High-dimensional node generation with variable density

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We show how to use strongly repulsive energy functionals for distributing nodes according to a prescribed density, so that certain local properties are satisfied, and the resulting node configuration is well-behaved. The properties of interest include distribution of distances to the (k-) nearest neighbors, depths of the Voronoi holes, and the angular structure of the Voronoi diagram.

The importance of constructing such discrete configurations is due to applications in meshless methods, in particular for building PDE solvers and interpolants with radial basis functions. A variant of our technique draws on quasi-Monte Carlo methods.