

Research Paper

Quadratic form solution of the multivariate skew Laplace distribution for fisher information

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Abstract: In this paper, we provide the expectation of a function of the quadratic form of the multivariate skew Laplace distribution using the generalized Laguerre series that can be applied to compute the elements of the Fisher information matrix. Finally, we give a numerical example to obtain the expectation of this quadratic form.

Keywords: Chi-Square distribution; Fisher information; Generalized Laguerre series.
Mathematics Subject Classification (2010): 33C45, 62B10.

1 Introduction

Consider \mathbf{Z} follows a p -dimensional normal distribution with mean vector $\mathbf{0}$ and covariance matrix I_p , and V follows a gamma distribution with parameters θ and $\frac{1}{2}$ such that $E(V) = 2\theta$. Also, consider that \mathbf{Z} and V are independent. The generalized asymmetric Laplace (GAL) distribution is a p - dimensional random variable defined as

$$X = \boldsymbol{\mu} + V\boldsymbol{\gamma} + \sqrt{V}\Sigma^{1/2}\mathbf{Z}, \quad (1)$$

where $\boldsymbol{\mu} \in \mathbb{R}^p$ is a location parameter, $\boldsymbol{\gamma} \in \mathbb{R}^p$ is a skewness parameter and Σ is a positive definite matrix. This distribution is a special case of the normal variance-mean mixture distributions and is introduced by Kotz et al. (2001). A spacial case of GAL distribution with $\theta = (p + 1)/2$ is considered by Arslan (2010) and some of its properties are studied. This spacial case is called multivariate skew Laplace (MSL) distribution with the following probability density function:

$$f(\mathbf{x}) = \frac{|\Sigma|^{1/2}}{c2^p\pi^{\frac{p-1}{2}}\Gamma(\frac{p+1}{2})} \exp(-c\sqrt{Q(\mathbf{x})} + A(\mathbf{x})),$$

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