Title: **Ridgelets: Estimating with Ridge Functions**

Author(s): **Emmanuel J. Candès**

Technical Report number (Dept. of Statistics, Stanford Univ.): **1999-27**

Date: **November 1999**

Abstract:

Feedforward neural networks, projection pursuit regression, and more generally, estimation via ridge functions have been proposed as an approach to bypass the curse of dimensionality and are now becoming widely applied to approximation or prediction in applied sciences. To address problems inherent to these methods — ranging from the construction of neural networks to their efficiency and capability — Candès (1999d) developed a new system that allows the representation of arbitrary functions as superpositions of specific ridge functions, the *ridgelets*.

In a nonparametric regression setting, this article suggests expanding noisy data into a ridgelet series and applying a scalar nonlinearity to the coefficients (dumping); this is unlike existing approaches based on stepwise additions of elements. The procedure is simple, constructive, stable and spatially adaptive — and fast algorithms have been developed to implement it.

The ridgelet estimator is nearly optimal for estimating functions with certain kinds of spatial inhomogeneities. In addition, ridgelets help to identify new classes of estimands — corresponding to a new notion of smoothness — that are well suited for ridge functions estimation. While the results are stated in a decision theoretic framework, numerical experiments are also presented to illustrate the practical performance of the methodology.