

Bibliography

- AITKIN, M. and RUBIN, D. B. (1985). Estimation and hypothesis testing in finite mixture models. *J. Roy. Statist. Soc. Ser. B* **47** 67–75.
- AITKIN, M. and WILSON, G. T. (1980). Mixture models, outliers, and the EM algorithm. *Technometrics* **22** 325–331.
- ANDERSON, E. B. (1973). *Conditional Inference and Models for Measuring*. Mentalhygiejnisk Forlag, Copenhagen.
- BERAN and HALL (1992). Estimating coefficient distributions in random coefficient regressions. *Ann. Statist.* **20** 1970–1984.
- BICKEL, P. J., KLAASSEN, C. J., RITOV, Y. and WELLNER, J. A. (1993). *Efficient and Adaptive Estimation for Semiparametric Models*. Johns Hopkins Univ. Press.
- BÖHNING, D. (1985). Numerical estimation of a probability measure. *J. Statist. Plann. Inference* **11** 57–69.
- BÖHNING, D. (1995). A review of reliable maximum likelihood algorithms for semiparametric mixture models. *J. Statist. Plann. Inference*. To appear.
- BÖHNING, D., DIETZ, E., SCHAUB, R., SCHLATTMAN, P. and LINDSAY, B. G. (1994). The distribution of the likelihood ratio for mixtures of densities from the one parameter exponential family. *Ann. Inst. Statist. Math.* **46** 373–388.
- BÖHNING, D., SCHLATTMAN, P. and LINDSAY, B. G. (1992). Computer assisted analysis of mixtures (C.A.MAN): Statistical algorithms. *Biometrics* **48** 283–304.
- BRÄNNÄS, K. and ROSENQVIST, G. (1994). Semiparametric estimation of heterogeneous count data models. *European J. Oper. Res.* **76** 247–258.
- BUTLER, S. M. and LOUIS, T. A. (1992). Random effects models with nonparametric priors. *Statist. Med.* **11** 1981–2000.
- CHEN, J. (1993). A new approach to testing the number of components in finite mixture models. Unpublished manuscript, Univ. Waterloo.
- CHERNOFF, H. (1954). On the distribution of the likelihood ratio. *Ann. Math. Statist.* **25** 573–578.
- CLOGG, C. C. (1995). Latent class models. In *Handbook of Statistical Modeling for the Social and Behavioral Sciences* (G. Arminger, C. C. Clogg and M. E. Sobel, eds.) 311–359. Plenum, New York.
- DALAL, S. R. and HALL, W. J. (1983). Approximating priors by mixtures of natural conjugate priors. *J. Roy. Statist. Soc. Ser. B*, **45** 278–286.
- DAVIDIAN, M. and GALLANT, A. R. (1992). Smooth nonparametric maximum likelihood estimation for population pharmacokinetics, with application to quinidine. *Journal of Pharmacokinetics and Biopharmaceutics* **20** 529–556.
- DAVIES, R. B. (1993). Nonparametric control for residual heterogeneity in modeling recurrent behavior. *Comput. Statist. Data Anal.* **16** 143–160.

- DEMPSTER, A. P., LAIRD, N. M. and RUBIN, D. B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *J. Roy. Statist. Soc. Ser. B* **39** 1–22.
- DERSIMONIAN, R. (1986). Maximum likelihood estimation of a mixing distribution. *J. Roy. Statist. Soc. Ser. C* **35** 302–309.
- DERSIMONIAN, R. (1989). Tests of homogeneity in mixed models. *Technical Report*. Dept. Public Health, School of Medicine, Yale University.
- DERSIMONIAN, R. (1990). Correction to algorithm AS 221: maximum likelihood estimation of a mixing distribution. *J. Roy. Statist. Soc. Ser. C* **39** 176.
- DIACONIS, P. (1977). Finite forms of de Finetti's theorem on exchangeability. *Synthese* **36** 271–281.
- DIACONIS, P. and EFRON, B. (1985). Testing for independence in a two-way table: New interpretations of the chi-square statistic. *Ann. Statist.* **13** 845–874.
