

GOODNESS OF FIT TEST FOR LOGISTIC DISTRIBUTION INVOLVING KULLBACK-LEIBLER INFORMATION

(Ujian Kebagusan Penyuaian untuk Taburan Logistik menerusi Maklumat Kullback-Leibler)

S. A. AL-SUBH, K. IBRAHIM & A. A. JEMAIN

ABSTRACT

In this paper, our objective is to test the statistical hypothesis $H_0 : F(x) = F_o(x)$ for all x against $H_1 : F(x) \neq F_o(x)$ for some x , where $F_o(x)$ is a known distribution function. In this study, a goodness of fit test statistic for testing the logistic distribution based on Kullback-Leibler information as proposed by Song (2002) is studied. The logistic parameters are estimated by using several methods of estimation such as maximum likelihood, order statistics, moments, L-moments and LQ-moments. The critical value based on the statistics which involves the Kullback-Leibler information under the assumption that H_0 is true is computed using Monte Carlo simulations. The performance of the test under simple random sampling is investigated. Ten different distributions are considered under the alternative hypothesis. Based on Monte Carlo simulations, for all the distributions considered, it is found that the test statistics based on estimators found by moment and LQ-moment methods have the highest power, except for *Weibull* (2, .5) and Gamma distributions.

Keywords: Goodness of fit test; Kullback-Leibler information; logistic distribution

ABSTRAK

Objektif di dalam makalah ini ialah menguji hipotesis $H_0 : F(x) = F_o(x)$ untuk semua x melawan $H_1 : F(x) \neq F_o(x)$ untuk sesetengah x , yang $F_o(x)$ suatu fungsi taburan yang diketahui. Dalam kajian ini statistik ujian kebagusan penyuaian untuk taburan logistik berdasarkan maklumat Kullback-Leibler yang dicadangkan oleh Song (2002) dikaji. Parameter-parameter logistik dianggarkan dengan menggunakan berbagai-bagai kaedah penganggaran seperti kaedah kebolehjadian maksimum, statistik tertib, kaedah momen, momen-L dan momen-LQ. Nilai genting didasarkan statistik yang melibatkan maklumat Kullback-Leibler di bawah anggapan yang H_0 benar dan dihitung menerusi simulasi Monte Carlo. Prestasi ujian ini di bawah pensampelan rawak mudah dikaji. Sepuluh taburan yang berbeza dipertimbangkan sebagai hipotesis alternatif. Berdasarkan simulasi Monte Carlo telah didapati bahawa ujian statistik berdasarkan penganggar momen dan momen-LQ mempunyai kuasa yang terbesar kecuali bagi *Weibull* (2, .5) dan taburan-taburan Gama.

Kata kunci: Ujian kebagusan penyuaian; maklumat Kullback-Leibler; taburan logistik

References

- Arizono I. & Ohta H. 1989. A test for normality based on Kullback-Leibler Information. *Amer. Statistician*. **43**: 20-22.
- Balakrishnan N. 1992. *Handbook of the Logistic Distribution*. New York: Marcel Dekker, Inc.
- David H.A. & Nagaraja H.N. 2003. *Order Statistics*. 3rd Ed. Hoboken, NJ: Wiley.
- Hosking J.R.M. 1990. L-moments: Analysis and estimation of distribution using linear combinations of order statistics. *J. Roy. Statist. Se. B*. **52**: 105-124.
- Ibrahim K., Alodat M.T., Jemain A.A. & Al-Subh S.A. 2009. Chi-square test for goodness of fit using ranked set sampling. Tenth Islamic Countries Conference on Statistical Sciences. December 20-23, 2009, Cairo, Egypt.

- Song K.S. 2002. Goodness-of-fit tests based on Kullback-Leibler discrimination information. *IEEE Trans. Inform. Theor.* **48**: 1103-1117.
- Vasicek O. 1976. A test for normality based on sample entropy. *J. Roy. Statist. Soc.* **38**: 54-59.

*School of Mathematical Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
43600 UKM Bangi
Selangor DE, MALAYSIA
E-mail: salsubh@yahoo.com*, kamarulz@ukm.my, azizj@ukm.my*

*Corresponding author