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Title: Generalized fiducial inference with application to forensic science

Abstract: R. A. Fisher, the father of modern statistics, developed the idea of fiducial inference during the first half of the 20th century. While his proposal led to interesting methods for quantifying uncertainty, other prominent statisticians of the time did not accept Fisher's approach as it became apparent that some of Fisher's bold claims about the properties of fiducial distribution did not hold up for multi-parameter problems. Beginning around the year 2000, the presenter and collaborators started to re-investigate the idea of fiducial inference and discovered that Fisher's approach, when properly generalized, would open doors to solve many important and difficult inference problems. They termed their generalization of Fisher's idea as generalized fiducial inference (GFI). The main idea of GFI is to carefully transfer randomness from the data to the parameter space using an inverse of a data generating equation without the use of Bayes theorem. The resulting generalized fiducial distribution (GFD) can then be used for inference. After more than a decade of investigations, the authors and collaborators have developed a unifying theory for GFI and provided GFI solutions to many challenging practical problems in different fields of science and industry. Overall, they have demonstrated that GFI is a valid, useful, and promising approach for conducting statistical inference. After introducing the general idea of GFI we will discuss promising applications of GFD to examining the validity of likelihood ratio assessments. We illustrate our approach by examining LR values calculated using standard approaches in the forensic literature. We also use the new tool to show limitations of a common method of post-hoc re-calibrating of outputs.