Nonlinear function approximation using different dimension-incremental strategies

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We present a dimension-incremental algorithm for the nonlinear approximation of high-dimensional functions in an arbitrary bounded orthonormal product basis. Our goal is to detect a suitable truncation of the basis expansion of the function, where the corresponding basis support is assumed to be unknown. Our method is based on point evaluations of the considered function and adaptively builds an index set of a suitable basis support, such that the approximately largest basis coefficients are still included. There are various minor modifications of the algorithm investigated as well, which may yield additional benefits in several situations. For the first time, we provide a proof of a detection guarantee for such an index set in the function approximation case under certain assumptions on the sub-methods used within our algorithm, which can be used as a foundation for similar statements in various other situations as well. Numerical examples in different settings underline the effectiveness and accuracy of our method.

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