

Geometric and Algebraic Properties of the Eigenvalues of Monotone Matrices

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Abstract : For stochastic matrices of any order, the geometric description of the convex set of eigenvalues is completely known. The purpose of this study is to investigate the subset of the monotone matrices. This type of matrix appears in contexts such as intergenerational occupational mobility, equal-input modeling, and credit ratings-based systems. Monotone matrices are stochastic matrices in which each row stochastically dominates the previous row. The monotonicity property of a stochastic matrix can be expressed by a nonnegative lower-order matrix with the same eigenvalues as the original monotone matrix (except for the eigenvalue 1). Specifically, the aim of this research is to focus on the properties of eigenvalues of monotone matrices. For those matrices up to order 3, there already exists a complete description of the convex set of eigenvalues. For monotone matrices of order at least 4, this study gives, through simulations, more insight into the geometric description of their eigenvalues. Furthermore, this research treats in a geometric and algebraic way the properties of eigenvalues of monotone matrices of order at least 4.

Keywords : eigenvalues of matrices, finite Markov chains, monotone matrices, nonnegative matrices, stochastic matrices

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