Image Retrival by Comparing Color Features

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Outline

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   - Image Retrieval
   - Application
2. Proposal
   - Color Features
3. Methodology
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   - Histogram Based Image Retrival
   - Extraction of Visual Feature
   - Coherence Bassed Image Retrival
4. Results
5. Decisions

Problem

What is Image Retrieval?

- Retrieve image from database
- Search by keywords or a query image

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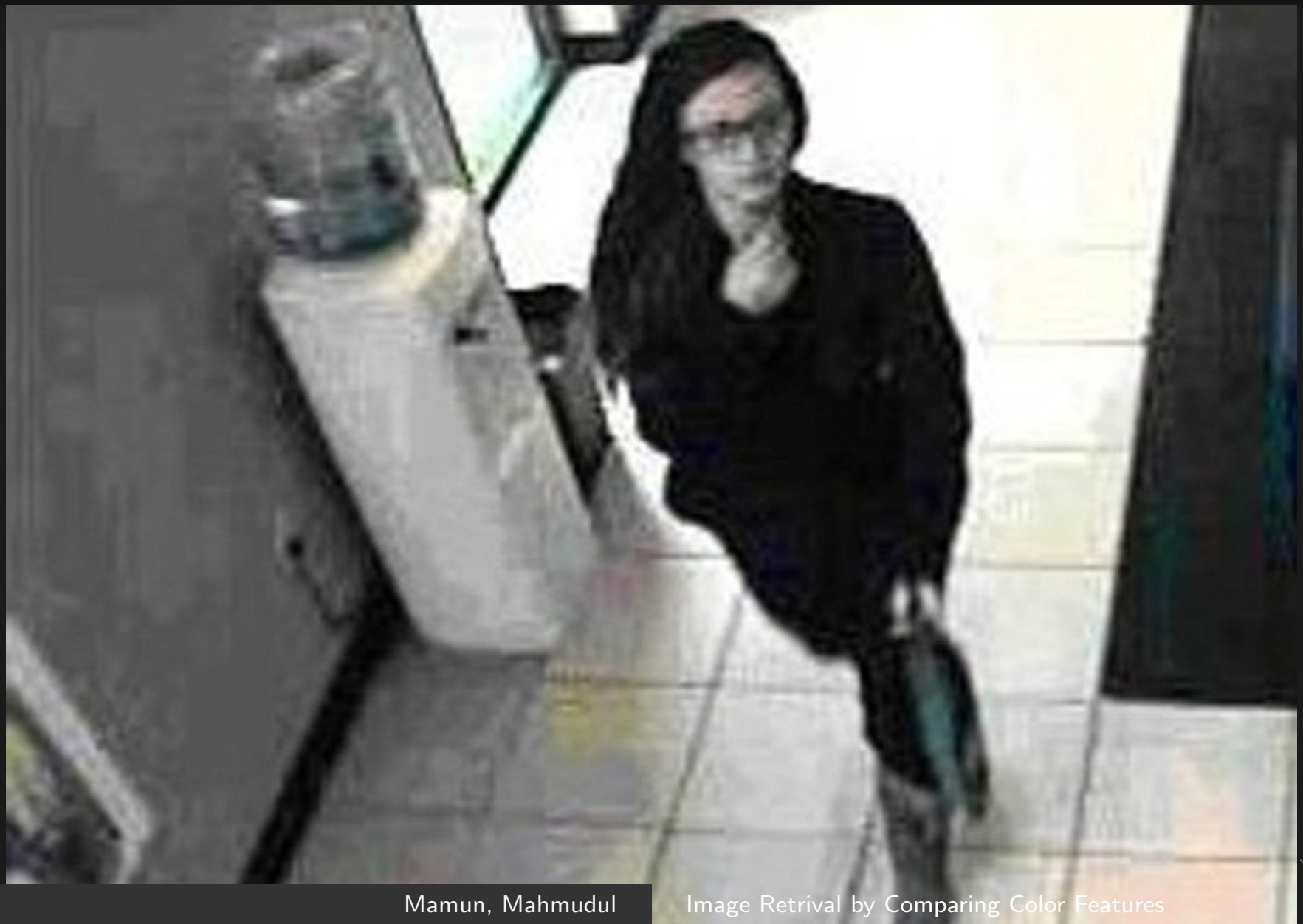
- Retrieve image from database
- Search by keywords or a query image
- Our focus: Content Based Image Retrieval (CBIR)

Content Based Image Retrieval

- Search key is an **image**
- Retrieve image comparing similarity

Application

- Finding similar images
- Retrieving a criminal's profile



Proposal

Proposal

Compare the Color Features

Color Features

Color Features

- Color Moments

Color Features

- Color Moments
- Histogram

Color Features

- Color Moments
- Histogram
- Color Coherent Vector (CCV)

Color Moments

Color Moments

- Mean

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- Mean
- Variance

Color Moments

- Mean
- Variance
- Standard Deviation

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Let, P_{ij} is the pixel value of the pixel on ith row and jth column.
N is the number of pixels.

