Motivating letter of the SurvMetrics add-on package

by Hanpu Zhou, Hong Wang, Sizheng Wang and Yi Zou*

Recently, survival models have found vast applications in biostatistics, bioinformatics, reliability engineering, finance and related fields. But there are few R packages specifically on evaluating the predictive power of survival models. To our knowledge, currently there are four related CRAN R packages, namely **Hmisc**(Harrell Jr, 2019), **survival**(Therneau and Lumley, 2014), **ipred**(Peters et al., 2009) and **survcomp**(Schröder et al., 2011), which can be used to get predictive metrics for survival models.

However, most of these available packages have implemented only one or two evaluation metrics and/or some of them often throw errors in real survival problems. Meanwhile, the available metrics are scatter across different R packages that use heterogeneous interfaces, which makes it difficult for the non-specialist to use or compare the performance of various survival models. And we try to fill the gap by providing an "all-in-one" R package called **SurvMetrics** which includes concordance index (C-index), Brier score (BS), integrated Brier score (IBS), integrated absolute error (IAE), integrated square error (ISE) and mean absolute error (MAE) and provides a uniform interface to an extensive set of performance assessment and statistical comparison methods. The major differences between **SurvMetrics** and other packages are threefold:

- Unlike existing R packages that calculate only one or two metrics, in the current version of the SurvMetrics package, six evaluation metrics are present which provides a uniform interface to an extensive set of performance assessment and statistical comparison methods. Practitioners can easily implement comparative studies and identify the best model(s) using this package.
- As far as we know, when calculating C-index, all the above mentioned packages in their current versions do not consider all the cases of tied survival data, i.e., samples with the same survival time, which will miss a lot of information. In the proposed R package, we will take a similar strategy adopted in Ishwaran et al. (2008) which takes full account of survival data tied.
- The calculation of IBS using `sbrier()` function from the **ipred** package does not always go smoothly. Users of `sbrier()` often receive error messages for incorrect input types. We have found that its input requirement of a list of *survfit* objects, which may be incorrectly provided by non-specialists. In the **SurvMetrics** package, we will make life easier for those non-specialists. Users only need to input survival time, survival status, the predicted survival probability matrix and the range of integration to the `IBS()` function, and our program will take care of all the rest work and give a correct output.

Hence, we present an "all-in-one" R package, **SurvMetrics**, that provides a more friendly way for non-statistical clinical research workers in evaluating survival models. This removes some of the barriers to survival model evaluating, opening it as a possibility to a broader class of users.