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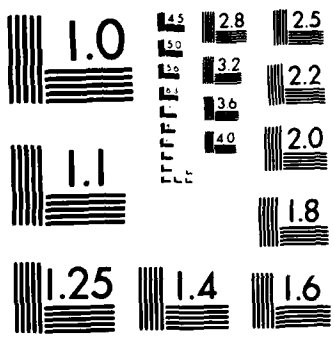

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report describes the results obtained during the grant year 1 November 1983 - 31 October 1984. References are made to ten publications produced during the year.

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Interim Scientific Report

ANNUAL TECHNICAL REPORT OF RESEARCH

ON

"STATISTICAL TECHNIQUES FOR SIGNAL PROCESSING"

Supported by Grant AFOSR-82-0022

Grant Year: November 1, 1983 - October 31, 1984

Report Date: December 10, 1984

Saleem A. Kassam
Principal Investigator

SUMMARY OF PROGRESS IN PREVIOUS YEAR (STARTING NOVEMBER 1, 1983)
OF RESEARCH UNDER GRANT AFOSR 82-0022

The grant year covered by this report began on November 1, 1983; it was the third year of continuing effort on the development of new "Statistical Techniques for Signal Processing". The progress made in the first two years has been documented in annual reports dated December 1982 and December 1983. In addition, advances made over a five year period under a previous grant (AFOSR 77-3154) have been described in five previous annual reports (dated December 1977, December 1978, December 1979, December 1980 and December 1981).

Here we summarize our activity in this latest complete year of research effort. Some interesting and significant results have been obtained and reported during this period; these are listed as references [1] - [10] on page 3. Copies of references currently available are being sent together with this report.

One major project which was completed recently was an invited survey paper [1] on robust signal processing. This paper is a comprehensive survey of the main ideas, results and applications of robust signal processing, and should serve as a useful reference of general interest.

The area of nonlinear edge-preserving robust smoothing was one area of focus for our research. In this area the dissertation [2] was completed. Arising from this research are the two conference papers [3,4], both of which also contain discussions of applications in image restoration. In addition, the paper [5] on this subject has been accepted for publication. Very good progress has been made last year on this important area of research. We have been able to give deterministic and statistical characterizations of the performance of some useful types of nonlinear filters which

may be thought of as arising from the classical robust estimates of location (L- and M- estimates), and we have demonstrated their applicability in image processing. We are continuing to obtain new results in this area in our current work.

In the area of nonparametric detection the case of narrowband signals in noise has been studied, with preliminary results reported in [6]. This paper establishes the natural counterparts of the sign-detection schemes for this class of signals. This material is currently being prepared for publication in a technical journal.

A paper [7] on quantization of data in narrowband signal detection was also published during the last grant year. On the subject of optimum quantization of data for signal detection (hypothesis testing) a comprehensive exposition has been written [8] for publication as a chapter in a book to be published next year. These results on statistical optimization of quantization in detection systems are of considerable interest for digital implementations. Currently being revised for publication is also paper [9] on optimum quantization in matched filtering and smoothing of data.

Finally, paper [10] on multi-input robust Wiener smoothing was also published during the last grant year.

PERSONNEL SUPPORTED

Y. H. Lee, Graduate Research Assistant	10 months, (Nov. 1, 1983 - Aug. 31, 1984)
I. H. Song, Graduate Research Assistant	4 months, (July 1, 1984 - Oct. 31, 1984)
S. A. Kassam, Principal Investigator	3 man-months, (2 months summer, 1 month Academic year)

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(List of Publications)

* 1. S. A. Kassam and H. V. Poor, "Robust Techniques for Signal Processing: A Survey," Proceedings IEEE (Invited Paper), Vol. 73, 1985 (to be published).

* 2. Y. H. Lee, Nonlinear Edge-Preserving Noise Suppression Techniques with Applications in Image Enhancement. Ph.D. Dissertation, Dept. of Systems Engineering, University of Pennsylvania, 1984.

* 3. Y. H. Lee and S. A. Kassam, "Nonlinear Edge-Preserving Filtering Techniques for Image Enhancement," Proc. 27-th Midwest Symp. on Circuits and Systems, pp. - , June 1984.

* 4. Y. H. Lee and S. A. Kassam, "Applications of Nonlinear Adaptive Filters for Image Enhancement," Proc. 7th International Conf. on Pattern Recognition, pp. - , 1984.

* 5. Y. H. Lee and S. A. Kassam, "Generalized Median Filtering and Related Nonlinear Filtering Techniques," IEEE Trans. Acoustics, Speech and Signal Processing, Vol. ASSP-33, pp. - , 1985 (to be published).

* 6. S. A. Kassam, "Nonparametric Detection of Narrowband Signals," Proc. 27-th Midwest Symp. on Circuits and Systems, pp. - , 1984.

* 7. L. J. Cimini and S. A. Kassam, "Data Quantization for Narrowband Signal Detection" IEEE Trans. Aerospace Electronic Systems, Vol. AES-20, pp. 848-858, Nov. 1984.

8. S. A. Kassam, "Optimum Data Quantization is Signal Detection," Chapter in Advances in Communications and Networks (I. F. Blake and H. V. Poor, Eds.), Springer-Verlag, 1985 (to be published).

9. C. T. Chen and S. A. Kassam, "Optimum Quantization of FIR Wiener and Matched Filters, "IEEE Trans. on Communications, (to be published).

* 10. C. T. Chen and S. A. Kassam, "Robust Wiener Filtering for Multiple Inputs with Channel Distortion," IEEE Trans. Inform Theory, Vol. IT-30, pp. 674-677, 1984.

* Copies being sent under separate cover

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