STATISTICAL ANALYSIS OF CURVE FITTING IN ERRORS-IN-VARIABLES MODELS.

ALI AL-SHARADQAH

Abstract. Fitting geometric curves such as lines, circles, and ellipses to a set of experimental observations is one of the basic tasks in computer vision, image processing, and pattern recognition. These kinds of fitting problems are considered as Errors-in-Variables models (EIV), where both coordinates of any observation are contaminated by noisy errors, and as such they are quite different and much more difficult than the classical regression. In this talk I will give an overview about this hot topic in modern statistics. Firstly, I will point out some phenomena related to EIV models; we noticed that accurate fits have infinite absolute first moment while the one with finite first moment is, paradoxically, the least accurate and has the heaviest bias. Thus, after adopting suitable statistical assumptions, we develop an unconventional statistical analysis, which allows us to effectively assess EIV parameter estimators. Accordingly, we study the statistical properties of two kinds of fits; geometric fit and algebraic fits for circle and ellipse fitting problems. We theoretically compare the most popular fits for circles and ellipses with each other and we show why and by how much each fit differs from others. Our theoretical comparison leads to new unbeatable fits with superior characteristics that surpass all existing fits theoretically and experimentally.

Department of Mathematics, University of Mississippi, University, MS 38677-1848
E-mail address: aalshara@olemiss.edu