Report Q1: Is the polynomial part need and why?

Answer:

The polynomial part is not required as the Gaussian equation is positive definite.

Report Q2: Write down the linear algebra used to represent the spline fitting problem and the solution. Cite the key formula in the report in the relevant part of your code.

Answer:

The transformation function between a set of source points, **p**, and target points, **q**, can be described as:

For each point in the 2 sets, n, and for each dimension of the data, k (for 3 dimensions, k = 1:3).

Viewing this transformation function as a radial basis function, it can be described as:

Where the sum of polynomials, and the sum of RBFs, is equal to:

Combining these 2 equations with the constraints …:

… gives the system of linear equations (Including the weighting parameters, λ and σ.):

Writing the linear equations as:

As we are dealing with a Gaussian kernel, the polynomial part, , can be ignored.

As a result, the transfer function is equal to:

… and, as P is equal to:

… the linear equations can be simplified to:

Rearranging for the equation coefficient, α, gives us:

For a Gaussian fit, K is equal to:

Which we insert into the equation for α to give us the solutions of the linear equations in each dimension as:

Report Q3: What is the best linear algebra algorithm should be implemented to solve this spline fitting problem and why?

Answer: