UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN

DAA LAB - 3

Strassen Matrix Multiplication

MTECH-COMPUTER SCIENCE
ENGINEERING
CYBER SECURITY AND FORENSICS

Name: Jigesh Sheoran
SAP ID: 590025428

JIGESH SHEORAN
590025428
M.Tech CSE

Title: : Implement an algorithm for Strassen Matrix Multiplication

Implementation: Language used : Python

starssenMM.py

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```python
# Author: Jigesh Sheoran
# SAPID: 590025428

import numpy as np

def read_matrix(n):

    matrix = []
    for _ in range(n):
        row = list(map(int, input().split()))
        matrix.append(row)
    return np.array(matrix)

def split(matrix):
    #split into 4 parts
    row, col = matrix.shape
    row2, col2 = row // 2, col // 2
    return (
        matrix[:row2, :col2],  # a11
        matrix[:row2, col2:],  # a12
        matrix[row2:, :col2],  # a21
        matrix[row2:, col2:],  # a22
    )

def strassen_multiply(x, y):

    if len(x) == 1:
        return x * y

    a, b, c, d = split(x)
    e, f, g, h = split(y)

    # 7 multiplications
    d1 = strassen_multiply(a + d, e + h)
    d2 = strassen_multiply(c + d, e)
    d3 = strassen_multiply(a, f - h)
    d4 = strassen_multiply(d, g - e)
    d5 = strassen_multiply(a + b, h)
    d6 = strassen_multiply(c - a, e + f)
    d7 = strassen_multiply(b - d, g + h)

    # Combining back
    c11 = d1 + d4 - d5 + d7
    c12 = d3 + d5
    c21 = d2 + d4
    c22 = d1 + d3 - d2 + d6

```

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```
48      return np.vstack((np.hstack((c11, c12)), np.hstack((c21, c22))))
49
50  def strassen(x, y):
51      #padding
52      n = x.shape[0]
53      if n & (n - 1) == 0 and n != 0:
54          return strassen_multiply(x, y)
55
56      m = 1
57      while m < n:
58          m *= 2
59
60      x_padded = np.zeros((m, m))
61      y_padded = np.zeros((m, m))
62      x_padded[:n, :n] = x
63      y_padded[:n, :n] = y
64
65      result_padded = strassen_multiply(x_padded, y_padded)
66      return result_padded[:n, :n]
67
68
69  if __name__ == "__main__":
70      n = int(input("Enter the size of Matrix: "))
71      print("\nEnter elements for Matrix A:")
72      A = read_matrix(n)
73      print("\nEnter elements for Matrix B:")
74      B = read_matrix(n)
75
76      strassen_result = strassen(A, B)
77      print("\nResult Strassen's Algo:\n", strassen_result)
78
79      numpy_result = np.dot(A, B)
80      print("\nResult from NumPy (for verification):\n", numpy_result)
```

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590025428
M.Tech CSE

Output:

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
/usr/local/bin/python3 "/Users/sheoraninfosec/Documents/Masters UPES/DAA/Lab4/sta
sheoraninfosec@Jigeshs-MacBook-Air / % /usr/local/bin/python3 "/Users/sheoraninfo
Enter the size of Matrix: 3

Enter elements for Matrix A:
1 43 43
13 45 32
4 7 89

Enter elements for Matrix B:
43 5 61
43 2 3
22 57 81

Result Strassen's Algo:
 [[2838. 2542. 3673.]
 [3198. 1979. 3520.]
 [2431. 5107. 7474.]]

Result from NumPy (for verification):
 [[2838 2542 3673]
 [3198 1979 3520]
 [2431 5107 7474]]
sheoraninfosec@Jigeshs-MacBook-Air / %
```

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JIGESH SHEORAN
590025428
M.Tech CSE