Convex Optimization Collaborative Filtering to Find Causality in Market Indices

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Abstract

Recommender systems have been advanced and widely utilized in the past few years in various scientific fields. In the recommender system, the information is being filtered to support the decision-making process. In this paper, we developed a collaborative filtering algorithm based on convex optimization techniques to find if the returns in one market financial index are influenced by other market financial indexes. The daily prices of thirty-four financial indices for the last five years were collected and synchronized, starting the far east index of DJ New Zealand (NZDOW) to the far west index S&P/BMV IPC of Mexico (MXX). This process leaves us with a matrix of five hundred fifty-four by thirty-three where the rows represent the classified return and the column represent the market index. The experiment proceeds by removing a certain percentage of matrix elements on a random basis. The missing elements of the matrix are then determined using minimization of the sum of singular values of the matrix, which is the convex heuristic of the matrix rank function. The underlying hypothesis is that the number of factors that influence market performance are small, which translates mathematically into the number of non-zero singular values of the matrix is also small. Results are promising and prediction performance was high even when 50% of the matrix elements are removed.

Keywords
Collaborative Filtering, Convex Optimization, Causality, Market Indices, Returns Matrix.

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