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Robustness and Density Power Divergence Measures

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SUMMARY

This paper is motivated by a classical experiment presented in Woodruff et al. (1984) and Simpson (1989). In that example males flies were exposed either to a certain degree of chemical to be screened or to control conditions and the responses are the numbers of recessive lethal mutations observed among daughters of those files. The data are given by

	0	1	2	3	4	5	6	7
Observed (Control)	159	15	3	0	0	0	0	0
Observed (Treated)	110	11	5	0	0	0	1	1

As in Simpson (1989), we will assume that the responses in the control group and the treated group are random samples from the Poisson distributions with mean θ_1 and θ_2 respectively. Our interest is in testing the hypothesis H_0: $\theta_1 \geq \theta_2$ against $H_1 : \theta_1 < \theta_2$. The apprehension is that the presence of the two large counts for the treated group may make the the mean of the second group appear larger, although this conclusion may not be supported by the rest of the data. Using Likelihood Ratio Test (LRT) based on Maximum Likelihood Estimator (MLE) we get $p\text{-}value = 0.0015$ and if we delete the two outliers (observations corresponding to observations 6 and 7 in observed treated we get $p\text{-}value = 0.1359$. What is the reason for this discordance? The problem is that the MLE as well as the LRT are not robust procedures.

In this paper we consider Density Power Divergence introduced and studied in Basu et al. (1998) for estimation and we use them in the framework of hypothesis testing to overcome the problem pointed previously. Some theoretical results are presented as well as a simulation study in order to study the robustness of the new procedure in relation to the procedures based on MLE and LRT.

Keywords: density power divergence, robustness, tests of hypotheses

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