

Statistics Seminar
Department of Mathematical Sciences

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| DATE: | Thursday, Dec. 2, 2021 |
| TIME: | 1:15pm - 2:15pm |
| LOCATION: | Zoom meeting |
| SPEAKER: | Zhou Wang, Binghamton University |
| TITLE: | Testing for Outliers with Conformal p-values |

Abstract

This paper studies the construction of p-values for nonparametric outlier detection, taking a multiple-testing perspective. The goal is to test whether new independent samples belong to the same distribution as a reference data set or are outliers. The authors propose a solution based on conformal inference, a broadly applicable framework which yields p-values that are marginally valid but mutually dependent for different test points. They prove these p-values are positively dependent and enable exact false discovery rate control, although in a relatively weak marginal sense. They then introduce a new method to compute p-values that are both valid conditionally on the training data and independent of each other for different test points; this paves the way to stronger type-I error guarantees. Their results depart from classical conformal inference as they leverage concentration inequalities rather than combinatorial arguments to establish their finite sample guarantees. Furthermore, their techniques also yield a uniform confidence bound for the false positive rate of any outlier detection algorithm, as a function of the threshold applied to its raw statistics. Finally, the relevance of results is demonstrated by numerical experiments on real and simulated data.

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