



Compression 101

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Compression Overview

- What is compression
- Spatial vs. Temporal compression
- JPEG compression
- M-JPEG compression
- MPEG-1 compression
- MPEG-2 compression
- MPEG-4 compression
- H.264 (a.k.a. MPEG-4 Part 10) compression
- Wavelet compression
- Conclusion

The logo for ApexCCTV features a stylized yellow star with a blue outline and a small yellow circle at its center. Below the star, the text "ApexCCTV" is written in a bold, orange, sans-serif font with a blue outline and a slight shadow effect.

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What is compression?

- Compression – Refers to reducing the quantity of data used to represent video images with the goal of retaining as much of the original's quality as possible.
- On the next few slides we will go over the different types of compression that are more prevalent in the CCTV industry.

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Spatial vs. Temporal compression

- Compression techniques revolve around two basic concepts: Spatial compression and Temporal compression.
- **Spatial Compression** – Used on a single image as a completely independent entity with no relation to other frames, and removes data unuseful for describing the image. (JPEG)
- **Temporal Compression** – Focuses on storing the changes between subsequent frames rather than the entire frame in isolation. If very little changes between subsequent frames then very little storage space is consumed. (MPEG)

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JPEG Compression

- **JPEG** – An extremely popular spatial compression algorithm focusing on individual photographs or very low framerate video.



Figure 1: A Five-picture JPEG video sequence.

JPEG Compression (contd)

- **Strengths**

- An industry standard, meaning that a camera that can generate JPEGs is likely to be 'viewable' by the largest range of video management systems.
- Effective with very active scenes
- Particularly easy to implement trick-play (play/pause/rewind/forward wind/step forward/reverse/etc.)

- **Weaknesses**

- Under high compression ratios the video appears blocky
- Inefficient at compressing moderate activity scenes
- Bitrates of 8 Mbps are very common, which makes it hard to transmit but almost unaffordable to store.

- **Ideal Applications**

- Storing photographs or snapshots from a video
- Very low framerate CCTV (< 5 FPS) but with high scene-activity levels.

MJPEG Compression

- **MJPEG** – Spatial compression algorithm where JPEGs are played in rapid succession to give the illusion of motion video.

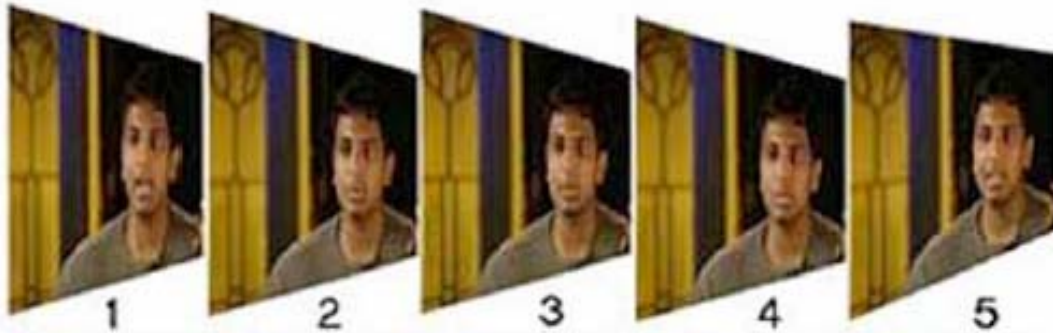


Figure 1: A Five-picture JPEG video sequence.

MJPEG Compression (contd)

- **Strengths**
 - Same as JPEG, except the JPEG images are played in rapid succession.
- **Weaknesses**
 - Same as JPEG
- **Ideal Applications**
 - Same as JPEG, but particularly common in CCTV due to its simplicity.
 - Its popularity has caused the CCTV market to accept low framerates (3.75 FPS) as the 'norm'.

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MPEG Compression

- **MPEG** – Temporal compression standard that focuses on storing the changes between subsequent frames rather than the entire frame in isolation.

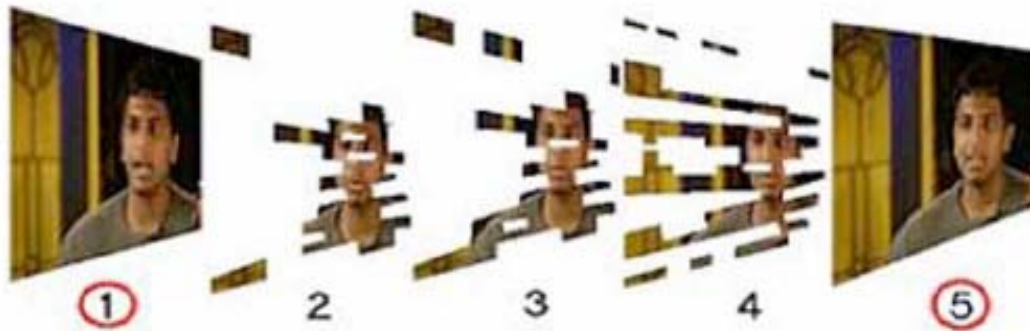


Figure 2: A Five-picture MPEG video sequence.

MPEG-1 Compression

- **Strengths**
 - VHS quality video on extremely cheap CD media
- **Weaknesses**
 - VHS quality is considered by many as an unreasonable quality restriction
- **Ideal Applications**
 - Low cost video CDs (VCDs)
 - The audio component of MPEG-1 has become known as MP3

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MPEG-2 Compression

- **Strengths**
 - The best quality video modern CCTV systems can buy
- **Weaknesses**
 - Bandwidth-intensive, typically 2.5-15 Mbps per camera
- **Ideal Applications**
 - Broadcast quality video, DVDs, LAN TV, high-fidelity stereo audio

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MPEG-4 (Part 2) Compression

- **Strengths**
 - Very efficient at high framerates when the difference between subsequent frames diminishes
 - Bandwidth is typically 100-1,000 kbps per camera
- **Weaknesses**
 - Low efficiency at very low framerates or extremely high scene activity
 - When the bitrate is limited the video artifacts are speckling and a blocky effect
- **Ideal Applications**
 - CCTV, especially when a high framerate is used, or when the majority of scene activity is low to medium

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H.264 (MPEG-4 Part 10) Compression

- **Strengths**
 - Promising broadcast-oriented technology that is more efficient than current MPEG-4 Part 2
- **Weaknesses**
 - High power processing hardware required and higher lag-times
- **Ideal Applications**
 - Next generation MPEG-4, to be used on HD DVDs, HDTV and pay-TV

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Wavelet Compression

- **Strengths**
 - Video looks great even under high compression because the human eye accepts a fuzzy picture more than discrete blocks
- **Weaknesses**
 - Under extreme compression the video becomes fuzzy and diffused, not blocky.
 - Incompatibility between different manufacturers.
- **Ideal Applications**
 - CCTV recording.

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Conclusion

- JPEG and MJPEG are suitable for lower framerates.
- The MPEG-4 compression algorithm offers the best video quality for the most common networks available today.

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