

Entropy-guided least squares: a robust approach to scattered data approximation

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We propose a novel weighted least-squares approximation framework in which both the approximating function and the error weights are determined simultaneously through a maximum entropy principle. Interpreting the weights as a probability distribution, we select them by maximizing entropy - i.e., the degree of uncertainty - under the constraint that the mean squared error remains below a prescribed threshold. This constraint acts as a regularization mechanism, resulting in a robust regression method capable of automatically identifying and down-weighting outliers during the fitting process. We consider the use of both polynomials and univariate/bivariate splines. We demonstrate the versatility of the method through a range of illustrative examples drawn from diverse application domains.

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References

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