Determining “Optimal” Shape Parameters with Precision Adapted Radial Basis Function Interpolation

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In Radial Basis Function (RBF) interpolation, Cross Variance techniques such as Rippa’s LOOCV are often used to determine the value of the shape parameter, $c$. These Cross Variance techniques only require the points of the interpolant to choose a value of $c$. Care must be taken, however, to ensure that any value of $c$ considered will provide a stable interpolant. The range of acceptable values of $c$ varies based on the type of basis function used, the number of points, their spacing, and the machine precision used in calculation. If greater machine precision is applied to interpolation, then the range of values of $c$ that may potentially provide good results is larger. The value of $c$ ultimately chosen will depend on the cost function used. We propose a novel method to determine what range of $c$ values should be examined when searching for a suitable $c$. This method considers the interpolation points being used as well as the available machine precision. The method works for both uniformly and non-uniformly spaced points.