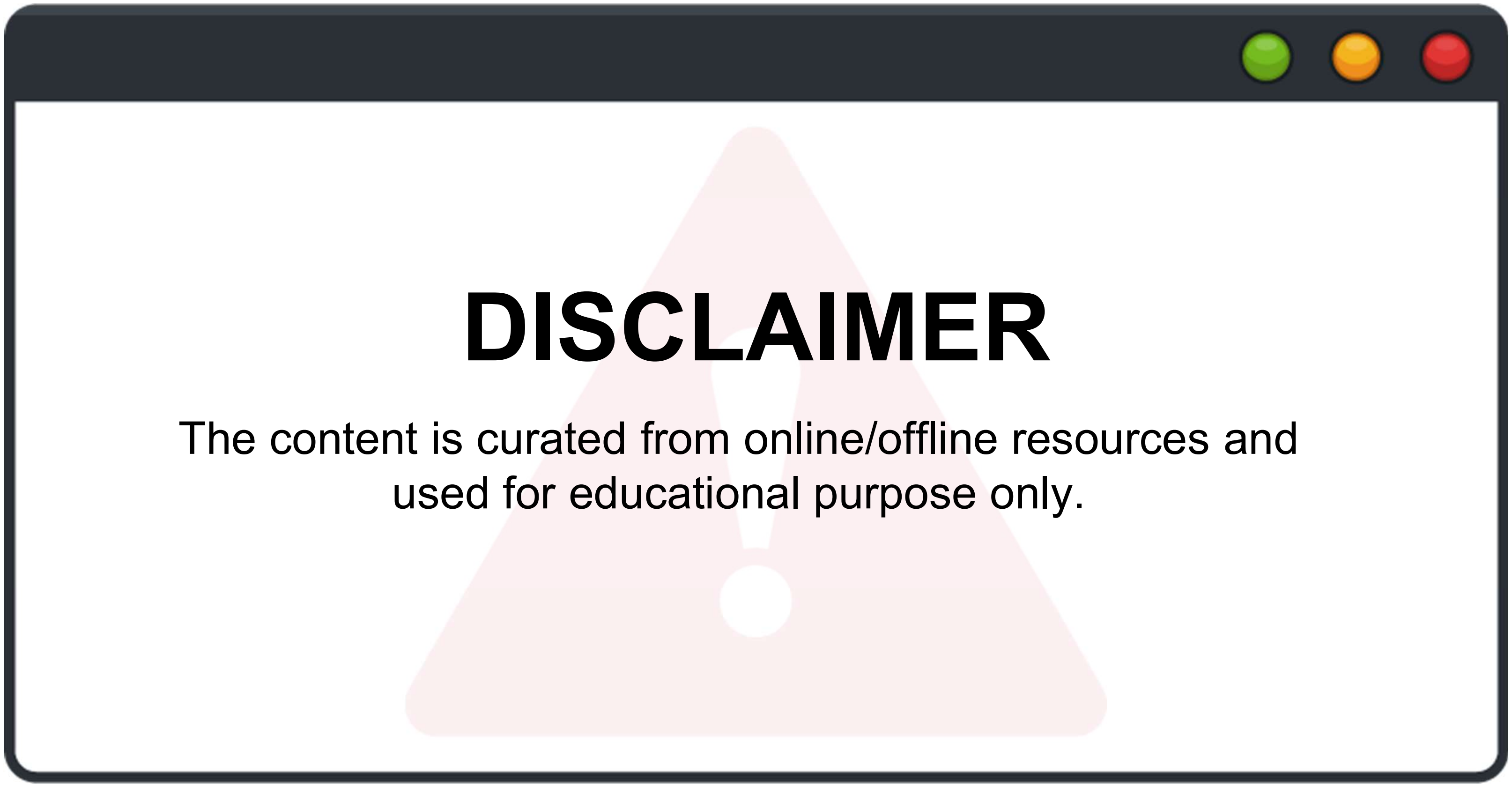
edunet
foundation

Unit 4
Hands on Session on Computer Vision



DISCLAIMER

The content is curated from online/offline resources and used for educational purpose only.

