MA635P-Scientific Programming Laboratory

Shepard Interpolation

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Deadline: March 16, 2025

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Shepard Interpolation

Title of the Project

Shepard Interpolation: Analyzing Accuracy and Applications in Scattered Data Approximation

Background

- Shepard interpolation is a weighted inverse distance interpolation method used for approximating functions based on scattered data points.
- It is particularly useful when data points are unevenly distributed, such as in geospatial mapping, fluid dynamics, and machine learning regression.

Objective

- To implement hepard interpolation and explore its properties.
- To analyze its error behavior and convergence properties.
- To Apply it to real-world problems like terrain modeling, weather prediction, and scattered data approximation.

Requirements

Read the following papers/Lecture Notes:

1. Modified Shepard Algorithm for Interpolation of Scattered Multivariate Data
2. TWELVE DIFFERENT INTERPOLATION METHOD
3. A two-dimensional interpolation for irregularly-spaced data

Steps to Solve

1. Code
   - 1.1 Python Code for computing Shepard interpolation.
2. Mathematical Report
   - 2.1 Introduction to Shepard interpolation. and their properties.
   - 2.2 Mathematical derivation of the interpolation formula.
3. Compare with Polynomial Interpolation
   - 3.1 Comparison with equally spaced interpolation (Lagrange, Newton).
   - 3.2 Error analysis: How interpolation error depends on function smoothness.
4. Applications
   - 4.1 Geospatial Data Approximation: Shepard interpolation for terrain modeling.
   - 4.2 Machine Learning: Feature interpolation for irregularly spaced datasets.

Deliverable

1. Python-code
2. A report on error analysis, comparison with polynomial interpolation and Runge's phenomenon
3. Identify Applications

Team

Team

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Thanks

Doubts and Suggestions

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