Analysis of Algorithms

Amypo Technologies Pvt Ltd

Agenda
Day 10 - Analysis of Strassen’s Algorithm

- Strassens Matrix Mutiplication

Introduction to Strassen's Matrix Multiplication

Strassen's Matrix Multiplication is an advanced algorithm for multiplying matrices efficiently, reducing the time complexity for large matrices.

Basic matrix multiplication algorithm

Concept

Traditional method involving row-by-column multiplication and addition.

Usage

Applicable to small-sized matrices and for educational purposes.

Complexity

Has a time complexity of O(n^3) for two n x n matrices.

Limitations of the basic algorithm

1. **Time Complexity**

   Quadratic time complexity, limiting performance for large matrices.

2. **Scalability**

   Not efficient for multiplying very large matrices due to its time complexity.

3. **Resource Consumption**

   High utilization of computational resources for larger matrices.

Overview of Strassen's algorithm

1

Invention

Developed in 1969 by Volker Strassen as a breakthrough in computational complexity theory.

2

Approach

Utilizes a divide and conquer strategy to reduce the number of scalar multiplications.

3

Impact

Revolutionized matrix multiplication by introducing a faster method.

Divide and conquer approach

1

Divide

Split the matrices into smaller submatrices to simplify the calculations.

2

Conquer

Perform recursive multiplication on the submatrices.

3

Combine

Recompose the matrices using the results of the submatrix products.

Recursive steps of Strassen's algorithm

Base Case

Identify the point where matrix multiplication stops recursively.

Multiplication

Perform the Strassen's algorithm on the submatrices.

Addition & Subtraction

Combine results using addition and subtraction operations.

Complexity analysis of Strassen's algorithm

O(n^log7)

Time Complexity

Space Efficient

Resource Usage

Innovative

Efficiency

Reduces the number of scalar multiplications from 8 to 7.

Conclusion and future directions

Optimization

Continuous efforts to fine-tune the algorithm for better performance.

Application

Exploring applications in diverse fields like graphics rendering and scientific simulations.

Innovation

Adapting the principles of Strassen's algorithm for new computational challenges.