Learning Objectives

- What is Face Detection
- Canny Edge Detection
- Viola-Jones Algorithm for face detection
- Face Blurring in Live Video Detection
- Number Plate Detection
- Creating new filters saving them in xml file and using those filters on to images

What is Face Detection?

- Object detection is a computer technology that is connected to image processing and computer vision.
- Concerned with detecting instances of an object such as human faces, buildings, trees, cars, etc.
- Primary aim of face detection algorithms is to determine whether there is any face in an image or not.
- In recent years, we have seen significant advancements of technologies that can detect and recognize faces.
- Our mobile cameras are often equipped with such technology where we can see a box around the faces.
- Although there are quite advanced face detection algorithms, especially with the introduction of deep learning.
- The introduction of the viola jones algorithm in 2001 was a breakthrough in this field. Now let us explore the viola jones algorithm in detail.

Impact of Viola-Jones Approach

- Viola Jones algorithm is named after two computer vision researchers who proposed the method in 2001, Paul Viola and Michael Jones in their paper, “Rapid Object Detection using a Boosted Cascade of Simple Features”.

- Despite being an outdated framework, Viola-Jones is quite powerful, and its application has proven to be exceptionally notable in real-time face detection. This algorithm is painfully slow to train but can detect faces in real-time with impressive speed.

- Given an image(this algorithm works on grayscale image), the algorithm looks at many smaller subregions and tries to find a face by looking for specific features in each subregion.

- It needs to check many different positions and scales because an image can contain many faces of various sizes. Viola and Jones used Haar-like features to detect faces in this algorithm.

Viola-Jones Algorithm for Face Detection

The Viola Jones algorithm has four main steps, which we shall discuss in the sections to follow:

- Selecting Haar-like features
- Creating an integral image
- Running AdaBoost training
- Creating classifier cascades

There are 3 types of Haar-like features that Viola and Jones identified in their research:

- Edge features
- Line-features
- Four-sided features

Face Detection Using OpenCV

Lab 1: Face Detection from an Image

Face Blurring in Live Video Detection

- Face blurring is a computer vision method used to anonymize faces in images and video.

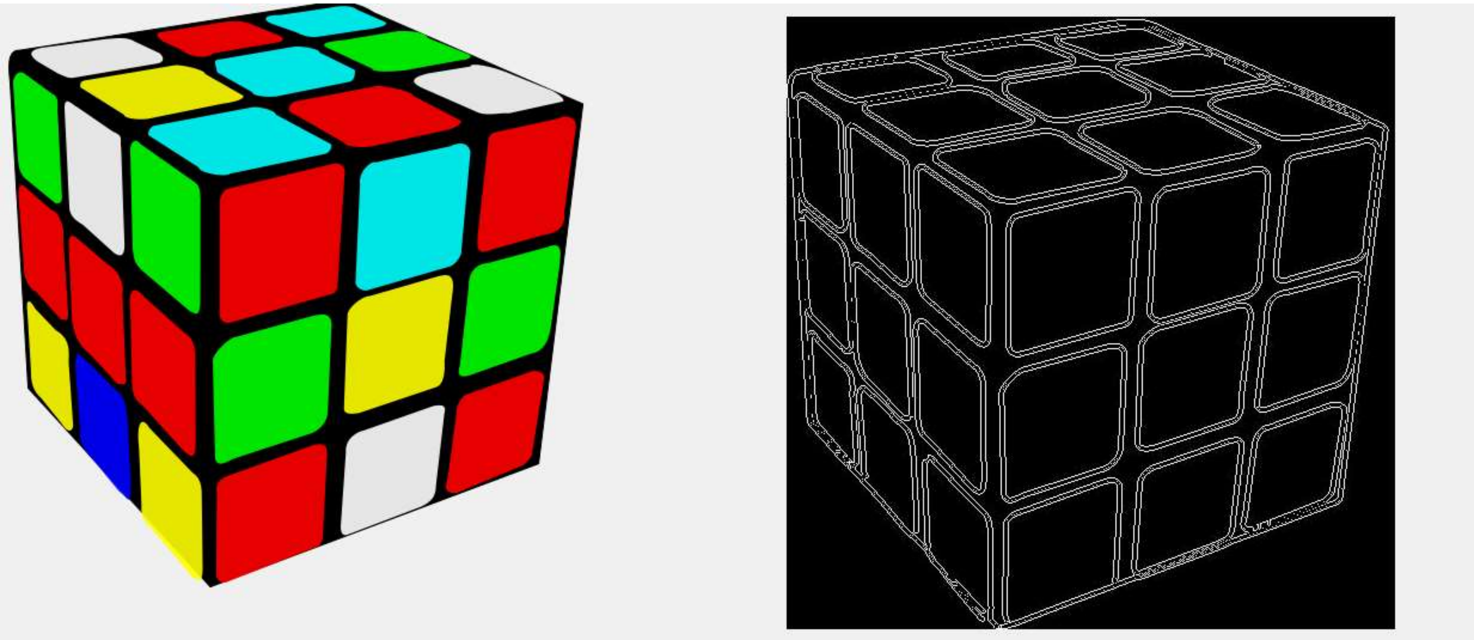
Their 3 steps to perform face blurring:

