Nadar Saraswathi College of Engineering & Technology

NSCET E-LEARNING PRESENTATION

LISTEN … LEARN… LEAD…

ELECTRONICS & COMMUNICATION ENGINEERING

IV YEAR / VIII th SEMESTER

EC 6018 – MULTIMEDIA COMPRESSION & COMMUNICATION

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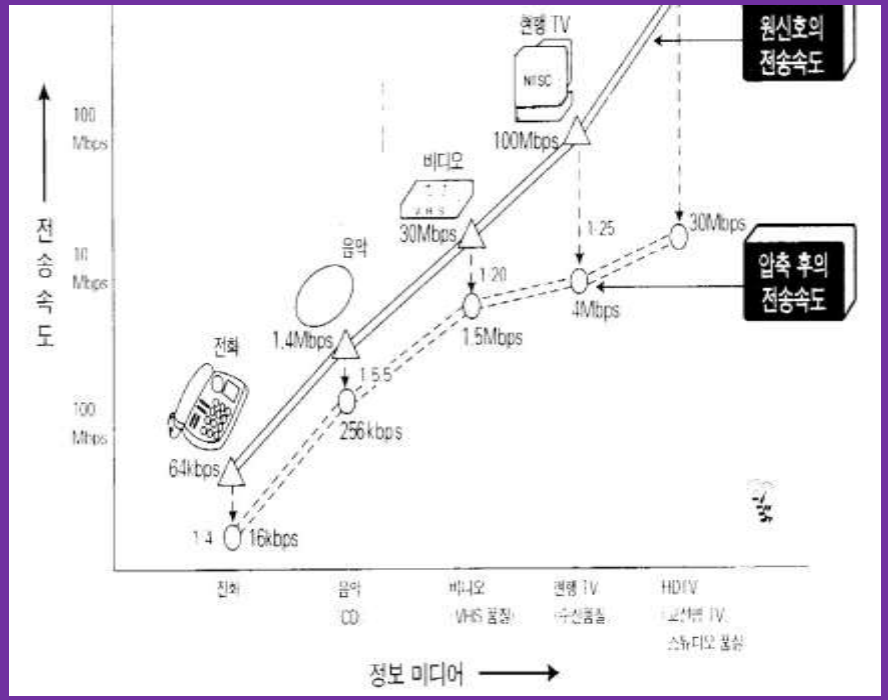
UNIT-2

TEXT AND IMAGECOMPRESSION

Data Compression



Types of Redundancy

- Spatial redundancy
- Values of neighboring pixels are strongly correlated
- Redundancy in scale
- Straight edges and constant regions are invariant under rescaling
- Redundancy in frequency the spectral values for the same pixel location are often correlated
- An audio signal can completely mask a sufficiently weaker signal in its frequency-vicinity
- Temporal redundancy
- Adjacent frames in a video sequence
- A strong audio signal can mask an adequately lower distortion in a previous or future time block
- Stereo redundancy
- Stereo channels are correlated

Tradeoffs in Compression

- Quality vs. Size
- Reduced quality is often OK for multimedia

Example

- .bmp (1153 KB) .gif (196 KB)
- .jpg max quality (168 KB) .jpg low quality (63 KB)
- Processing time vs. Size
- Software vs. hardware encoding and decoding
- Advantages of software decompression
- Reasonable compression ratio with acceptable quality
- Audio: 4:1 Images: 10:1 Video: 50:1

Characteristics of Compression Method

- Lossless : Original data can be recovered precisely
- Lossy : Not lossless
- Intraframe : Frames are coded independently

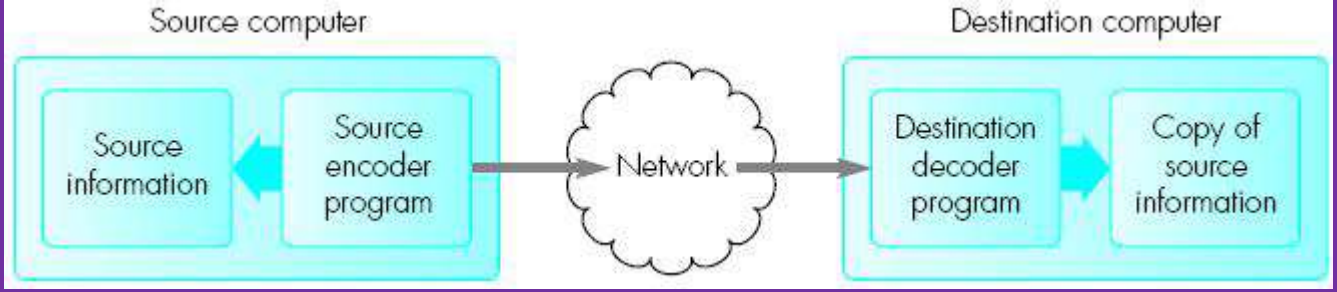
Interframe : Frames are coded with reference to previous and/or future frames

