

HARVARD UNIVERSITY
DEPARTMENT OF STATISTICS



Tel. 617-495-5496
Fax. 617-496-8057
statdept@stat.harvard.edu
<http://www.stat.harvard.edu/>

Science Center 7th Fl.
One Oxford Street
Cambridge, MA 02138

DEMPSTER AWARD COLLOQUIUM

MONDAY, APRIL 25, 2016

TALK: 4:00 PM — SCIENCE CENTER RM. 705

RECEPTION: 5:15 PM — SCIENCE CENTER, 7TH FLOOR

“Randomization-Based Causal Inference from Unbalanced 2^2 Split-Plot Designs”

Anqi Zhao

**Department of Statistics
Harvard University**

ABSTRACT

Given two 2-level factors of interest, a 2^2 split-plot design (a) takes each of the $2^2=4$ possible factorial combinations as a treatment, (b) identifies one factor as ‘whole-plot’, (c) divides the experimental units into blocks, and (d) assigns the treatments in such a way that all units within the same block receive the same level of the whole-plot factor.

Assuming the potential outcomes framework, we propose in this paper a randomization-based estimation procedure for causal inference from 2^2 designs that are not necessarily balanced. Sampling variances of the point estimates are derived in closed form as linear combinations of the between- and within-block covariances of the potential outcomes. Results are compared to those under complete randomization as measures of design efficiency. Interval estimates are constructed based on conservative estimates of the sampling variances, and the frequency coverage properties evaluated via simulation. Asymptotic connections of the proposed approach to the model-based super-population inference are also established. Superiority over existing model-based alternatives is reported under a variety of settings for both binary and continuous outcomes.