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A Graduated Non-convexity Method for Applications in Finance

Investment and risk management in finance often require determining a small number of assets to minimize some measure of tracking error. Determining such a solution requires solving a mixed non-linear integer programming problem. We propose a graduated non-convexity method to minimize portfolio tracking error with the total number of assets no greater than a specified integer K. The solution of this tracking error minimization problem is the global minimizer of the sum of the tracking error function and the discontinuous counting function. We attempt to track the globally minimal tracking error portfolio by approximating the discontinuous counting function with a sequence of continuously differentiable non-convex functions, a graduated non-convexity process. We discuss the advantages of this approach and present numerical results in index tracking and hedging under basis risk applications in finance.