- Symmetrical : encoding time decoding time

Asymmetrical : encoding time >> decoding time

- Real-time : Encoding-decoding delay 50ms
- Scalable : Frames are coded in different resolutions and quality levels

Source Encoders / Destination Decoders



Classification of Coding Methods

Entropy encoding: lossless

- Run-length encoding
- Statistical encoding
- Source encoding: lossy
- Hybrid coding

Entropy Encoding

- Entropy : Uncertainty, Surprise, or Information defines min # of bits needed to represent the information content without information loss
- Entropy
- The semantics of data is ignored
- Data to be compressed is considered as a digital sequence
- Can be used for any media
- Run-length encoding
- Huffman encoding
- Arithmetic encoding
- LZW (Dictionary) encoding

$$\sum = = -niH\ Pi\ Pi\log\ 29$$

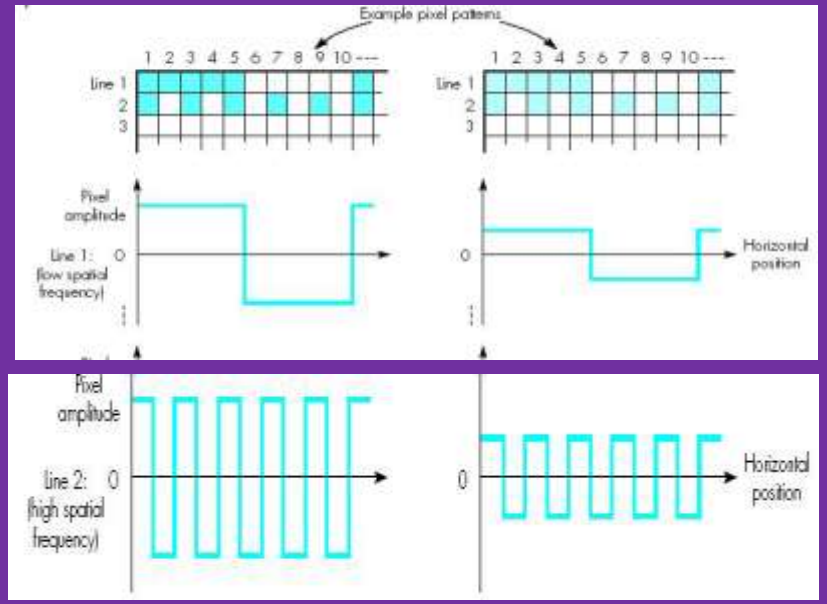
Run-Length Encoding

- Many messages have long ``runs'' of a single symbol
- Uncompressed data : UNNNNNNIMANNHEIM
- Encoding: transmit run length instead of the run itself
- Run-length coded : U!6NIMANNHEIM need byte stuffing
- Binary string: 000000011111111110000011… 0 7 1 10 0 5 1 2 …
- If first string is always 0, 7 10 5 2
- Run length encoded in count field of length k
- What is the optimum value for k?
- Run encoded as 1 bit = ‘1’, 7 bits = Count, 8 bits = Symbol
- Non-run encoded as 1 bit = ‘0’, 7 bits = Count, b*8 bits = sequence of symbols (b is the value ofCount)

Source Encoding

- Takes into account the semantics of the data
- is based on the content of the original signal
- divides the original data into relevant and irrelevant information, and remove irrelevant data
- exploits different characteristics of the human perceptive faculty
- Differential (Predictive) encoding
- DPCM
- DM
- Motion-compensated prediction
- Transformation encoding
- FT (Fourier Transformation)
- DCT (Discrete Cosine Transformation)
- DWT (Discrete Wavelet Transformation)

Transform Encoding



Type of coding

- Static coding

  Character set and the relative frequencies of occurrence are known

  Compute a set of codewords once, then used for all subsequent transfer
- Dynamic/Adaptive coding
- Dynamically compute the set of codewords that are being used at each point during a transfer

Huffman Coding (1)

