Performance guarantees for individualized treatment rules

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Because many illnesses show heterogeneous response to treatment, there is increasing interest in individualizing treatment to patients [Arch. Gen. Psychiatry 66 (2009) 128--133]. An individualized treatment rule is a decision rule that recommends treatment according to patient characteristics. We consider the use of clinical trial data in the construction of an individualized treatment rule leading to highest mean response. This is a difficult computational problem because the objective function is the expectation of a weighted indicator function that is nonconcave in the parameters. Furthermore, there are frequently many pretreatment variables that may or may not be useful in constructing an optimal individualized treatment rule, yet cost and interpretability considerations imply that only a few variables should be used by the individualized treatment rule. To address these challenges, we consider estimation based on l_1-penalized least squares. This approach is justified via a finite sample upper bound on the difference between the mean response due to the estimated individualized treatment rule and the mean response due to the optimal individualized treatment rule.

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