The “See”-Value App: Visual Decision Making for Drug Development

H. Diehl [1], A. M. Stein [2], N. Roy Chowdhury [2], M. Shiffman [1], A. Gelman [3], T. Broderick [1]

[1] MIT, [2] Novartis Pharmaceuticals, [3] Columbia

Motivation

In drug development, small trials inform large trials. It’s easy to see a signal from a small trial even when there isn’t one.

Want: A check for significance that is...

- Fast, easy, and intuitive
- Convincing even when users are incentivized to see a signal

Contribution

We provide a Shiny app that...

- Facilitates visual permutation tests as described in [1], [2], and [3].
- Allows users to explore the app through preloaded examples.
- Allows users to upload their data, view a lineup (see middle column), vote on the plot they think has the real data, and see if they are correct (+ supports team voting).
- Calculates the “see”-value based on votes from team members. This “see”-value can be used to decide significance.

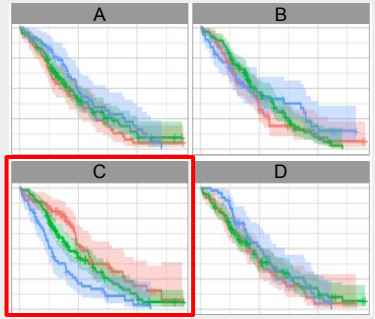
www.mit.edu/~hdiehl/lineups/

Lineup Testing

The app displays both the user’s data and simulated data generated under the null hypothesis (a “lineup” of plots).

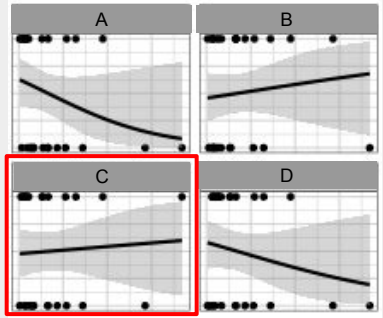
Currently, the app permutes the real data to generate null plots.

Lineup, **Significant**



Subset of facets (4 of 20), true data in C.

Lineup, **Non-significant**



Subset of facets (4 of 20), true data in C.

Team members then attempt to identify which plot contains real data.

Roughly, we are checking if analysts can reliably pick real data out of the lineup.

App Features

Supports biomarker-response analyses with the option to include subgroups, for any combination of:

X (biomarker)		Y (response)
Continuous Categorical	**VS**	Continuous Binary Time-to-Event

Supports team voting:

- User uploads data, specifies lineup settings, and shares configuration file.
- Teammates upload file + vote on lineup.
- User enters vote counts into in-app calculator to get “see”-value (as per [1]):

see-value = P($X \geq c$) for $X \sim$ Binom(N, $1/m$)

c is # of correct votes, N is # of total votes, m is # of plots in the lineup

References

[1] Buja et al. 2009 Statistical inference for exploratory data analysis and model diagnostics

[2] Majumder et al. 2013 Validation of Visual Statistical Inference, Applied to Linear Models

[3] Roy Chowdhury et al. 2015 Using visual statistical inference to better understand random class separations in high dimension, low sample size data

[4] DSAIRM by Handel Group at UGA for app template

[5] nullabor package by Cook et al. for lineup generation