

3. Define and describe the measures of performance for compression techniques. How they are used to evaluate efficiency

#### → Compression Ratio

\* Show how much the original data size is reduced after compression.

$$CR = \frac{\text{original Size}}{\text{compressed Size}}$$

- \* Higher CR → Better size reduction
- \* used to compare different compression technique

#### → Compression Efficiency

Show how much storage space is saved

$$\text{compression efficiency} = \frac{\text{original Size} - \text{compressed Size}}{\text{original Size}} \times 100$$

- \* Help measure storage or bandwidth saving
- \* useful in network transmission system.

#### → Bit Rate

Number of bits used per second / per pixel

$$\text{Bit Rate} = \frac{\text{Total bits in compressed image}}{\text{Number of pixels}}$$

- \* Lower bit rate → more compression
- \* But very low bit rate may reduce quality



## → Distortion

used mainly in lossy compression

$$MSE = \frac{1}{N} \sum (\text{original} - \text{compressed})^2$$

lower MSE → Better quality

- \* used in image and video compression
- \* Balances compression and visual quality

## → Compression Time

Time taken to compress data

- \* Important in real-time system.
- \* Fast compression needed for streaming and communication

## → Entropy

Minimum average number of bits required to represent data.

$$H = - \sum P(x) \log_2 P(x)$$

- \* Compares algorithm performance without theoretical limit
- \* Good compression approaches entropy value

## → Compression efficiency is evaluated by balancing:

- Size Reduction
- Quality preservation
- Speed (compression/decompression time)
- Resource usage (complexity, memory)