Provides the optimal code for given data

using min. # of bits given the probability

Most frequently-occurring symbols have shortest codes

No symbol code can be a prefix of any other symbol's code

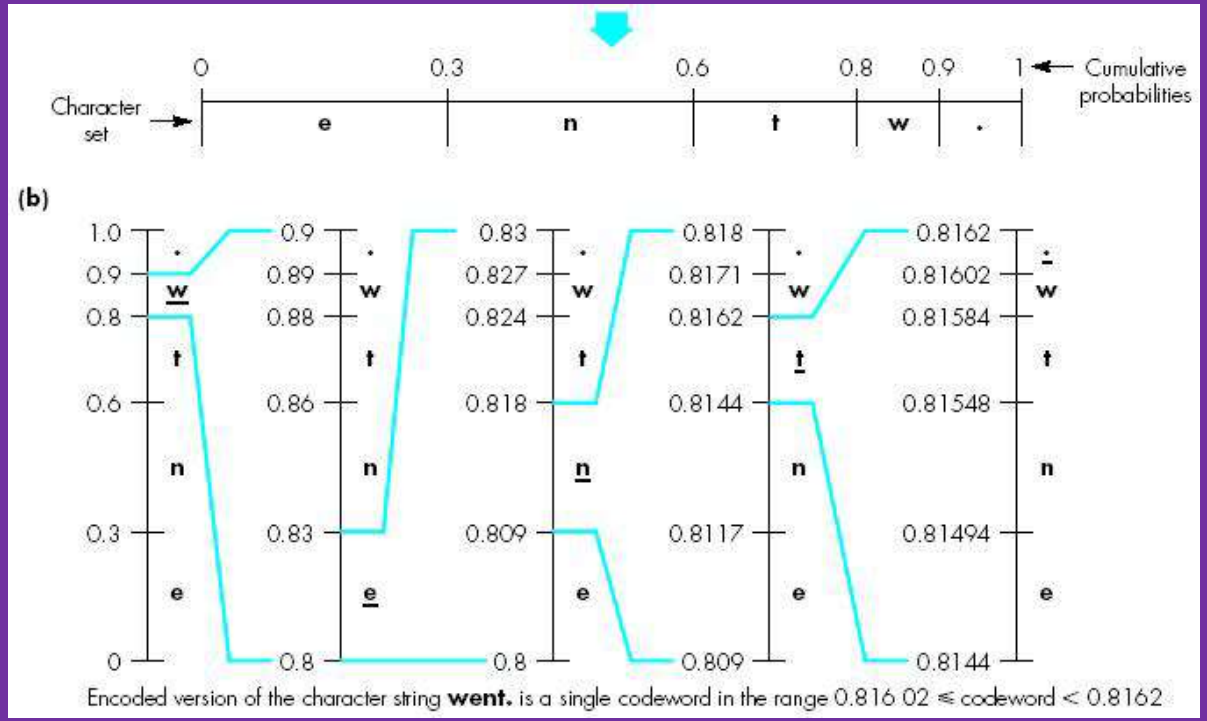
Huffman code tree and encoding

Huffman Coding (2)

- Decoding Huffman code
- needs Huffman table
- a part of the transmitted data stream
- or already known by the decoder
- or calculated at run-time (dynamic Huffman coding)
- performs only a simple table lookup
- Standard Huffman table used in audio/video coding
- known in advance both encoder and decoder
- Adv : faster encoding (real-time encoding)
- Disadv: not optimal

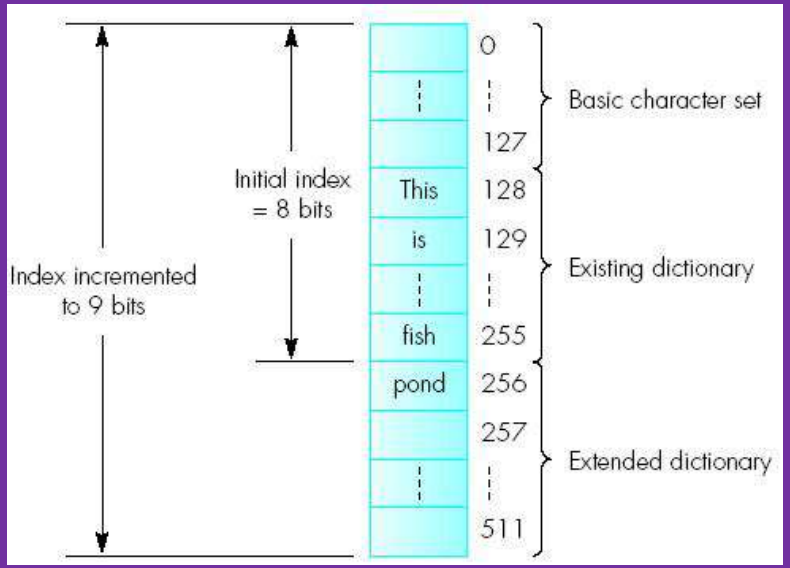
Arithmetic Coding

- In theory, as optimal as Huffman coding
- In practice, slightly better than Huffman coding in audio/video coding
  - Works with floating point number instead of characters, so enables a closer approximation
  - But introduces truncation error
  - Patents held by IBM, AT&T, Mitsubish



Encoded version of the character string **went.** is a single codeword in the range 0.816 02 ≤ codeword < 0.8162

Lempel-Ziv (LZ) Coding



Thank You