

Video Compression

Using Unsupervised Machine Learning

Team Members

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Problem Statement

- **Increased video consumption:** As people have started consuming video content, much more content is being produced and stored, which consumes a lot of storage space.
- **Transmission:** Transferring this content from one place to another takes much time, and transmission costs increase for more extensive data/videos.
- **Hardware Cost:** Also, more hardware must be manufactured to store that much content, and the need is increasing daily.

So, video compression and decompression are needed to save storage space, reduce the cost of transmission, and reduce resource wastage.



EXPLORATORY DATA ANALYSIS

PyScene Detect

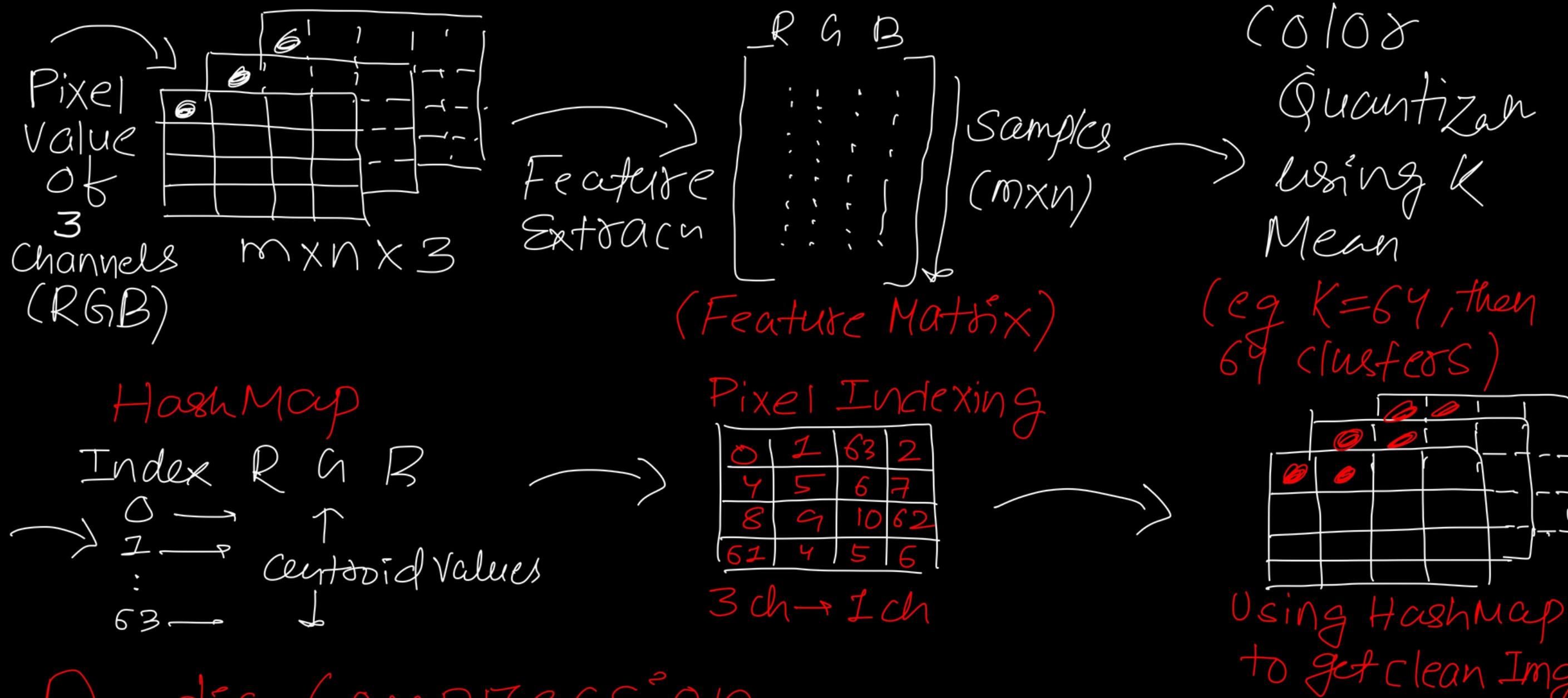
- ❖ Scene Change / shots
- ❖ Detectors
 - detect - adaptive
 - detect - content
 - detect - threshold
- ❖ Used → adaptive method
- ❖ Shot indexes obtained
 - $[1 \quad 49 \quad 00 \dots \quad 14,000]$