Color Moments

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Let, P_{ij} is the pixel value of the pixel on ith row and jth column. N is the number of pixels.

$$mean = \frac{SUM(P_{ij})}{N}$$

Histogram

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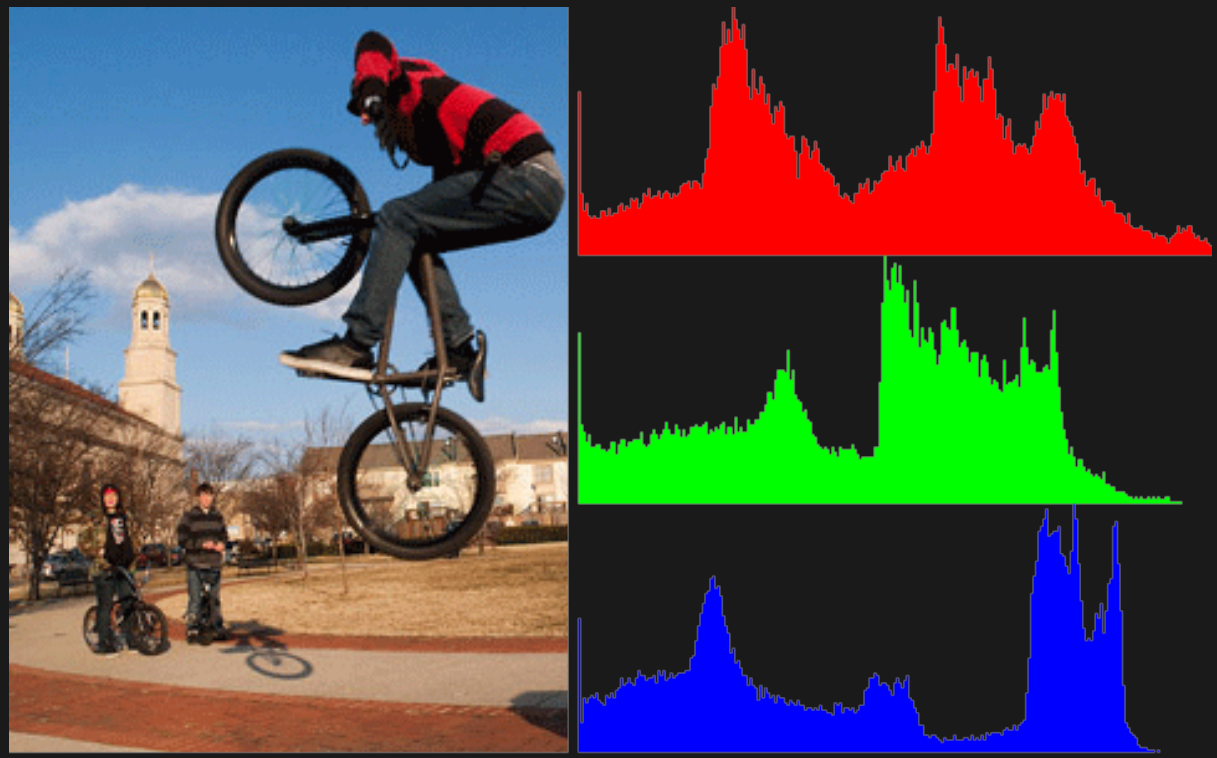
- Tonal range is a measurement of darkness or lightness

- Can be used to find the Color Moments
- Used for very large datasets when direct methods are expensive

Histogram



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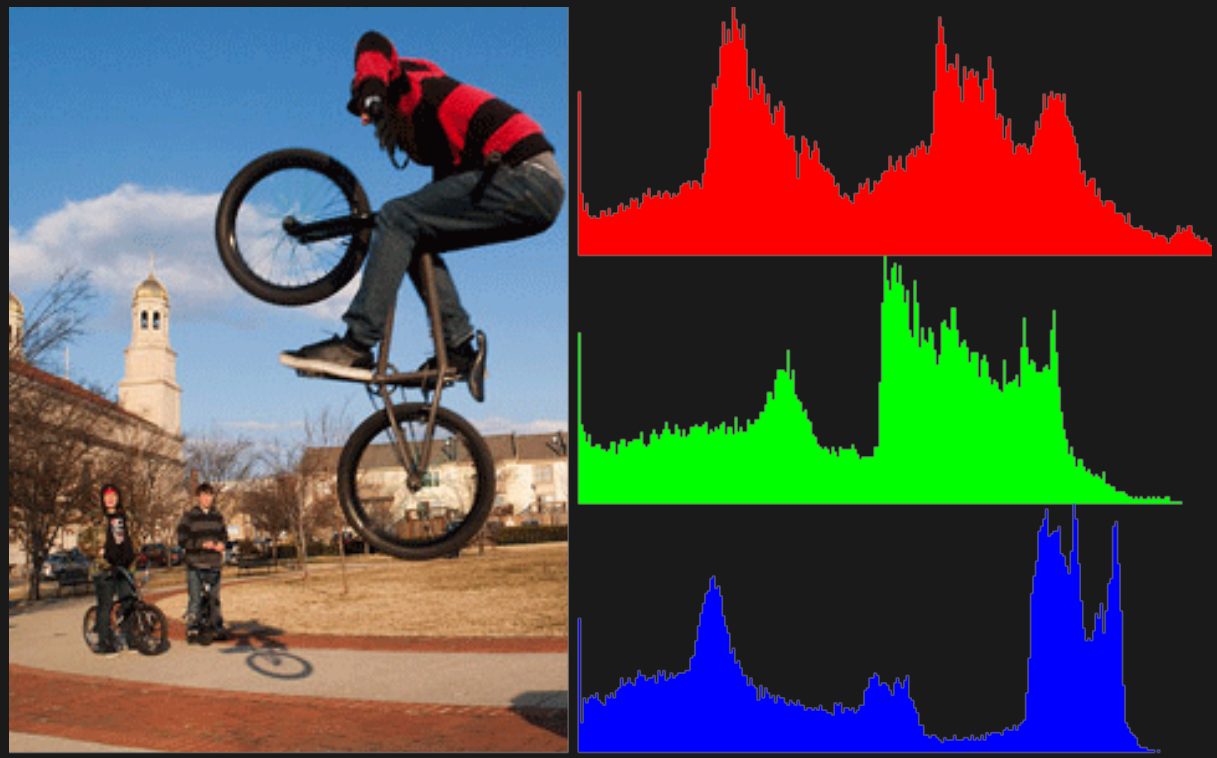

