The functions.R program that includes the functions and sample code for implementing the landmark PSH supermodel. The CSV file is a simulated example data including a time-fixed binary covariate and a time-dependent continuous covariate.

* **R functions**

In “*Landmark PSH supermodel sample code.R*” file, there are two functions defined, **Transdata.LM()** and **Fwpredict()**.

* + **Transdata.LM()** is used to transform each landmark subset into counting process format and to add IPCW weight. This function is used in building the stacked super dataset.
  + **Fwpredict()**is used to estimate the dynamic prediction. It calculates the conditional CIF based on the fitted landmark PSH supermodel. The model form in this function will need to be customized according to the specified landmark PSH supermodel.

In addition, the R packages of survival and dynpredare needed to implement the proposed method.

* **Example data**

“*Example data.csv*” file contains a simulated competing risks data as described in the simulation studies of our paper. There are time-fixed binary covariate z and time-dependent continuous covariate zt. As illustrated below, time is event time, failure indicates the event type (1=main event, 2=competing event, 0=censored), zt.time is the measure time of zt.

id time failure z zt.time zt

1 1 3.9269372 1 1 0.000000 2.212530

2 1 3.9269372 1 1 1.371795 4.170619

3 1 3.9269372 1 1 2.112957 5.228548

4 1 3.9269372 1 1 3.925255 7.815407

5 2 0.4726495 2 0 0.000000 3.754406

6 3 3.7873589 1 1 0.000000 3.032888

7 3 3.7873589 1 1 1.107997 5.680072

8 3 3.7873589 1 1 2.824324 9.780653

9 4 4.2372892 1 0 0.000000 3.620500

10 4 4.2372892 1 0 1.130476 5.908978

11 4 4.2372892 1 0 2.723349 9.133512

12 4 4.2372892 1 0 3.311103 10.323330

13 5 1.7472433 2 0 0.000000 2.837365

14 5 1.7472433 2 0 1.457901 5.347951

15 6 4.7201490 1 0 0.000000 2.702835

16 6 4.7201490 1 0 1.579315 5.612483

17 6 4.7201490 1 0 2.090319 6.553930

18 6 4.7201490 1 0 3.559243 9.260197

19 6 4.7201490 1 0 4.041027 10.147810

* **Instructions of implementing the landmark PSH supermodel**

The sample code in “*Landmark PSH supermodel sample code.R*” file is a template for implementing our method by using the simulated data as an example. It includes the following steps:

* + Specify the prediction window w and a set of fine grid landmark time points s0 which are used to fit the landmark PSH supermodel.
  + Build the stacked landmark super datasets, transform to counting process format, and add IPCW weights for competing events.
  + Construct parametric functions for landmark effects, and use Wald test with robust covariance matrix to test the landmark-covariate interactions to select the covariates of which the effects are dependent on the landmark points.

As the example showed, the Wald test for time-fixed covariate z was not significant (p-value=0.076), but significant for the time-dependent covariate zt (p-value=0.011.) This example focused on the main event.

* + Fit the final landmark PSH supermodel.

In the example, the final model included z, zt, zt\*s, zt\*s2, and baseline parameters with the estimated regression parameters showed below

|  |  |  |  |
| --- | --- | --- | --- |
| Covariate |  | Coefficients | Robust se of coef. |
| z | constant | 0.410 | 0.051 |
| zt | constant | -0.848 | 0.520 |
|  | s | 0.962 | 0.321 |
|  | s2 | -0.148 | 0.050 |
| Baseline parameters | s | -8.817 | 2.618 |
|  | s2 | 1.159 | 0.426 |

* + Calculate the conditional CIF for each selected landmark time point in dynamic prediction.