

Matrix Multiplication

Parallelism

Link:

[Implementation Link](#)

Applications

- Quantum Computing: Quantum circuits are represented as matrices, and operations on qubits are implemented using matrix multiplication. Quantum algorithms such as quantum Fourier transform and Shor's algorithm heavily rely on matrix operations.
- Machine Learning and Data Analysis: Matrix multiplication plays a fundamental role in machine learning algorithms, particularly in neural networks. It is used for operations like forward and backward propagation, weight updates, and computing activations.

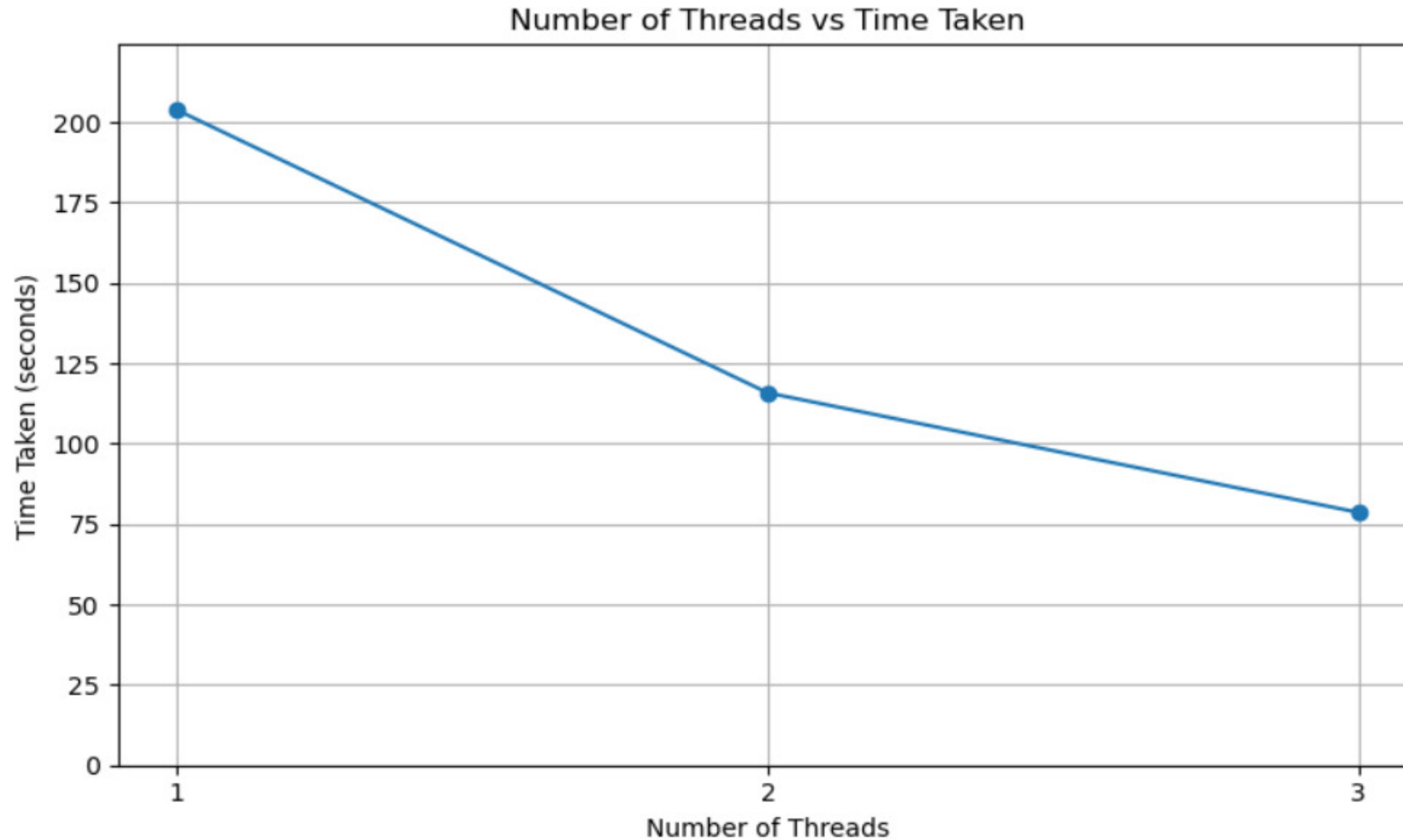
Parallelism Implementation

- Matrix multiplication can be parallelized using threads by dividing the workload among multiple threads, with each thread computing a portion of the resulting matrix. This involves partitioning the input matrices into smaller blocks or rows/columns, and assigning each thread to work on a separate block or set of rows/columns. Synchronization mechanisms ensure data consistency, enhancing performance and efficiency through thread-level parallelism on multi-core processors.

