

Title:

**Validity of the Expected Euler Characteristic Heuristic**

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

**2003-26**

Date:

**September 2003**

Abstract: We study the accuracy of the expected Euler characteristic approximation to the distribution of the maximum of a smooth, centered, unit variance Gaussian process  $f$ . Using a point process representation of the error, valid for arbitrary smooth processes, we show that the error is in general exponentially smaller than any of the terms in the approximation. We also give a lower bound on this exponential rate of decay in terms of the maximal variance of a family of Gaussian processes  $f^x$ , derived from the original process  $f$ .