- Face Detection
- Extract ROI
- Blur Face

Face Blurring Using OpenCV

Lab 2: Face Blur from an image

Edge Detection



Canny Edge Detection

A Canny edge detector is a multi-step algorithm to detect the edges for any input image. It involves the below-mentioned steps to be followed while detecting edges of an image.

- Removal of noise in input image using a Gaussian filter.
- Computing the derivative of Gaussian filter to calculate the gradient of image pixels to obtain magnitude along x and y dimension.
- Considering a group of neighbors for any curve in a direction perpendicular to the given edge, suppress the non-max edge contributor pixel points.
- Lastly, use the Hysteresis Thresholding method to preserve the pixels higher than the gradient magnitude and neglect the ones lower than the low threshold value.

Canny Edge Detection Using OpenCV

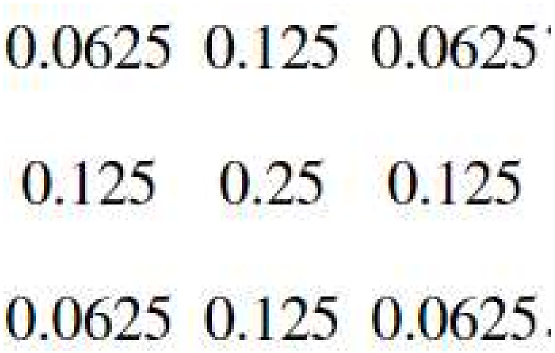
Lab 3: Canny Edge Detection on an image

Example Blur Filters

Image Kernel

Small matrix applied to an entire image

1/16	1/8	1/16
1/8	1/4	1/8
1/16	1/8	1/16



0.0625	0.125	0.0625
0.125	0.25	0.125
0.0625	0.125	0.0625.

Blur Filter

- Filters are referred to as Convolution Kernels.
- The process of passing the Kernels over an image is called Convolution

Note: Padding can be used if you don't want to lose border information

Kernel-based filtering Using OpenCV

Lab 4: Blurring a given image

Lab 5: Number Plate Detection

Lab 6: Generating & Handling .xml files

Summary

In this session we have learned:

- Understood the mechanism of extracting Haar features in Viola-Jones.
- How to identify regions of interest to blur a face.
- How to handle overlapped faces using tuning parameters
- Understood the canny edge detection system
- How to extract significant edge features form an image and live stream.
- How to detect number plates in a given frame.
- Handling and generation of .xml files in OpenCV

Let’s Start

Quiz

Q1. What is Viola-Jones?

A. A music composition algorithm

B. An object detection framework

C. A video compression technique

D. A text recognition algorithm

Answer: B

Quiz

Q2. Which component is a crucial part of the Viola-Jones framework for face detection?

A. Haar-like features

B. Deep neural networks

C. Genetic algorithms

D. Principal Component Analysis (PCA)

Answer: A

Quiz

Q3. How does Viola-Jones achieve real-time object detection?

A. By using convolutional neural networks (CNNs)

B. By employing complex feature engineering

C. By using a cascaded classifier with simple Haar-like features

D. By applying deep reinforcement learning

Answer: C

Quiz

Q4. Which OpenCV function is commonly used for reading images from files?

A. cvtColor()

B. imread()

C. imshow()

D. resize()

Answer: B

References

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Thank You