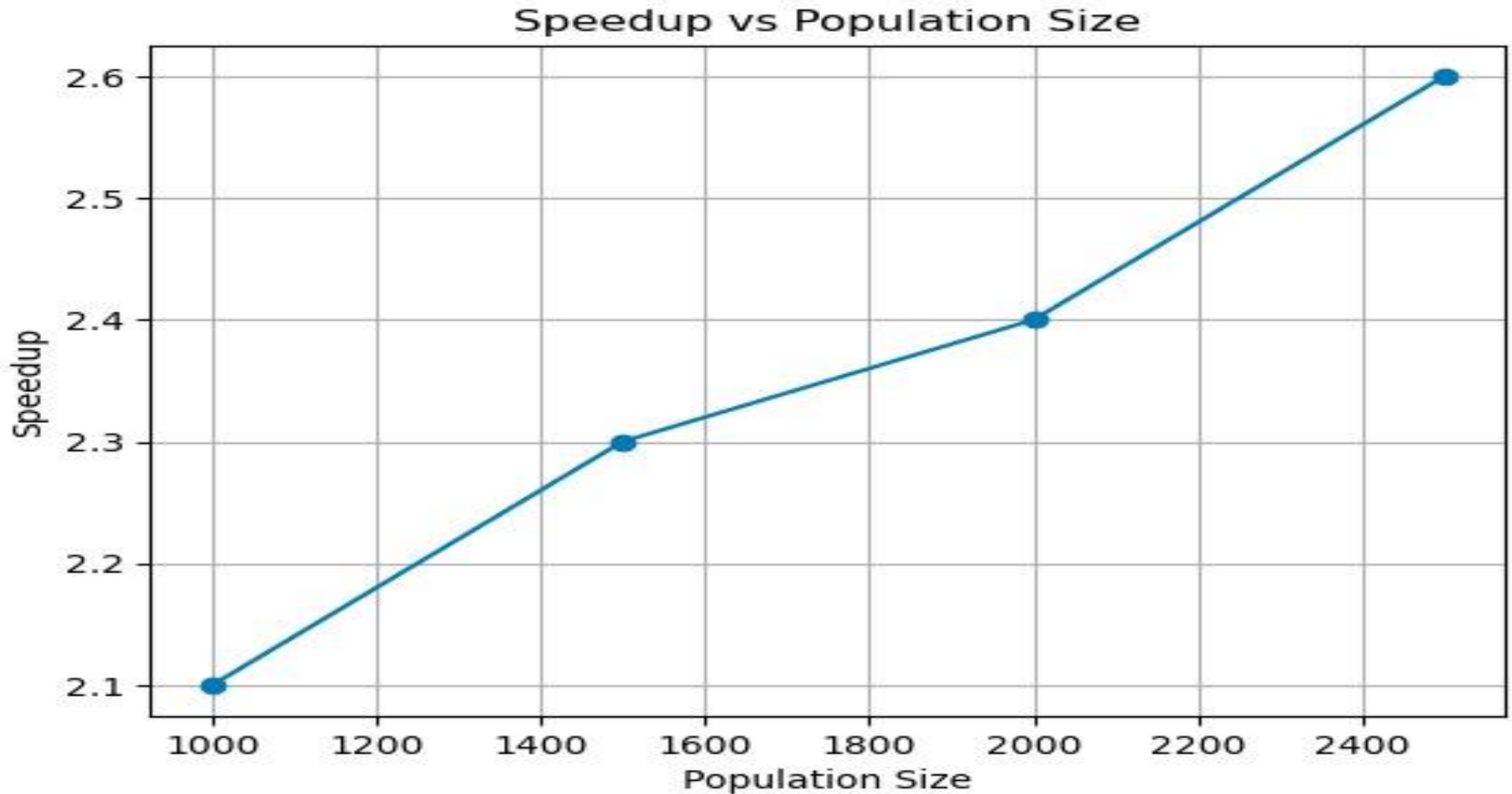
Table

No. of Samples(n)	Serial Time(sec)	Parallel Time(sec)	Speed Up
1000	4.4	1.9	2.1
1500	19.6	8.3	2.3
2000	125	35	2.4
2500	203	78	2.6

