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Biomedical Oriented Logistic Dantzig Selector (BOLD Selector) for Biomarker Selection and its Applications to Patient Group Differentiation across Parkinsonism Spectrum

Frederick Kin Hing Phoa
Institute of Statistical Science, Academia Sinica, Taipei, Taiwan

Abstract

We present a robust, efficient and easily accessible differential diagnosis (D/D) scheme of patient groups from the Parkinsonism spectrum. The scheme includes a newly proposed Biomedical Oriented Logistic Dantzig Selector (BOLD Selector) for identifying robust biomarkers for D/D from the main effect model of a supersaturated experiment with a binary response. To test the scheme's robustness via a published lipidomic dataset, double cross-validation is implemented to assess the generalizability of the model and single out suitable tuning parameters of the BOLD Selector. We investigate our newly generated proteomic dataset by profiling plasma EV proteins by LC/MS-MS from Parkinson's disease without dementia (PDND), PD with mild cognitive impairment (PD-MCI), PD with dementia (PDD), multiple system atrophy (MSA) and healthy controls (HC), using a multi-stage binary tree that employs a BOLD Selector at each stage to derive the prediction formulas for D/D of various patient groups. Biomarker candidates are engaged in the lipid metabolic pathway relevant to α-synucleinopathy, the pathological hallmark for both PD and MSA, indicating the promise of the BOLD Selector. Not only can it identify robust biomarkers with pathophysiological significance, thus facilitating D/D, but it can also pave the way towards identifying disease-relevant targets. This is a joint work with Ms. Jing-Wen Huang (National Tsing Hua University), Mr. Yan-Han Lin, Dr. Shau-Ping Lin, Dr. Yi-Tzang Tsai (National Taiwan University), Dr. Ming-Che Kuo, Dr. Ruey-Meei Wu (National Taiwan University Hospital), and Dr. Koji Ueda (Japanese Foundation for Cancer Research).

Keywords:
Biomarker; Dantzig Selector; Dementia; Diagnosis; Factor Screening; Parkinsonism.