# Matrix Variate Generalized Laplace Distributions

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## Abstract

The generalized asymmetric Laplace (GAL) distribution, also known as the *variance/mean-gamma* model, is a popular flexible class of distributions that can account for peakedness, skewness, and heavier than normal tails, often observed in financial or other empirical data. We consider extensions of the GAL distribution to the matrix variate case, which arise as covariance mixtures of matrix variate normal distributions. Two different mixing mechanisms connected with the nature of the random scaling matrix are considered, leading to what we term matrix variate GAL distributions of Type I and II. While Type I matrix variate GAL distribution has been studied before, there is no comprehensive account of Type II in the literature, except for their rather brief treatment as a special case of matrix variate generalized hyperbolic distributions. With this work we fill this gap, and present an account for basic distributional properties of Type II matrix variate GAL distributions. In particular, we derive their probability density function and the characteristic function, as well as provide stochastic representations related to matrix variate gamma distribution. We also show that this distribution is closed under linear transformations, and study the relevant marginal distributions. In addition, we also briefly account for Type I and discuss the interconnections with Type II. We hope that this work will be useful in the areas where matrix variate distributions provide an appropriate probabilistic tool for three-way or, more generally, panel data sets, which can arise across different applications.

## Keywords

Covariance mixture of Gaussian distributions, Distribution theory, Generalized Laplace distribution, MatG distribution, Matrix variate distribution, Matrix variate gamma distribution, Matrix gamma-normal distribution, Matrix variate $t$ distribution, Normal variance-mean mixture, Variance gamma distribution.