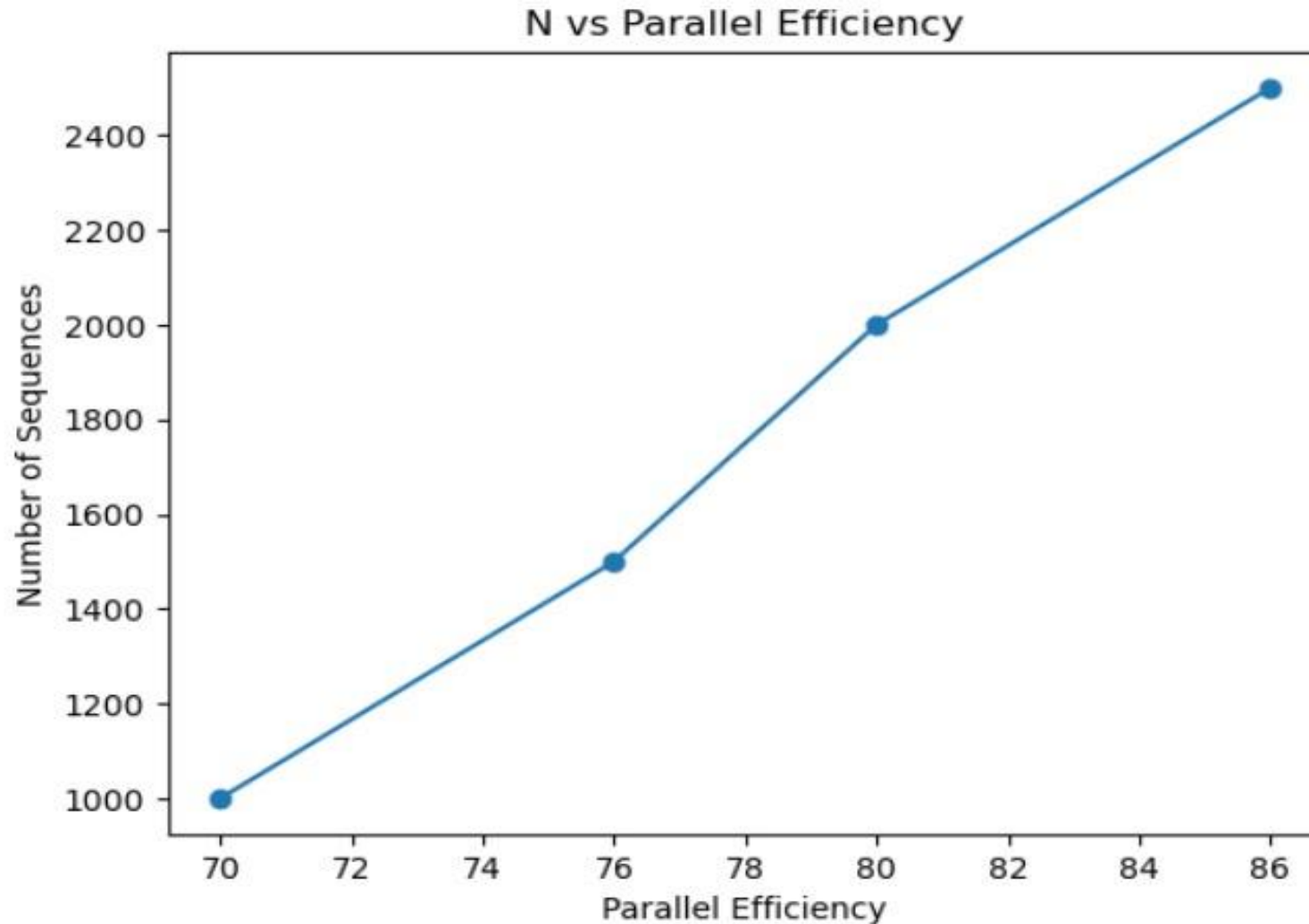
Number of Threads vs Time Taken



Speedup vs Population Size



N vs Parallel Efficiency



Parallel Efficiency
N - Parallel Efficiency
1000 - 70
1500 - 76
2000 - 80
2500 - 86



Thank You