Project 1: Sudoku

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The method I used is based on constraint linear programming with L1 sparse optimization method and repeated steps.

Actually, sudoku problem can be written as a linear system which solved by the corresponding sparse optimization model.

Basic model: Based on the the reference, I firstly make numbers from 1 to 9 into a 9-dimensional binary vector, then transform in total 81(9x9) numbers into an 729 (81x9) vector which is also the solution of the corresponding Sudoku problem.

Final method: After reading some references, I get a 9x9 matrix with 81 nonzero numbers from the basic method. Then, I need to check verify if a number is repeated. After finding all the repeated values and their corresponding locations, I set those numbers into 0 which will give us a new Sudoku problem with new and more clues to solve and repeat and repeat again. Also, I choose to apply weighted L1 norm minimization.

Final result: (choose weight: 1)

For small 1: 100%
For small 2: 93.7%
For large 1: 98.6%
For large 2: 100%

Reference:

Yuchao Tang1, Zhenggang Wu2, Chuanxi Zhu1, “A Warm Restart Strategy for Solving Sudoku by Sparse Optimization Methods”,

P. Babu, K. Pelckmans, P. Stoica, J. Li, Linear systems, sparse solutions, and Sudoku, IEEE Signal Processing Letter

E. Candes, M. Wakin, S. Boyd, Enhancing sparsity by reweighted l1 minimization, Journal of Fourier Analysis Applications