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SEQUENTIAL ANALYSIS AND PROBABILITY THEORY(U) STANFORD
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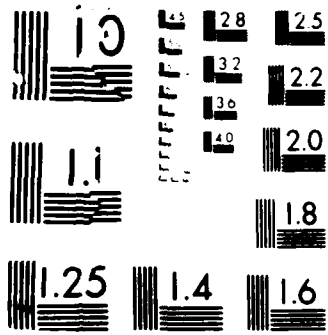
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Final Report: ONR Contract N00014-77-C-0306

David Siegmund, Principal Investigator

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Most of the research performed under this contract can be described under four broad, related categories: (1) Nonlinear renewal theory and its applications to sequential analysis; (2) corrected diffusion approximations and their applications; (3) sequential analysis of the proportional hazards model; and (4) change-point problems.

(1) Nonlinear renewal theory had its beginnings in papers by Woodroffe in 1976 and Lai and Siegmund in 1977. The systematic extension and application of this theory to problems of sequential analysis, especially those involving repeated significance tests and confidence intervals following sequential tests, have been the dominant theme of this contract, which culminated in the book *Sequential Analysis: Tests and Confidence Intervals* (Springer-Verlag, 1985). These subjects are discussed in Technical Reports 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 15, 32 (The 1984 Wald Lectures of the Institute of Mathematical Statistics), and 34.

(2) Corrected diffusion approximations were introduced in Technical Report 4 and developed further in 13, 24, 25, 26, and 37. Applications were given to approximate computation of the operating characteristics of truncated sequential probability ratio tests, the average run length of CUSUM tests, and some miscellaneous problems of applied probability. (The forthcoming book on stochastic processes by S. Asmussen will describe additional applications in applied probability.)

(3) Although the proportional hazards model is widely used in survival analysis, and in clinical trials is some times applied sequentially, the standard, highly developed asymptotic theory does not justify the sequential applications. This problem was studied in Technical Reports 19 and 20, where it was shown that after a random change of the time scale, standard approximations of sequential analysis can also be applied to the proportional hazards model.

(4) Change-point problems were studied in sequential detection and in fixed sample contexts in Technical Reports 22, 29, 30, 35, and 39. Related probability problems were addressed in 31, 33, 36, 37, and 38. In 22 and 29 the method of sequentially detecting a change-point proposed originally by Shiriyayev was developed, and in 30 it was systematically compared to the method of CUSUM tests. For fixed sample problems, different tests for a change-point proposed in the literature were compared in 35, and the related boundary crossing probability approximations were developed in 36. Confidence sets for a change-point were discussed in 39. Probability problems involving maxima of random fields, especially those arising in change-point problems, were studied in Technical Reports 33 and 38.

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David Siegmund

TR No.	Title	Author(s)	Date
1	A Non-Linear Renewal Theory with Applications to Sequential Analysis II	D. Siegmund T. L. Lai	05-03-77
2	Estimation Following Sequential Tests	D. Siegmund	10-01-77
3	Confidence Intervals Related to Sequential Tests for the Exponential Distribution	D. Siegmund	10-10-77
4	Corrected Diffusion Approximations in Certain Random Walk Problems	D. Siegmund	08-01-78
5	A Sequential Clinical Trial for Testing $p_1 = p_2$	D. Siegmund P. Gregory	02-02-79
6	Sequential χ^2 and F tests and the Related Intervals	D. Siegmund	08-17-79
7	A Sequential Confidence Interval for the Odds Ratio	D. Siegmund	02-02-80
8	Sequential Medical Trials	T. L. Lai B. Levin W. Robbins D. Siegmund	02-04-80
9	Non-linear Renewal Theory for Lattice Random Walks	S. Lalley	06-01-80
10	Repeated Likelihood Ratio Tests for Curved Exponential Families	S. P. Lalley	09-01-80
11	The Anscombe-Woodroffe Method in Renewal Theory	S. P. Lalley	09-01-80
12	Maximally Selected Chi-squares	R. Miller D. Siegmund	12-80
13	Brownian Approximations to First Passage Probabilities	D. Siegmund Y.-S. Yuh	12-15-80
14	Convergence Rates Related to the Strong Law of Large Numbers	J. A. Fill	12-15-80
15	Large Deviations for Boundary Crossing Probabilities	D. Siegmund	05-15-81
16	Fixed Accuracy Estimation of an Autoregressive Parameter	T. L. Lai D. Siegmund	05-82
17	On the Asymptotic Distribution of the Size of a Stochastic Epidemic	T. Sellke	05-82
18	Allocation Rules for Sequential Clinical Trials	D. Siegmund	07-82
19	Sequential Analysis of the Proportional Hazards Model	T. Sellke D. Siegmund	07-82
20	Large Sample Theory for Sequential Analysis of the Proportional Hazards Model	T. Sellke	08-82

TR No.	Title	Author(s)	Date
21	Moments of the Minimum of a Random Walk and Complete Convergence	M. Hogan	01-83
22	Average Run Lengths of an Optimal Method of Detecting a Change in Distribution	M. Pollak	09-83
23	On the Fatou Inequality	A. Dvoretzky	10-83
24	Corrected Diffusion Approximations and Their Applicatons	D. Siegmund	12-83
25	Corrected Diffusion Approximations to First Passage Times	M.L. Hogan	05-84
26	Comment on "Corrected Diffusion Approximations in Certain Random Walk Problems"	M. L. Hogan	05-84
27	Comments on a Problem of Chernoff and Petkau	M. L. Hogan	05-84
28	A Uniform Bound for the Tail Probability of Kolmogorov-Smirnov Statistics	I. Hu	05-84
29	Optimal Detection of a Change in Distribution	M. Pollak	08-84
30	A Diffusion Process and Its Application to Detecting a Change in the Drift of Brownian Motion	M. Pollak D. Siegmund	09-84
31	Convergence of Quasi-stationary to Stationary Distributions for Stochastically Monotone Markov Processes	M. Pollak D. Siegmund	10-84
32	Boundary Crossing Probabilities and Statistical Applications	D. Siegmund	01-85
33	Large Deviations for the Maxima of Some Random Fields	M. L. Hogan D. Siegmund	05-85
34	Repeated Significance Tests for Exponential Families	I. Hu	08-85
35	Tests for a Change-point	B. James K. L. James D. Siegmund	08-85
36	Conditional Boundary Crossing Probabilities with Applications to Change-point Problems	B. James K. L. James D. Siegmund	06-86
37	Approximations to the Average Run Lengths of Cusum Tests	M. Pollak D. Siegmund	08-86
38	Approximate Tail Probabilities for the Maxima of Some Random Fields	D. Siegmund	08-86
39	Confidence Sets for a Change-point	D. Siegmund	10-86
40	A Complete Coupling Proof of Blackwell's Renewal Theorem	H. Thorisson	02-87

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