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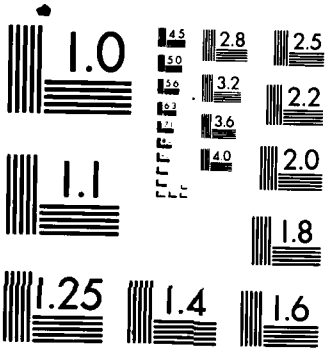

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TIME SERIES ANALYSIS AND MULTIVARIATE STATISTICAL ANALYSIS

FINAL REPORT

Theodore W. Anderson
Principal Investigator

July 1, 1982, to July 31, 1985

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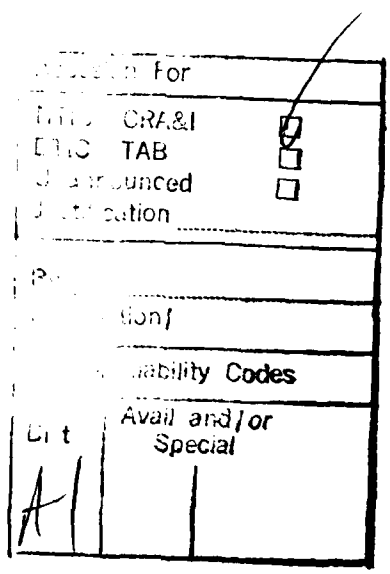
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Time series analysis, multivariate statistical analysis.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The probability of an estimated moving average model being noninvertible was characterized. Generalizations of autocorrelation and partial autocorrelation coefficients are suggested for determining the orders of autoregressive moving average processes. Maximum likelihood estimators and likelihood ratio criteria were derived for a class of elliptically contoured distributions. Zonal polynomials were developed as characteristic vectors of a matrix of polynomials.



Research was carried out mainly in the areas of time series analysis and multivariate analysis. In the first area emphasis was on statistical inference in autoregressive moving averages (ARMA) models; in the second area emphasis was on elliptically contoured distributions, zonal polynomials, and estimation of covariance matrices.

Maximum likelihood estimates of coefficients in moving average models can yield noninvertible estimated models with positive probability. This probability was characterized and its limit obtained in various cases. To determine the appropriate orders of the autoregressive and moving average parts the autocorrelation and partial autocorrelation coefficients were generalized; a two-way table of calculated values of these coefficients can be used to assign the two orders. It was shown that the determination is consistent. A range of methods based on autoregressive processes were applied to various substantive problems.

Maximum likelihood estimators and likelihood ratio criteria were derived for a class of elliptically contoured distributions; this class is a generalization of the family of normal distributions and serves as a framework for the study of robustness in multivariate analysis. These estimators and criteria have been related to corresponding estimators and criteria for normal distributions. Their distributions for some cases have been characterized. Invariant tests and their properties have been obtained for linear hypotheses; for example, Hotelling's T^2-test is uniformly locally most powerful. Several definitions of spherically symmetric distributions were compared and analyzed.

Zonal polynomials, which are essential to noncentral distributions in multivariate analysis, have been defined here as the characteristic

vectors of a certain matrix. This definition permitted the development of the properties of zonal polynomials by fairly elementary algebraic methods.

The triangular decomposition estimator of a covariance matrix was symmetrized by means of the Haar invariant measure on orthogonal matrices to obtain an estimator that dominates this conventional unbiased estimator. Some other topics investigated were generalizations of Cochran's theorem and related problems of ranks of matrices, use of tensors in the analysis of variance, and goodness-of-fit criteria.

SCIENTIFIC PERSONNEL

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Akimichi Takemura, Ph.D., June 1982

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