Vignette to R package: rectime

1 Load the data

After the package **rectime** has been installed, load the example dataset (a simulated dataset for illustration purpose).

```
library(rectime)
data(simdata)
```

The dataset `simdata` includes the following variables.

- `id`: ID of subjects.
- `time`: The time variable.
- `z1`: A continuous covariate.
- `z2`: A binary covariate.
- `type`: Type of the observation: 1 (event visit), 2 (regular visit), 0 (censoring time).

Note that the value of the two covariates (z1, z2) are marked as `NA` for the observations with type `0`.

The next step is to use the `recdata` function to transform the dataset `simdata` into the `rectime` data object as the required input type of the other functions.

```
recd <- recdata(id="id", type="type", time="time", data=simdata)
```

The arguments `id, type, time` are used to specify the column names for the three variables in the dataset specified by `data=`. The transformed dataset `recd` is a list of two datasets: one is for the observations at event times and one is for the observations at regular visits. The censoring time is included as a variable in both datasets.

The user may visualize the data using the following command:

```
plot.recdata(recd, time="time", n.id=5, ids=NULL, xlab="time", ylab
    ="id")
```

The above command plots the data for 5 subjects as the default. The user may specify the number of subjects in the plot by the argument `n.id` or the set of subject ids by the argument `ids`.

2 Data analysis

First, we fit the additive rates model to the example dataset using the proposed kernel smoothing method. We use a fixed bandwidth 1.

```
fit.add1 <- rectime(time ~ z1 + z2, recdata=recd, model="add",
    method="kernel", bandwidth=1)
```

The output is

```
Fitted additive rates model: time ~ z1 + z2
Estimated coefficients:
  Covariate  Est.
1        z1 0.0815
2        z2 0.4685
Number of subjects: 100
Average number of events per subject: 4.45
Average number of regular visits per subject: 11.05
```

If `bandwidth` is not specified, a selected bandwidth based on a proposed bandwidth selection procedure will be used.

The estimated standard errors of the regression coefficients by the bootstrap method can be provided by setting `SE=TRUE` as shown in the following `rectime` function, where `nb=` is for setting the number of resampling times:

```
fit.add2 <- rectime(time ~ z1 + z2, recdata=recd, model="add",
    method="kernel", SE=TRUE, nb=10)
```

The baseline mean function can be estimated by

```
fit.base <- recbase(fit.add1, time ~ z1 + z2, recdata=recd)
```

The output `fit.base` is a table with the estimated baseline mean function at 40 time points by default. The following command is for plotting the estimated baseline function.

```
plot.base(fit.base, main=NULL, xlab="time", ylab="baseline")
```

We have illustrated how to analyze recurrent event data with intermittenly observed time-dependent covariates by using the additive rates model. One can also use the `rectime` function to fit the proportional rates model or the additive-multiplicative rates model. The model specification for the two models is `model="prop"` and `model="add-mul"`, respectively.