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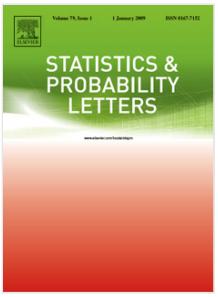

Distribution and moments of the vector of the maximum of two absolutely continuous random vectors

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Distribution and moments of the vector of the maximum of two absolutely continuous random vectors

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Abstract

In this paper, we determine the exact distribution of the vector of the componentwise maximum of two absolutely continuous dependent random vectors and we show that it is a finite mixture of particular skew distributions studied in the literature. The results are detailed when the two vectors are elliptically distributed and some particular cases are discussed. The exact expression of the covariance matrix is obtained in the normal case.

Keywords: Skew distributions, elliptical distributions, normal distributions, mixture, covariance, order statistics.

1. Introduction

Let $\mathbf{X} = (X_1, X_2, .., X_n)^t$ and $\mathbf{Y} = (Y_1, Y_2, .., Y_p)^t$, $p \leq n$, be two random vectors with joint absolutely continuous distribution. We are interested in the distribution of $\mathbf{Z} = \max(\mathbf{X}, \mathbf{Y})$ the componentwise maximum, that is $\mathbf{Z} = (\max(X_1, Y_1), .., \max(X_p, Y_p), X_{p+1}, ., X_n)^t$. The joint distribution of extreme measures is of interest in many practical situations from a variety of fields (medicine, education, etc.). (X_i, Y_i) may be observations taken from both sides of the same person (eyes, ears, etc.), as in the visual acuity problem studied by Olkin and Viana (2000): the visual acuity of the two eyes (left and right) of one subject are measured at p times, $\max(X_i, Y_i)$ is a synthetic index. They can also represent the scores obtained by one student in the discipline i among a total of p, only the highest is reported in each discipline. $X_{p+1}, .., X_n$

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