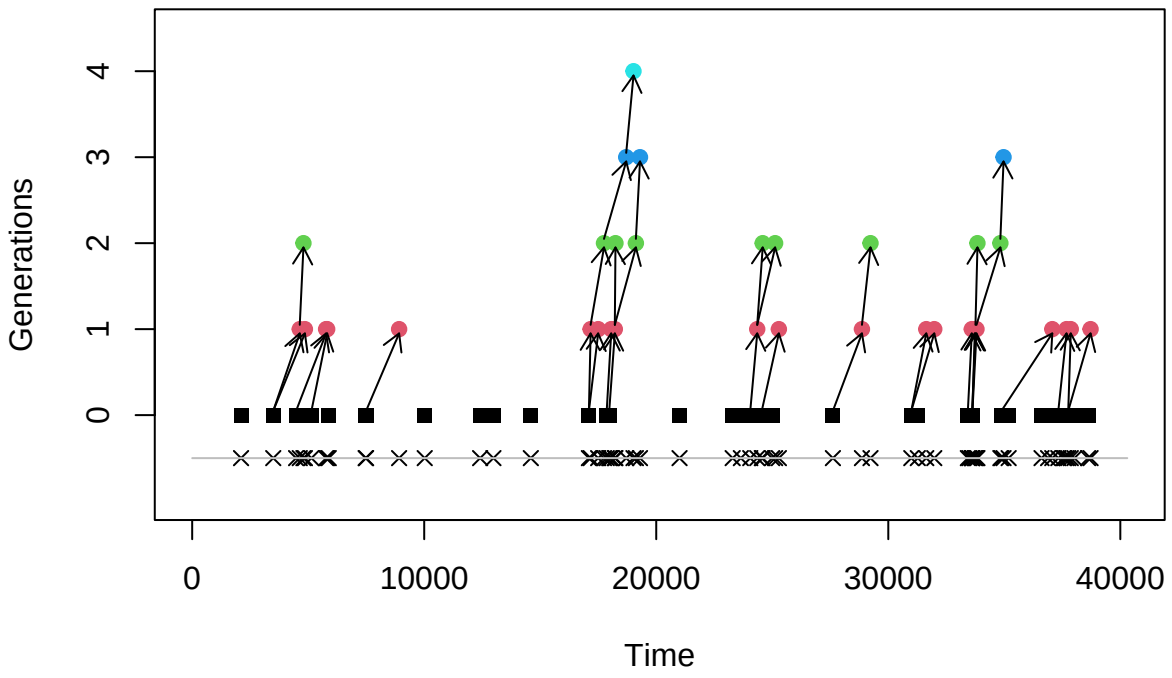
```
optMarathon$end
```

```
## [1] 40300
```

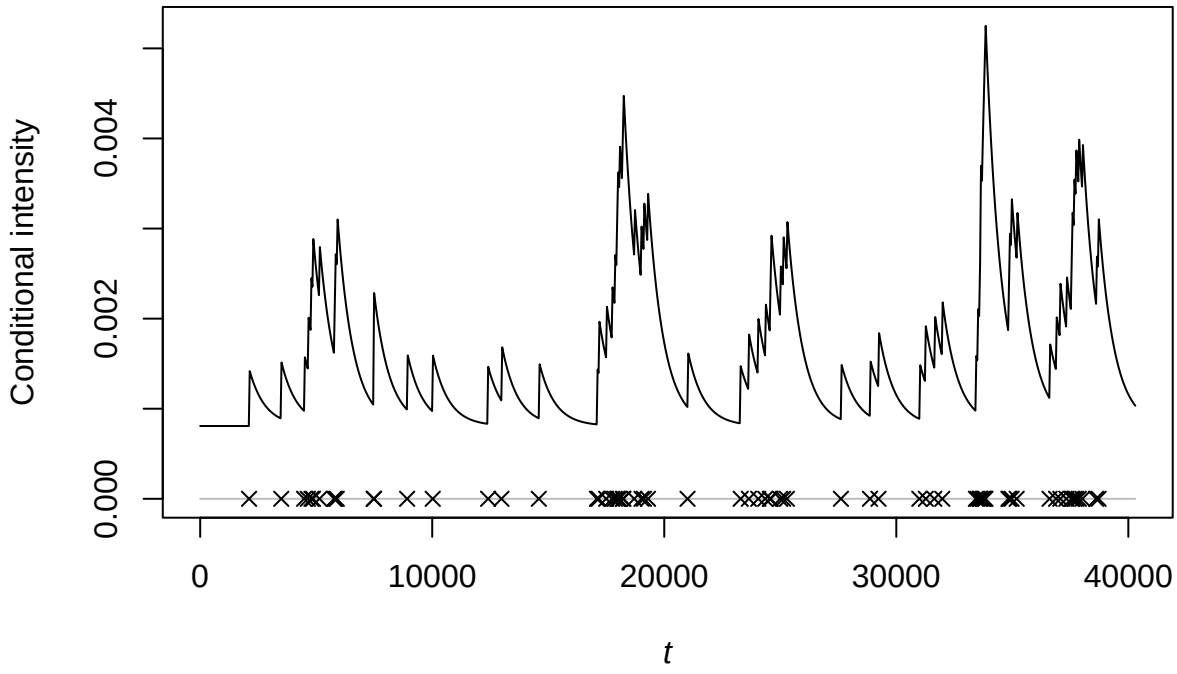
Simulation using Hawkes model with MLE parameter estimates from data

Simulation for the same number of days used in the estimation.

```
simRecs <- hawkes(40300, fun = optMarathon$par[1], repr = optMarathon$par[2],
                  family = "exp", rate = optMarathon$par[3])
plot(simRecs, intensity = FALSE)
```




```
plot(simRecs, intensity = TRUE)
```



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.