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Algebraic properties of copulas defined from matrices

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We propose a new family of copulas, defined by:

$$S_\phi(u,v) = {}^t\phi(u)A\phi(v), \quad (u,v) \in [0,1]^2,$$

where ϕ is a function from $[0,1]$ to $\mathbb{R}^p$ and A is a $p \times p$ matrix. Let us remark that if $p = 2$ and A is a diagonal matrix, then S_ϕ reduces to the family proposed in [1]. As a consequence, S_ϕ can be seen as an extension of this former family to arbitrary matrices.
First, we shall give sufficient conditions on A and ϕ to obtain copulas. Then, we shall establish the dependence and symmetry properties of this family of copulas. Finally, we shall study the stability properties of S_ϕ with respect to the operator $*$ (presented for instance in [2], p. 194) as well as other algebraic properties.

References

[1] C. Amblard, S. Girard. Estimation procedures for a semiparametric family of bivariate copulas, *Journal of Computational and Graphical Statistics*, vol 14(2), pp 1–15 (2005).

[2] R.B. Nelsen, *An introduction to copulas*, Lecture Notes in Statistics, Springer (1999).

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