- DIACONIS, P. and YLVISAKER, D. (1979). Conjugate priors for exponential families. *Ann. Statist.* **7** 269–281.
- DO, K. and MCLACHLAN, G. J. (1984). Estimation of mixing proportions: A case study. *J. Roy. Statist. Soc. Ser. C* **33** 134–140.
- EFRON, B. (1986). Double exponential families and their use in generalized linear regression. *J. Amer. Statist. Assoc.* **81** 709–721.
- EFRON, B. and MORRIS, C. (1977). Stein's paradox in statistics. *Scientific American* **236** 119–127.
- EVERITT, B. S. and HAND, D. J. (1981). *Finite Mixture Distributions*. Chapman and Hall, New York.
- EZZET, F. L. and DAVIES, R. B. (1988). A manual for MIXTURE. Center for Applied Statistics, Univ. Lancaster, England.
- FAN, J. Q. (1991). On the optimal rates of convergence for nonparametric deconvolution problems. *Ann. Statist.* **19** 1257–1272.
- FELLER, W. (1971). *An Introduction to Probability Theory and Its Applications* **2**. Wiley, New York.
- FINCH, S. J., MENDELL, N. R. and THODE, H. C. (1989). Probabilistic measures of adequacy of a numerical search for a global maximum. *J. Amer. Statist. Assoc.* **84** 1020–1023.
- FISHER, R. A. (1925). *Statistical Methods for Research Workers.*, 1st ed. Oliver and Boyd, Edinburgh.
- FOLLMAN, D. A. and LAMBERT, D. (1989). Generalizing logistic regression by nonparametric mixing. *J. Amer. Statist. Assoc.* **84** 295–300.
- FOLLMAN, D. A. and LAMBERT, D. (1991). Identifiability of finite mixtures of logistic regression models. *J. Statist. Plann. Inference* **27** 375–381.
- FRASER, D. A. S. and MASSAM, H. (1989). A mixed primal-dual bases algorithm for regression under inequality constraints. *Scand. J. Statist.* **16** 65–74.
- FURMAN, D. and LINDSAY, B. G. (1994a). Measuring the relative effectiveness of moment estimators as starting values in maximizing mixture likelihoods. *Comput. Statist. Data Anal.* **17** 493–507.
- FURMAN, D. and LINDSAY, B. G. (1994b). Testing for the number of components in a mixture of normal distributions using moment estimators. *Comput. Statist. Data Anal.* **17** 473–492.
- GALLANT, A. R. and NYCHKA, D. W. (1987). Semiparametric maximum likelihood estimation. *Econometrica* **55** 363–390.
- GEISSLER, A. (1889). Beiträge zur Frage des Geschlechts Verhältnisses der Geborenen. Zeitschrift des K. Sächsischen Statistischen Bureaus.
- GELFAND, A. E. and DALAL, S. R. (1990). A note on overdispersed exponential families. *Biometrika* **77** 55–64.
- GHOSH, J. K. and SEN, P. K. (1985). On the asymptotic performance of the log likelihood ratio statistic for the mixture model and related results. In *Proceedings of the Berkeley Conference in Honor of Jerzy Neyman and Jack Kiefer* (L. M. LeCam and R. A. Olshen, eds.) **2** 789–806. Wadsworth, Belmont, CA.
- GOFFINET, B., LOISEL, P. and LAURENT, B. (1992). Testing in normal mixture models when the proportions are known. *Biometrika* **79** 842–846.
- GROENEBOOM, P. and WELLNER, J. A. (1992). Information bounds and nonparametric maximum likelihood estimation. *DMV Sem.* **19**. Birkhäuser, Boston.

- HARTIGAN, J. A. (1985). A failure of likelihood asymptotics for normal mixtures. In *Proceedings of the Berkeley Conference in Honor of Jerzy Neyman and Jack Kiefer* (L. M. Le Cam and R. A. Olshen, eds.) 2 807–810. Wadsworth, Belmont, CA.
