

Multiple-test procedures and smile plots

Roger Newson
King's College London, UK
roger.newson@kcl.ac.uk

The ALSPAC Study Team
University of Bristol, UK
<http://www.alspac.bris.ac.uk>

Abstract.

`multproc` carries out multiple-test procedures, taking as input a list of p -values and an uncorrected critical p -value, and calculating a corrected overall critical p -value for rejection of null hypotheses. These procedures define a confidence region for a set-valued parameter, namely the set of null hypotheses that are true. They aim to control either the family-wise error rate (FWER) or the false discovery rate (FDR) at a level no greater than the uncorrected critical p -value. `smileplot` calls `multproc` and then creates a smile plot, with data points corresponding to estimated parameters, the p -values (on a reverse log scale) on the y -axis, and the parameter estimates (or another variable) on the x -axis. There are y -axis reference lines at the uncorrected and corrected overall critical p -values. The reference line for the corrected overall critical p -value, known as the parapet line, is an informal “upper confidence limit” for the set of null hypotheses that are true and defines a boundary between data mining and data dredging. A smile plot summarizes a set of multiple analyses just as a Cochrane forest plot summarizes a meta-analysis.

Keywords: st0035, smile plot, multiple-test procedure, closed testing procedure, data mining, family-wise error rate, false discovery rate, Bonferroni, Šidák, Holm, Holland, Copenhaver, Hochberg, Rom, Simes, Benjamini, Yekutieli, Krieger, Liu