

Institute of Mathematical Statistics
LECTURE NOTES — MONOGRAPH SERIES

DEPENDENT BOOTSTRAP CONFIDENCE INTERVALS

Wendy D. Smith and Robert L. Taylor
Department of Statistics
The University of Georgia
Athens, GA 30602-1952

Abstract

A dependent bootstrap is shown to produce estimators which have smaller variances but which are still consistent and asymptotically valid. Simulated confidence intervals are used to examine possible gains in coverage probabilities and interval lengths.

1 Introduction

Inference for stochastic processes seeks to provide more appropriate dependent models to situations where the assumption of independence is not plausible. The use of independent models is prevalent in bootstrapping. Efron (1979) introduced the bootstrap as a tool to estimate the standard error of a statistic, and an enormous amount of applied and theoretical research on the bootstrap technique has followed in the past two decades. While much of this ensuing research has been methodological adaptations and theoretical validity verifications for different statistics, considerable research has been directed toward shortcomings and possible improvements to the basic bootstrap technique. The traditional resampling of the sample observations (with replacement) produces independent and identically distributed (bootstrap) random variables (conditional on the original sample), and many of the theoretical justifications of the bootstrap procedures are crucially related to techniques involving independent random variables. Resampling without replacement produces dependent random variables (actually negatively dependent) which are still identically distributed (and in fact has the desirable property of exchangeability). The purpose of this paper is to consider some estimation using a form of dependent bootstrapping. In particular, confidence interval comparisons will be given for the traditional bootstrap procedure and the dependent bootstrap procedure.