- HATHAWAY, R. (1985). A constrained formulation of maximum-likelihood estimation for normal mixture distributions. *Ann. Statist.* **13** 795–800.
- HECKMAN, J. J. and SINGER, B. (1984). Econometric duration analysis. *J. Econometrics* **24** 63–132.
- HEINEN, T. (1993). *Discrete Latent Variable Models*. Tilburg Univ. Press, The Netherlands.
- HOEFFDING, W. (1956). One the distribution of the number of successes in independent trials. *Ann. Math. Statist.* **27** 713–721.
- HOTELLING, H. (1939). Tubes and spheres in n -spaces, and a class of statistical problems. *Amer. J. Math.* **61** 440–460.
- HSI, H., LINDSAY, B. G. and LYNCH, J. (1992). On mixtures of hazards: Nonparametric maximum likelihood in a competing risk model. *Journal of Nonparametric Statistics* **2** 89–103.
- JEWELL, N. P. (1982). Mixtures of exponential distributions. *Ann. Statist.* **10** 479–484.
- JEWELL, N. P., MALANI, H. M. and VITTINGHOFF, E. (1994). Nonparametric estimation for a form of doubly censored data with application to two problems in AIDS. *J. Amer. Statist. Assoc.* **89** 7–18.
- KARLIN, S. (1968). *Total Positivity*. Stanford Univ. Press.
- KARLIN, S. and STUDDEN, W. J. (1966). *Tchebysheff Systems: With Applications to Analysis and Statistics*. Wiley, New York.
- KIEFER, J. and WOLFOWITZ, J. (1956). Consistency of the maximum likelihood estimator in the presence of infinitely many incidental parameters. *Ann. Math. Statist.* **27** 886–906.
- KIEFER, N. M. (1978). Discrete parameter variation: Efficient estimation of a switching regression model. *Econometrica* **46** 427–434.
- LAIRD, N. M. (1978). Nonparametric maximum likelihood estimation of a mixing distribution. *J. Amer. Statist. Assoc.* **73** 805–811.
- LAIRD, N. M. and LOUIS, T. A. (1991). Smoothing the nonparametric estimate of a prior distribution by roughening. *Comput. Statist. Data Anal.* **12** 27–37.
- LAMBERT, D. and ROEDER, K. (1995). Overdispersion diagnostics for generalized linear models. *J. Amer. Statist. Assoc.* To appear.
- LESPERANCE, M. L. and KALBFLEISCH, J. D. (1992). An algorithm for computing the nonparametric MLE of a mixing distribution. *J. Amer. Statist. Assoc.* **87** 120–126.
- LIANG, K. (1984). The asymptotic efficiency of conditional likelihood methods. *Biometrika* **71** 305–313.
- LINDSAY, B. G. (1981). Properties of the maximum likelihood estimator of a mixing distribution. In *Statistical Distributions in Scientific Work* (G. P. Patil, ed.) 5 95–109. Reidel, Boston.
- LINDSAY, B. G. (1983a). The geometry of mixture likelihoods: A general theory. *Ann. Statist.* **11** 86–94.
- LINDSAY, B. G. (1983b). Efficiency of the conditional score in a mixture setting. *Ann. Statist.* **11** 486–497.
- LINDSAY, B. G. (1983c). The geometry of mixture likelihoods, Part II: The exponential family. *Ann. Statist.* **11** 783–792.
- LINDSAY, B. G. (1986). Exponential family mixture models (with least squares estimators). *Ann. Statist.* **14** 124–137.
- LINDSAY, B. G. (1989a). On the determinants of moment matrices. *Ann. Statist.* **17** 711–721.
- LINDSAY, B. G. (1989b). Moment matrices: Applications in mixtures. *Ann. Statist.* **17** 722–740.
- LINDSAY, B. G. and BASAK, P. (1993). Multivariate normal mixtures: A fast consistent method of moments. *J. Amer. Statist. Assoc.* **88** 468–476.
- LINDSAY, B. G., CLOGG, C. C. and GREGO, J. (1991). Semi-parametric estimation in the Rasch model and related exponential response models, including a simple latent class model for item analysis. *J. Amer. Statist. Assoc.* **86** 96–107.
- LINDSAY, B. G. and LESPERANCE, M. L. (1995). A review of semiparametric mixture models. *J. Statist. Plann. Inference* To appear.
- LINDSAY, B. G. and ROEDER, K. (1992a). Residual diagnostics in the mixture model. *J. Amer. Statist. Assoc.* **87** 785–795.

- LINDSAY, B. G. and ROEDER, K. (1992b). Moment-based oscillation properties of mixture models. Technical Report **92-3**, Center for Likelihood Studies, Pennsylvania State University.
- LINDSAY, B. G. and ROEDER, K. (1993). Uniqueness and identifiability in nonparametric mixtures. *Canad. J. Statist.* **21** 139–147.
- LOUIS, T. A. (1982). Finding the observed information matrix when using the EM algorithm. *J. Roy. Statist. Soc. Ser. B* **44** 226–233.
- MACDONALD, P. D. M. and PITCHER, T. J. (1979). Age-groups from size-frequency data: A versatile and efficient method of analyzing distribution mixtures. *Journal of the Fisheries Board of Canada* **36** 987–1001.
- MALLET, A. (1986). A maximum likelihood estimation method for random coefficient regression models. *Biometrika* **73** 645–656.
- MALLET, A., MENTRE, F., STEIMER, J-L. and LOKIEC, F. (1988). Nonparametric maximum likelihood estimation for population pharmacokinetics, with application to cyclosporine. *Journal of Pharmacokinetics and Biopharmaceutics* **16** 311–327.
- MARITZ, J. S. and LWIN, T. (1989). *Empirical Bayes Methods*, 2nd ed. Chapman and Hall, London.
- MCLACHLAN, G. J. and BASFORD, K. E. (1988). *Mixture Models: Inference and Applications to Clustering*. Dekker, New York.
- MILLAR, R. B. (1987). Maximum likelihood estimation of mixed stock fishery composition. *Canadian Journal of Fisheries and Aquatic Sciences* **44** 583–590.
- MORAN, P. A. P. (1973). Asymptotic properties of homogeneity tests. *Biometrika* **60** 79–85.
- NAIMAN, D. Q. (1986). Conservative confidence bands in curvilinear regression. *Ann. Statist.* **14** 896–906.
- NEUHAUS, J. M., HAUCK, W. W. and KALBFLEISCH, J. D. (1992). The effects of mixture distribution misspecification when fitting mixed-effects logistic models. *Biometrika* **79** 755–762.
- NEUHAUS, J. M., KALBFLEISCH, J. D. and HAUCK, W. W. (1991). A comparison of cluster-specific and population-averaged approaches for analyzing correlated binary data. *Internat. Statist. Rev.* **59** 25–35.
- NEYMAN, J. (1959). Optimal asymptotic tests of composite statistical hypotheses. In *Probability and Statistics. The Harald Cramér Volume* (U. Grenander, ed.) 213–234. Wiley, New York.
- NEYMAN, J. and SCOTT, E. L. (1948). Consistent estimates based on partially consistent observations. *Econometrica* **16** 1–32.
- NEYMAN, J. and SCOTT, E. L. (1966). On the use of $C(\alpha)$ optimal tests of composite hypotheses. *Bull. Inst. Int. Statist.* **41** I 477–97.
- OWEN, A. B. (1988). Empirical likelihood ratio confidence intervals for a single functional. *Biometrika* **75** 237–249.
- PÓLYA, G. and SZEGŐ, G. (1925). *Aufgaben und Lehrsätze aus der Analysis* **2**. Springer, Berlin.
- PRAKASA RAO, B. L. S. (1992). *Identifiability in Stochastic Models, Characterization of Probability Distributions*. Academic, Boston.
- PRENTICE, R. L. and PYKE, R. (1979). Logistic disease incidence models and case-control studies. *Biometrika* **66** 403–412.
