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# Algebraic properties of copulas defined from matrices

Cécile Amblard<sup>\*</sup>, Stéphane Girard, Ludovic Mennetau

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  $\phi$  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  $S_\phi$  reduces to the family proposed in [1]. As a consequence,  $S_\phi$  can be seen as an extension of this former family to arbitrary matrices.

First, we shall give sufficient conditions on  $A$  and  $\phi$  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  $S_\phi$  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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