CONCURVITY BIAS: A WARNING BELL FOR FDA?

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The generalized additive model (GAM) is a conceptually straightforward extension of the generalized linear model (GLM) in which the linear components of the GLM are replaced by nonlinear functions fit with nonparametric smoothers. Although the general nature of the GAM—it is defined in terms of arbitrary smoothers—makes it extremely difficult to derive formal analytic properties of the model, users have gotten a lot of mileage out of relying on intuition derived from observing the GLM. This intuition has failed in the case of concurvity, the nonlinear analogue of collinearity. Rather than simply inflating the variance of fitted parameters, as one would expect from the consequences of collinearity, concurvity actually leads to biased parameter estimates. A consequence of the intrinsic bias of nonparametric smoothers, it seems entirely possible that concurvity bias might also have serious implications for non-additive smoothing-based models used in FDA. Fortunately, concurvity bias does not affect parametric smoothing models such as regression splines. This suggests that smoothing-based models should use parametric smoothers rather than nonparametric ones.