MA635P-Scientific Programming Laboratory

Padé Approximation

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Deadline: March 16, 2025

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Padé Approximation

Title of the Project

Padé Approximation for Geophysics

Background

- A powerful technique for approximating functions using rational functions (fractions of polynomials).
- It often outperforms Taylor series and other polynomial approximations
- Taylor series expansions can diverge or converge very slowly for some functions (e.g., near singularities or for large xx).
- Padé approximants can provide better accuracy with fewer terms by capturing asymptotic behavior more effectively.
- It helps in numerical reconstructions in Medical Imaging and Signal Processing
- It can approximate activation functions like sigmoid and tanh more efficiently in ML.

Objective

- To explore how Padé approximants can be used to improve function approximations in numerical computing and machine learning applications.
- To focus on comparing Padé approximants with Taylor series, polynomial interpolation for different types of functions.

Requirements

Read the following papers:

1. Applications of Pade Approximation in Numerical Analysis
2. Rational Approximants Defined from Double Power Series

Steps to Solve

1. Construct Pade approximation for e^x
2. Check how does scipy does the pade approximation

1. Develop a Pade approximation for general function

Deliverable

1. A Python-code for Pade approximations
2. Visualizations of the numerical interpolation for the Pade approximation
3. Identify a problem that has the application of Pade approximation, For example Geophysics

Team

Team

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Thanks

Doubts and Suggestions

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