

# A class of uniform tests for goodness-of-fit of the multivariate $L_p$ -norm spherical distributions and the $l_p$ -norm symmetric distributions

Jiajuan Liang<sup>1</sup> · Kai Wang Ng<sup>2</sup> · Guoliang Tian<sup>3</sup>

Received: 20 October 2012 / Revised: 14 July 2017 / Published online: 1 December 2017  
© The Institute of Statistical Mathematics, Tokyo 2017

**Abstract** In this paper we employ the conditional probability integral transformation (CPIT) method to transform a  $d$ -dimensional sample from two classes of generalized multivariate distributions into a uniform sample in the unit interval  $(0, 1)$  or in the unit hypercube  $[0, 1]^{d-1}$  ( $d \geq 2$ ). A class of existing uniform statistics are adopted to test the uniformity of the transformed sample. Monte Carlo studies are carried out to demonstrate the performance of the tests in controlling type I error rates and power against a selected group of alternative distributions. It is concluded that the proposed tests have satisfactory empirical performance and the CPIT method in this paper can serve as a general way to construct goodness-of-fit tests for many generalized multivariate distributions.

**Keywords** Goodness-of-fit · Monte Carlo study ·  $L_p$ -norm spherical distribution ·  $l_p$ -norm symmetric distribution · Uniformity

---

The research was supported in part by the University of Hong Kong Research Grant and University of New Haven Research Scholar Grant.

---

✉ Jiajuan Liang  
jliang@newhaven.edu

<sup>1</sup> College of Business, University of New Haven, 300 Boston Post Road, West Haven, CT 06516, USA

<sup>2</sup> Department of Statistics and Actuarial Science, The University of Hong Kong, Pokfulam Road, Hong Kong, China

<sup>3</sup> Department of Mathematics, Southern University of Science and Technology, 1088 Xueyuan Road, Nanshan District, Shenzhen 518055, China