

Power calculations for prognostic biomarker validation studies with time to event data

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The Question

How should researchers determine the sample size needed to draw clinically relevant conclusions from a biomarker validation study with censored time-to-event data?

Context

Often a goal for a prognostic biomarker validation study is to test whether a marker has clinical value with respect to a given accuracy measure A (i.e. AUC_t , $TPR_t(c)$, $FPR_t(c)$, ...). This hypothesis test has the form:

$$H_0 : A \leq A_0 \text{ vs. } H_a : A > A_0$$

where A_0 is the minimal performance requirement for the marker.

Methods

Given a biomarker with expected accuramecy measure performance $A = A_{expected}$ we use Monte Carlo simulation to both *estimate* the sample size needed to achieve a specified level of power and *assess* the estimation performance for all accuracy measures given a sample size.

Modeling choices

Marker distribution: $Y \sim N(0, 1)$

Failure time: We assume a Cox proportional hazards model:

$$S(t|Y) = S_0(t)^{e^{\beta Y}}$$

where the baseline survival function is exponential:

$$S_0(t) = e^{-at}$$

Censoring We assume non-informative censoring. Censoring time follows a right truncated exponential distribution with point mass at followup time.

Altering Column Spans

You can make columns that span multiple other columns relatively easily. Lengths are defined in the template that make columns look normal-ish if you want to use a four-column layout like this poster. If you want to use a different number of columns, you will have to modify those lengths accordingly at the top of the poster.tex file.

In particular, near the top of the TeX file you will see lines that look like:

```
\setlength{\sepwid}{0.024\paperwidth}
\setlength{\onecolwid}{0.22\paperwidth}
\setlength{\twocolwid}{0.464\paperwidth}
\setlength{\threecolwid}{0.708\paperwidth}
```

Set “sepwid” to be some small length somewhere near 0.025 (this is the space between columns). Then if n is the number of columns you want, you should set

$$\text{onecolwid} = \frac{1}{n}(1 - (n + 1) \times \text{sepwid}),$$

$$\text{twocolwid} = 2 \times \text{onecolwid} + \text{sepwid},$$

$$\text{threecolwid} = 3 \times \text{onecolwid} + 2 \times \text{sepwid}.$$

Block Colours

For the standard blocks there are two colours; one for the title and one for the block body:

```
\setbeamercolor{block title}
{fg=red,bg=white}
```

```
\setbeamercolor{block body}
{fg=black,bg=white}
```

The *fg* colour sets the text colour and *bg* sets the background colour. For the normal blocks it makes no sense to use a background colour other than white. You *can* change it, but it will look weird!

References

Some references and a graphic to show you how it’s done:

- [1] D. W. Kribs, R. Laflamme, D. Poulin, M. Lesosky, Quantum Inf. & Comp. **6** (2006), 383-399.
- [2] P. Zanardi, M. Rasetti, Phys. Rev. Lett. **79**, 3306 (1997).

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