

Efficient and robust tests for semiparametric models

Jingjing Wu¹ · Rohana J. Karunamuni²

Received: 18 March 2016 / Revised: 11 October 2016 / Published online: 11 March 2017
© The Institute of Statistical Mathematics, Tokyo 2017

Abstract In this paper, we investigate a hypothesis testing problem in regular semiparametric models using the Hellinger distance approach. Specifically, given a sample from a semiparametric family of ν -densities of the form $\{f_{\theta, \eta} : \theta \in \Theta, \eta \in \Gamma\}$, we consider the problem of testing a null hypothesis $H_0 : \theta \in \Theta_0$ against an alternative hypothesis $H_1 : \theta \in \Theta_1$, where η is a nuisance parameter (possibly of infinite dimensional), ν is a σ -finite measure, Θ is a bounded open subset of \mathbb{R}^p , and Γ is a subset of some Banach or Hilbert space. We employ the Hellinger distance to construct a test statistic. The proposed method results in an explicit form of the test statistic. We show that the proposed test is asymptotically optimal (i.e., locally uniformly most powerful) and has some desirable robustness properties, such as resistance to deviations from the postulated model and in the presence of outliers.

Keywords Tests of hypotheses, Hellinger distance · Semiparametric models · Asymptotic optimality · Robustness · Adaptivity

This research was supported by research grants from the Natural Sciences and Engineering Research Council of Canada.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s10463-017-0608-y>) contains supplementary material, which is available to authorized users.

✉ Rohana J. Karunamuni
R.J.Karunamuni@ualberta.ca

¹ Department of Mathematics and Statistics, University of Calgary, Calgary, AB T2N 1N4, Canada

² Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, AB T6G 2G1, Canada