Problems?

- Two different images may have almost same histogram.

Color Coherent Vector (CCV)

Differentiate every pixel into 2 categories:

- Coherent - neighborhood pixels have similar tonal range
- Incoherent - otherwise

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CCV represents this classification for each color.

METHODOLOGY

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- Total number of possible colors: 2^{24}

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- Reduced to: 256

Histogram Based Image Retrival

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- GCH: Global Color Histogram

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Represents images with **single** histogram.

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LCH:

Images are divided into fixed blocks of **size 8x8** & histogram is obtained for **each** block

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For **3D**

$$distance((x, y, z), (a, b, c)) = \sqrt{(x-a)^2 + (y-b)^2 + (z-c)^2} \qquad (1)$$

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Image B: $(y_1, y_2, \ldots, y_n)$

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Let, Image A: $(x_1, x_2, \ldots, x_n)$
Image B: $(y_1, y_2, \ldots, y_n)$

Distance between A & B = $\sqrt{\sum_{i=1}^{n}(x_i - y_i)^2}$

Extraction of Visual Feature

[3] Threshold value is based on the difference of the properties

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Extraction of Visual Feature

Extract viusal features using color histograms and moments

- Calculate mean and std. deviations of database images and store
- Compare mean & std. deviation of DB's images & query image
- Rank relevant images based on a fixed threshold value[3]

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Coherence Measure

Pixels: **Coherent** or **Incoherent**

[4] A pixel and its 8 surrounding neighbours
[5] 1% of the total image area

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Steps for image retrival:

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- Use a **color coherence vector** to represent those for each color.
- Compute similarity between query & DB's images CCVs and retrive.

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RESULTS

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General purpose image database containing 14500 images is used.

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- Beaches
- Buildings
- Buses
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- Image Format: **JPEG**
- Imgae Size: **384x256**

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- **Image Types :** Uniform, non-uniform & average color distribution

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- **Precision:** $\frac{\textit{Relevant retrived images}}{\textit{Total retrived images}}$

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- **Recall:** $\frac{\textit{Relevant retrived images}}{\textit{Total relevant images in DB}}$

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Performance Measurement Metrics:

- **Precision:** $\frac{\textit{Relevant retrived images}}{\textit{Total retrived images}}$
- **Recall:** $\frac{\textit{Relevant retrived images}}{\textit{Total relevant images in DB}}$

Table: **Category - Dinosaurs**

Descriptor	Recall	Precision
CM	0.100137931 0.09862069 0.097586207	0.698748797 0.754219409 0.815092166
GCH	0.099586207 0.09862069 0.096551724	0.529325513 0.580121704 0.615114236
LCH	0.097586207 0.095586207 0.093586207	0.5 0.508064516 0.534672971
CCV	0.10062069 0.099586207 0.096551724	0.555597867 0.585801217 0.631483987

Table: **Category - Africans**

Descriptor	Recall	Precision
GCH & CCV	0.088531187 0.08249497 0.079476861	0.871287129 0.872340426 0.877777778
LCH & CCV	0.100603622 0.099597586 0.097585513	0.487804878 0.5 0.510526316
CCV, CM, LCH & GCH	0.095573441 0.09054326 0.088531187	0.95959596 0.97826087 0.988764045
GCH, LCH & CCV	0.098591549 0.096579477 0.095573441	0.439461883 0.507936508 0.50802139

DECISIONS

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- **Uniform Color Distribution:** Color Histogram

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- **Uniform Color Distribution:** Color Histogram
- **Average Color Distribution:** Color Moments

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No feature is superior to other as performance is color distribution dependent.

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- **Average Color Distribution:** Color Moments
- **Widely Scattered Colors:** Color Coherent Vector

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The **combination** of different descriptors gives most satisfactory results.

Thank you!

Questions?