

EFFICIENCY OF ALGORITHMS

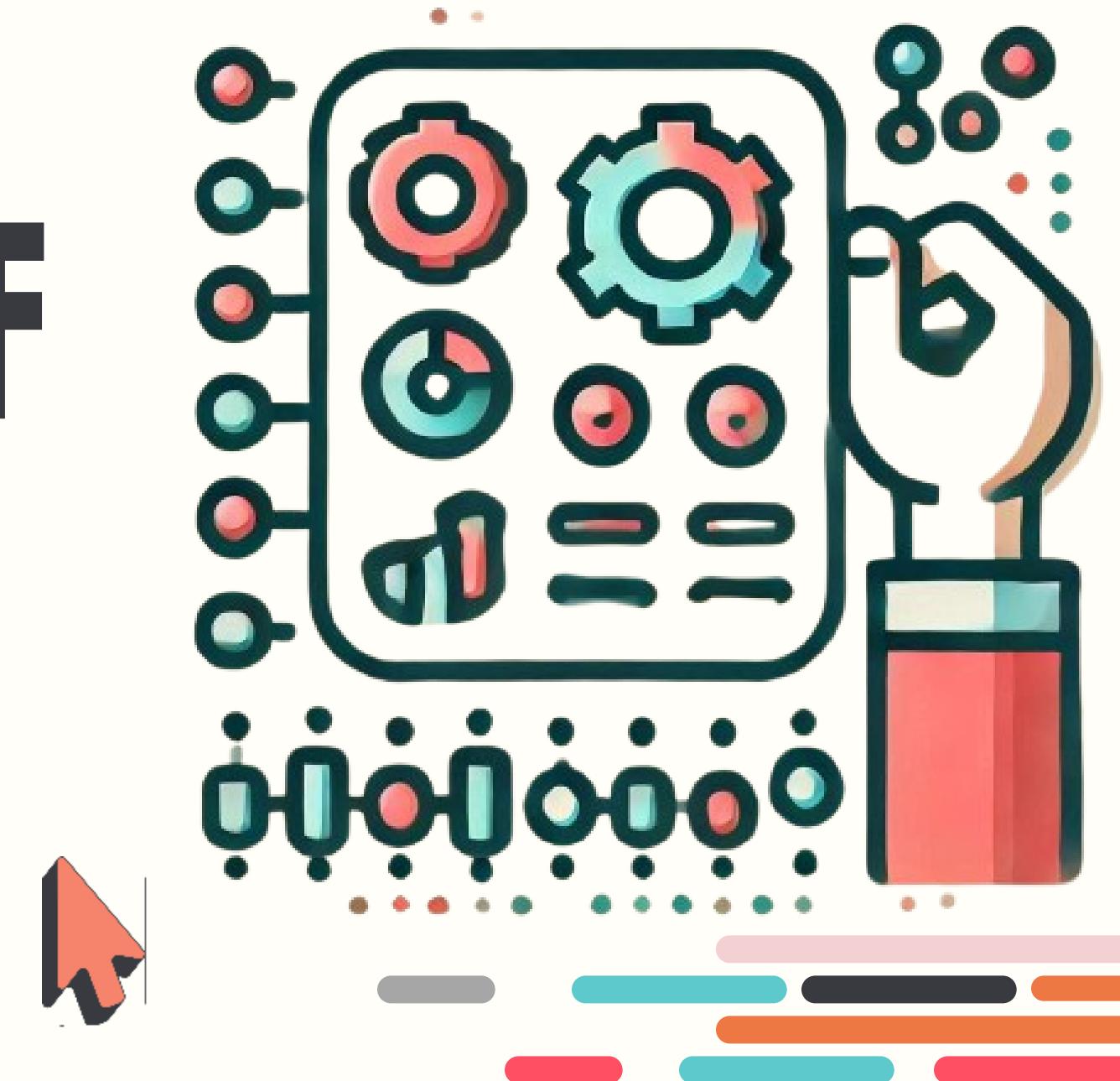




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SUMMARY



01

WHAT DOES ALGORITHM EFFICIENCY MEAN?

The measure of an algorithm's performance in terms of time and space used.

Why It Matters:

- Faster execution times improve user experience.
- Efficient use of resources reduces costs.
- Enables scalability in applications.





02

METRICS FOR MEASURING EFFICIENCY

1. TIME COMPLEXITY

Measures the time an algorithm takes as input size grows.

Common Notations:
 $O(1)$, $O(n)$, $O(\log n)$,
 $O(n^2)$.

Example Code:

```
# Linear search
def search(arr, target):
    for i in range(len(arr)):
        if arr[i] == target:
            return i
    return -1
```



METRICS FOR MEASURING EFFICIENCY

2. SPACE COMPLEXITY

Measures the amount of memory required by the algorithm.

Includes auxiliary and input data storage.

Example Code:

```
# Space-efficient reverse string
def reverse_string(s):
    return s[::-1]
```



03

FACTORS AFFECTING ALGORITHM EFFICIENCY



INPUT SIZE

Larger inputs require more time and space.



OPERATIONS

Number and type of operations performed.



HARDWARE

Processing power and memory availability.



PROGRAMMING LANGUAGE

Processing power and memory availability.

OPTIMIZING ALGORITHMS



1

CHOOSE THE RIGHT ALGORITHM

Select algorithms suited to the problem, such as using Merge Sort ($O(n \log n)$) for large datasets instead of Bubble Sort ($O(n^2)$).

2

USE EFFICIENT DATA STRUCTURES

Employ data structures that optimize operations, like Hash Tables for $O(1)$ lookups compared to $O(n)$ in a list.

3

AVOID UNNECESSARY CALCULATIONS

Use techniques like caching or dynamic programming to store intermediate results and avoid redundant computations.



05

SUMMARY

Algorithm efficiency is evaluated using time and space complexity.

Faster and memory-efficient algorithms improve scalability and performance.

Understanding input size and growth rates helps in selecting the best algorithm.





THANK YOU!

