Hildreth's algorithm with applications to soft constraints for user interface layout.

Summary: Hildreth's algorithm is a row action method for solving large systems of inequalities. This algorithm is efficient for problems with sparse matrices, as opposed to direct methods such as Gaussian elimination or QR-factorization. We apply Hildreth's algorithm, as well as a randomized version, along with prioritized selection of the inequalities, to efficiently detect the highest priority feasible subsystem of equations. We prove convergence results and feasibility criteria for both cyclic and randomized Hildreth's algorithm, as well as a mixed algorithm which uses Hildreth's algorithm for inequalities and Kaczmarz algorithm for equalities. These prioritized, sparse systems of inequalities commonly appear in constraint-based user interface (UI) layout specifications. The performance and convergence of these proposed algorithms are evaluated empirically using randomly generated UI layout specifications of various sizes. The results show that these methods offer improvements in performance over standard methods like Matlab's LINPROG, a well-known efficient linear programming solver, and the recent developed Kaczmarz algorithm with prioritized IIS detection.

Keywords: UI layout; Hildreth's algorithm; soft constraints; linear inequalities
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