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SOME DECOMPOSITIONS OF MATRIX VARIANCES

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Abstract: When D is a density matrix and $A_1,\ A_2$ are self-adjoint operators, then the standard variance is a 2×2 matrix:

$$\mathrm{Var}_D(A_1, A_2)_{i,j} := \mathrm{Tr}\, DA_iA_j - (\mathrm{Tr}\, DA_i)(\mathrm{Tr}\, DA_j) \qquad (1 \le i, j \le 2).$$

The main result in this work is that there are projections P_k such that $D = \sum_k \lambda_k P_k$ with $0 < \lambda_k$ and $\sum_k \lambda_k = 1$ and $\mathrm{Var}_D(A_1, A_2) = \sum_k \lambda_k \mathrm{Var}_{P_k}(A_1, A_2)$. In a previous paper only the $A_1 = A_2$ case was included and the relevance is motivated by the paper [8].

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