Bilinear interpolation Report

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2022

1 Bilinear Interpolation Method

Bilinear interpolation is a technique used to estimate the value of an unknown function f at a point (x, y) using known values of f at four surrounding points $Q11 = (x1, y1)$, $Q12 = (x1, y2)$, $Q21 = (x2, y1)$, and $Q22 = (x2, y2)$.

Linear Interpolation in x-Direction

First, linear interpolation is performed in the x-direction. This yields estimates $f(x, y1)$ and $f(x, y2)$:

$$f(x, y1) = \frac{x2 - x}{x2 - x1} \cdot f(Q11) + \frac{x - x1}{x2 - x1} \cdot f(Q21)$$
$$f(x, y2) = \frac{x2 - x}{x2 - x1} \cdot f(Q12) + \frac{x - x1}{x2 - x1} \cdot f(Q22)$$

Linear Interpolation in y-Direction

Using the estimated values from the previous step, linear interpolation is then performed in the y-direction to obtain the desired estimate $f(x, y)$:

$$f(x, y) = \frac{y2 - y}{y2 - y1} \cdot f(x, y1) + \frac{y - y1}{y2 - y1} \cdot f(x, y2)$$

In these equations, $x1$, $x2$, $y1$, and $y2$ are the known coordinates, and $Q11$, $Q12$, $Q21$, and $Q22$ are the known function values at those coordinates. The final $f(x, y)$ represents the estimated value of the unknown function at point (x, y).

1.1 Results

Figure 1: Bilinear Interpolation