

Title:

**Multiscale Maximum Likelihood Analysis of a Semiparametric Model,  
with Applications**

Author(s):

**Guenther Walther**

Technical Report number (Dept. of Statistics, Stanford Univ.):

**2001-5**

Date:

**April, 2001**

Abstract:

A special semiparametric model for a univariate density is introduced that allows to analyze a number of problems via appropriate transformations. Two problems treated in some detail are testing for the presence of a mixture and detecting a wear-out trend in a failure rate. The analysis of the semiparametric model leads to an approach that advances the maximum likelihood theory of the Grenander estimator to a multiscale analysis. The construction of the corresponding test statistic rests on an extension of a result on a two-sided Brownian motion with quadratic drift to the simultaneous control of ‘excursions under parabolas’ at various scales of a Brownian Bridge. The resulting test is shown to be asymptotically optimal in the minimax sense regarding both rate and constant, and adaptive with respect to the unknown parameter in the semiparametric model. The performance of the method is illustrated with a simulation study for the failure rate problem, and with data from a flow cytometry experiment for the mixture analysis. This technical report is a detailed version of Walther (2001).