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The competitive spectral radius of families of nonexpansive mappings

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We introduce a new class of perfect information repeated zero-sum games in which the payoff of one player is the escape rate of a switched dynamical system which evolves according to a nonexpansive nonlinear operator depending on the actions of both players. This is motivated by applications to population dynamics (growth maximization and minimization).

Considering order preserving finite dimensional linear operators over the positive cone endowed with Hilbert's projective (semi-)metric or the Funk hemi-metric, we recover subclasses of Matrix multiplication games, a 2-player extension of the joint spectral radius of sets of nonnegative matrices, introduced by Asarin and coauthors (2016).

We prove that escape rate games have a uniform value, which is characterized by a nonlinear eigenproblem. Then, we discuss the continuity and approximability of the value of the game with respect to the parameters. We show in particular that the competitive spectral radius of positive matrices can be approximated up to any accuracy.

This is joint works with Stéphane Gaubert, Loïc Marchesini, and Ian Morris.

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