

Ergodic Control and Polyhedral approaches to PageRank Optimization

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We study a general class of PageRank optimization problems which consist in finding an optimal outlink strategy for a web site subject to design constraints. We consider two versions of the PageRank optimization problem: a relaxed version in which one can choose the intensity of a link, and a discrete version in which in each page, there are obligatory links, optional links, and forbidden links. We model these problems by constrained Markov decision processes with ergodic reward, in which the webmaster determines the transition probabilities of websurfers. We first show that under general assumptions, the relaxed and discrete problems both can be solved in polynomial time, and provide efficient algorithms to do it. We then identify assumptions under which there exists a "master" page to which all controlled pages should point. We report numerical results on fragments of the real web graph obtained by combining dynamic programming and convex programming techniques.

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