COLOR HISTOGRAM

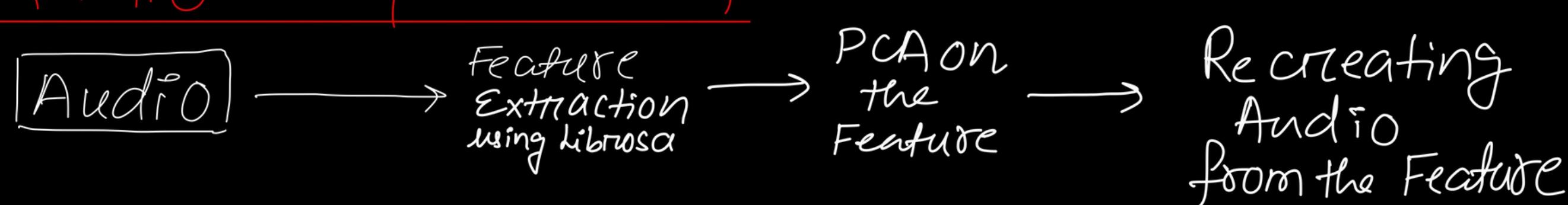
- ❖ Subshot creation within a shot.
- ❖ eg $[1 \quad 2 \quad 3 \quad \dots \quad 49]$
 - \uparrow
 - $\underbrace{\quad \quad \quad}_{\text{Subshot identify}}$
 - \uparrow
- ❖ Histogram differences
 - = $[0.228, 0.248, \dots]$
 - $(182) \quad (283) \quad \dots$
- ❖ Standard deviation threshold is detected.

COMPRESSION ALGORITHM

Video Compression



Audio Compression



DECOMPRESSION ALGORITHM

Video Decompression

Meta ($< 70\%$ of the
data video file)

Compressed
Frames

Obtained
From
SBD

SBD
(Shot Boundary
Detection
indexes)

(SBD)
[1 9 49 000]
↑ ↑ ↑
Indexes
↓
we have compressed frames
(2-8), (10, 78)
etc repeat frames.

Audio Decompression

.npy

(zipped)
audio

(Recreate the)
audio

Results

DATASET	ORIGINAL VIDEO SIZE	COMPRESSED VIDEO SIZE	DECOMRESSED VIDEO SIZE
VIDEO 1	167 MB	101 MB	381 MB
VIDEO 2	259 MB	61.6 MB	315 MB
AUDIO 1	9.16 MB	132 B	4.54 MB
AUDIO 2	9.15 MB	132 B	5.31 MB

- Metadata includes compressed frames, compressed audio, and a CSV file with shot indexes.
- Video compression involved storing shots and metadata.
- Audio compression resulted in an NPY file.
- Decompression used shots and metadata for video and the NPY file for audio.
- The final decompressed video was obtained by combining the video and audio.

Conclusion

- Utilized shot boundary detection for creating shots and representing the entire video with a reduced number of frames.
 - Applied k-Means for color quantization, where 'k' defines the size of compressed frames.
 - Increasing 'k' enhances image quality but also enlarges the compressed frame, leading to a trade-off between image quality and size.
 - Understood the basic working of a video codec, comprising an encoder and decoder for video compression and decompression.
 - Determined the size of metadata by choosing the number of clusters and threshold in color quantization.
 - The threshold chosen for shot boundary detection directly influences the number of shots identified in the shot boundary detection process.
- Acquired knowledge about different compression types, including lossy and lossless compression.

**Thank you
very much!**

Professor Vinayak Abrol