Difference-based Variance Estimation in Nonparametric Regression with Repeated Observations

Tiejun Tong*
Hong Kong Baptist University, Hong Kong, China tongt@hkbu.edu.hk

Yanyuan Ma
Texas A&M University, College Station, U.S.A ma@stat.tamu.edu

Wenlin Dai
Hong Kong Baptist University, Hong Kong, China 11466154@life.hkbu.edu.hk

Lixing Zhu
Hong Kong Baptist University, Hong Kong, China lzhu@math.hkbu.edu.hk

Over the past three decades, interest in cheap yet competitive variance estimators in nonparametric regression has grown tremendously. One family of estimators which has risen to meet the task is the difference-based estimators. Unlike their residual-based counterparts, difference-based estimators do not require estimating the mean function and are therefore popular in practice. This work further develops the difference-based estimators in the repeated measurements setting for nonparametric regression models. Three difference-based methods are proposed for the variance estimation under both balanced and unbalanced repeated measurements settings: the sample variance method, the partitioning method, and the sequencing method. Both their asymptotic properties and finite sample performance are explored. The sequencing method is shown to be the most adaptive while the sample variance method and the partitioning method are shown to outperform in certain cases. Finally, two real data examples are analyzed to demonstrate the practical use of the proposed methods.

Key Words: Asymptotic normality, difference-based estimator, repeated measurements, residual variance.