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Matrix Variate Hypergeometric Gamma Distribution

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Abstract

In this paper a generalized matrix gamma distribution including generalized hypergeometric function and zonal polynomials is introduced. Some important statistical characteristics such as the Laplace transformation and expectation of determinant are given.

Keywords: Generalized hypergeometric function, Matrix variate hypergeometric gamma distribution, Multivariate gamma function, Zonal polynomials.
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The inverted matrix variate gamma (IMG) distribution, which is the distribution of the inverse of the gamma matrix (GM), is the generalized form of the inverted Wishart (IW) distribution. It can be found in Iranmanesh et al.(2013). It is well known and well documented that the IW and IMG distributions have many applications in inferential problems concerning the covariance matrix. In Bayesian analysis they are used as the conjugate prior for the covariance matrix of a multivariate normal distribution. recently Nagar et al. (2013) defined an extended matrix variate gamma distribution by extending the multivariate gamma function.
In the present article, an attempt has been made to give a generalized definition of MG and IMG distribution including generalized hypergeometric function and zonal polynomials and study some of their properties.

1 Introduction

Definition 1.1. The multivariate gamma function, denoted by $\Gamma_m(a)$ is defined

$$\begin{aligned}\Gamma_m(a) &= \int_{\boldsymbol{X}>0} etr(-\boldsymbol{X})(\det \boldsymbol{X})^{a-\frac{(m+1)}{2}} d\,\boldsymbol{X}, \\ &= \pi^{m(m-1)/4} \prod_{j=1}^{m} \Gamma\left(a - \frac{j-1}{2}\right), \end{aligned} \tag{1}$$

where $Re(a) > \frac{m-1}{2}$, $etr(.) \equiv exp\,\mathrm{tr}(.)$ and $\boldsymbol{X}(m \times m) > 0$ is a $m \times m$ positive definite matrix. The integral is over the space of positive definite (and hence symmetric) $m \times m$

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