- QUINN, B. G., MCLACHLAN, G. J. and HJORT, N. L. (1987). A note on the Aitkin–Rubin approach to hypothesis testing in mixture models. *J. Roy. Statist. Soc. Ser. B* **49** 311–314.
- REDNER, R. and WALKER, H. F. (1984). Mixture densities, maximum likelihood and the EM algorithm. *SIAM Rev.* **26** 195–239.
- ROBBINS, H. (1950). A generalization of the method of maximum likelihood: Estimating a mixing distribution (abstract). *Ann. Math. Statist.* **21** 314–315.
- ROBERTS, A. W. and VARBERG, D. E. (1973). *Convex Functions*. Academic, New York.
- ROBERTSON, C. A. and FRYAR, J. G. (1969). Some descriptive properties of normal mixtures. *Skand. Aktuarier Tidskr.* **52** 137–146.
- ROBERTSON, T., WRIGHT, F. T. and DYKSTRA, R. L. (1986). *Order Restricted Statistical Inference*. Wiley, Chichester.
- ROEDER, K. (1990). Density estimation with confidence sets exemplified by superclusters and voids in the galaxies. *J. Amer. Statist. Assoc.* **85** 617–624.

- ROEDER, K. (1994). A graphical technique for determining the number of components in a mixture of normals. *J. Amer. Statist. Assoc.* **89** 487–495.
- ROEDER, K., CARROLL, R. J. and LINDSAY, B. G. (1993). A nonparametric mixture approach to case-control studies with errors in covariables. Technical Report 94-1, Center for Likelihood Studies, Pennsylvania State Univ.
- ROEDER, K., DEVLIN, B. and LINDSAY, B. G. (1989). Application of maximum likelihood methods to population genetic data for the estimation of individual fertilities. *Biometrics* **45** 363–379.
- RUDAS, T., CLOGG, C. C. and LINDSAY, B. G. (1994). A new index of fit based on mixture methods for the analysis of contingency tables. *J. Roy. Statist. Soc. Ser. B* **56** 623–639.
- SCHOLZ, F. W. (1980). Towards a unified definition of maximum likelihood. *Canad. J. Statist.* **8** 193–203.
- SHAKED, M. (1980). On mixtures from exponential families. *J. Roy. Statist. Soc. Ser. B* **42** 192–198.
- SHAPIRO, A. (1985). Asymptotic distribution of test statistics in the analysis of moment structures under inequality constraints. *Biometrika* **72** 133–144.
- SHEPP, L. A. and VARDI, Y. (1982). Maximum likelihood reconstruction in positron emission tomography. *IEEE Transactions on Medical Imaging* **1** 113–122.
- SILVEY, S. D. (1980). *Optimal Design*. Chapman and Hall, New York.
- SIMAR, L. (1976). Maximum likelihood estimation of a compound Poisson process. *Ann. Statist.* **4** 1200–1209.
- TITTERINGTON, D. M., SMITH, A. F. M. and MAKOV, U. E. (1985). *Statistical Analysis of Finite Mixture Distributions*. Wiley, New York.
- USPENSKY, J. V. (1937). *Introduction to Mathematical Probability*, 1st ed. McGraw-Hill, New York.
- VARDI, Y. and LEE, D. (1993). From image deblurring to optimal investments: Maximum likelihood solutions for positive linear inverse problems. *J. Roy. Statist. Soc. Ser. B* **55** 569–599.
- VARDI, Y., SHEPP, L. A. and KAUFMAN, L. (1985). A statistical model for positron emission tomography. *J. Amer. Statist. Assoc.* **80** 8–20.
- WALTER, G. G. and HAMEDANI, G. G. (1991). Bayes empirical Bayes estimation for natural exponential families with quadratic variance functions. *Ann. Statist.* **19** 1191–1224.
- WING, G. M. and ZAHRT, J. D. (1991). *A Primer on Integral Equations of the First Kind: The Problem of Deconvolution and Unfolding*. SIAM, Philadelphia.