Variable Selection for High-Dimensional Regression Models with Higher-Order Interactions

Hsueh-Han Huang [1], Jia-Syuan Wu [1], and Hai-Tang Chiou [2]

[1] Institute of Statistical Science, Academia Sinica, Taiwan
[2] Department of Mathematics, National Chung Cheng University, Taiwan

Abstract

This work proposes the network orthogonal greedy algorithm (Network OGA), an efficient method designed to capture higher-order (beyond second-order) interactions. By integrating the concepts of ranking and stepwise forward regression, Network OGA leverages the advantages of both approaches. The algorithm is applicable to high-dimensional interaction models of arbitrary unknown orders. We establish the sure screening property for Network OGA and demonstrate that, when coupled with a high-dimensional information criterion (HDIC), the method achieves variable selection consistency. Simulation studies further validate its superior performance.

Keywords: greedy algorithm, high dimensionality, higher-order interactions, sure screening, variable selection consistency