BULL. AUSTRAL. MATH. SOC.
VOL. 30 (1984), 317-318

62F10, 62G05, 62G35

MINIMUM MEAN SQUARED ERROR ESTIMATION

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Let $X_1, X_2, \ldots, X_n$ be independent and identically distributed random variables, each with distribution depending on one or more parameters. The random vector $\mathbf{X}$ usually depends on a parameter θ in a nonlinear fashion. We define a linearising transformation for θ to be a function $g(\mathbf{X})$ such that the dependence of $g(\mathbf{X})$ on θ is linear in the sense that $Eg(\mathbf{X})$ is proportional to θ.

If we can find m such transformations $g_1, g_2, \ldots, g_m$ we may construct an estimator of θ as a compound linearising transformation

$$\hat{\theta} = \sum_{i=1}^{m} c_i g_i(\mathbf{X}) .$$

The optimal estimator of this form may then be found by minimising the mean squared error of $\hat{\theta}$ with respect to the constants $c_1, c_2, \ldots, c_m$. We will call the combination of these two stages the Method of Minimum Mean Squared Error Estimation.

In this thesis, we discuss some approaches to finding linearising transformations. The resulting techniques are applied to several parametric problems, including a computer simulation study of estimators of scale parameters, in which a modification to the MLE is revealed to be almost optimal. Finally, we discuss distribution-free estimation of the centre of a symmetric distribution. In a computer simulation study, the

Received 18 June 1984. Thesis submitted to University of New South Wales, August 1983. Degree approved April 1984. Supervisor: Dr P.J. Cooke.

estimators resulting from the MMSEE approach are found to be superior to the best estimators from the Princeton Robustness Study.

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https://doi.org/10.1017/S000497270000201X Published online by Cambridge University Press