Density estimation for a non-Gaussian random variable observed with measurement error - Applications to dietary assessment

Alicia Carriquiry
Department of Statistics
Iowa State University
Ames, IA 50011-1210 USA
alicia@iastate.edu

Abstract

National food consumption surveys are used by almost every nation to monitor the nutritional status of the population, to identify vulnerable groups, to plan food assistance programs and to design interventions. To keep costs down and avoid respondent burden, most surveys collect only one or two days of daily intake on each sample person, even though the quantity of public health interest is the long-run average intake of foods or nutrients. Let Y and y denote daily intake and usual intake, respectively, and let u be error in the measurement. If y and u are independent and $Y = y + u$, then Y has density $f = f_y * f_u$, the convolution of the two densities. Thus, the problem of estimating the distribution of usual intakes f_y consists in estimating the density of a random variable observed with measurement error given observations generated from the convolution f.

We have proposed an approximation to a deconvolution estimator that produces estimates of the density of usual intakes with good statistical properties. Intake data are typically non-Gaussian and subject to a variety of nuisance effects. Further, we have also addressed the problem of estimating the prevalence of inadequate usual nutrient intakes given observed daily intakes. The approach we have suggested is semi-parametric and therefore highly portable and is currently in use by government agencies, research groups and other organizations in many countries around the world.