ELC-2022

Real-Time Applications based on Computer Vision

This ELC activity is aimed to provide knowledge about Computer vision for transformation of images for imparting different drawing effects in real-time. The student must be able to apply the various concepts of computer-vision to solve and develop the applications of real-life issues.

General Instructions

1. Students must submit one of the solutions to the ELC activity problem statements.

2. Integrity and collaboration: Students are encouraged to work in groups (**Number of members per group may vary from one to Ten**) but each student must contribute in that work. **If you work as a group, include the names, roll no. and contribution of all collaborators in your write up.** The interface is entirely interactive, adaptive and user-friendly. Code should NOT be shared or copied. Plagiarism (of write-up) is strongly prohibited and may lead to failure of this ELC activity.

3. Start early! Especially those not familiar with **MATLAB, Unity** and **Python**.

4. Submission: Your submission for this assignment should be a zip file, <shailendra-id.zip>, composed of your small demo video clip, write-up (read me file not more than 2-3 pages), your MATLAB/Python/Unity implementations (including any helper functions), and results (*demonstration video is mandatory to submit*).

1. **Title of the Activity: Creating AR Content with Unity & Vuforia**

   Problem statements

   1) **AR-Based Face Mask App:**

      Nowadays, because of the covid 19 pandemic situations, everyone uses face masks and now face masks have become a fashion trend. There are several kinds of fashionable and medical face masks. And also can find several kinds of face mask innovations. Also face masks have a big market capacity. Although, the problem is customers cannot check if the face masks are suitable for them before purchasing. And also when buyers use online shopping platforms, they cannot see the quality of

products until receiving them. This problem limits the selling of goods online. The task is to develop an Augmented Reality based virtual face mask fit-on Android application. The developed application will provide 3D models of face masks, and users can virtually match the face masks with their faces using the mobile application before purchasing them.

2) AR-Based Shopping App:

The biggest problem with buying furniture is that you have almost no idea how it will actually fit into your interior. This is why people hire visual designers who can show the whole picture. The objective of this AR app is to place any piece of furniture into your house without needing to bring it there physically. IKEA has managed to bring one such augmented reality idea to life when they released their augmented reality application that allows you to do that. It can even scale the furniture and change colors.

3) AR-Based Health Monitoring App:

Medical apps are trending right now, being the second most popular kind of application after games for smartphones. The objective of this app is to provide additional information to users of medical applications. For example, The doctors will be able to see a 3D image of an MRI while talking to patients or analysing their movements. Another example is, Anatomy 4D where the users can visualize the detailed bone structures and organ systems when the device is pointed.

2. Title of the Activity: Real-time object detection and drawing effects

Problem Statements:

Computer vision is a scientific field that deals with how computers can be made to understand the visual world such as digital images or videos. And after years of research by some of the top experts in the world, this is now a possibility. The future of computer vision is beyond our expectations.

In this ELC activity, we have discussed just an introduction of MATLAB and some idea about how the student must be able to apply the various concepts of Computer Vision to solve and develop the applications for real-world challenges. Some of the project's examples that we have to show here to make you all acquainted with the real-world experience and to make you job-ready.

Some CV based Project examples are as follows:

1. **Face Detection**

    Face detection is a technique to find the location of the human faces in an image. Computers use various types of algorithms to detect if the shape in the image resembles a face or not.

    You can build an app to automatically detect faces and capture the image in our system.


    You can also develop some other face related projects like:
    - Face Sketch Recognition using Sketch-to-Face Synthesis
    - Face Recognition under Mask
    - Facial Micro-expression Recognition
    - Pose Invariant Face Recognition

2. **Image Segmentation**

    Image segmentation is the process of dividing an image into multiple segments. It is very useful in finding meanings from the image. They are used in object detection of self-driving cars.
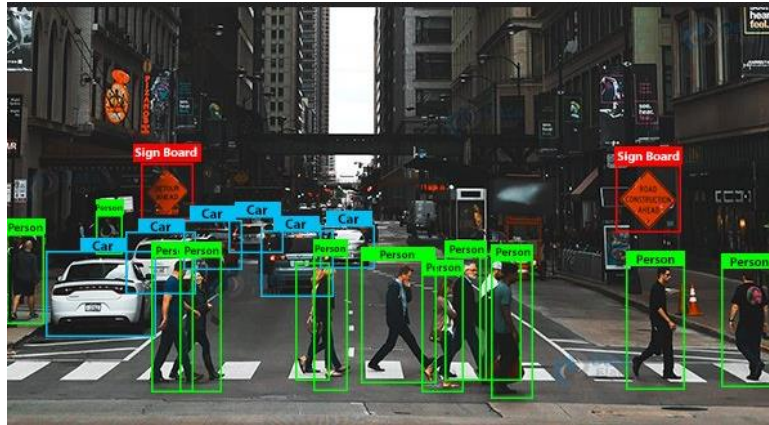
3. Cartoonifying an Image

In this project, you can build an application to upload the image on the app. Then by performing different transformations on the image we can make the image look like a cartoon

4. Human Counting with OpenCV

A camera can be used to monitor and count the number of people present in the room, building, street, etc.

5. **Mobile Document Scanner**
   Document images taken from the camera can contain background, and their perspective is not aligned properly. So, you can build a document scanner app that will fix this by detecting the edges of the document and then transform the perspective.

6. **Air Canvas**
   This is an interesting project in which you can draw anything by moving your hands in the air. The project will use a camera to detect the fingertip and then we can draw the shape on the canvas.

7. **Colour Detection**
   Build a simple app that is responsible for detecting a particular color from the image.


8. **Hand Gesture Recognition**

   In this project, you are going to determine the gesture of the hand in real-time using a webcam. First, the background is separated from the hand region and then the fingers are segmented to predict hand gestures.

   With different hand gestures, you can perform different actions.
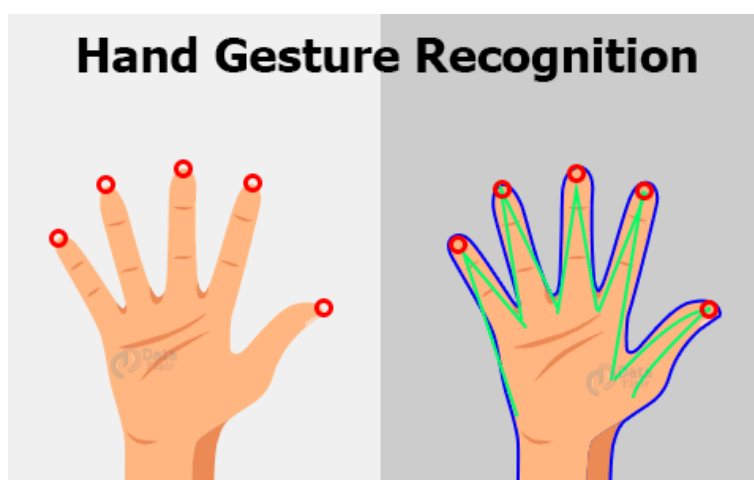
9. **Vehicle Counting and Classification**

You can use the computer vision techniques to classify vehicles on the road, HMV (heavy motor vehicle) or LMV (light motor vehicle) and also count the number of vehicles that travel through a road. The data can be stored to analyse the different vehicles that travel from a road.
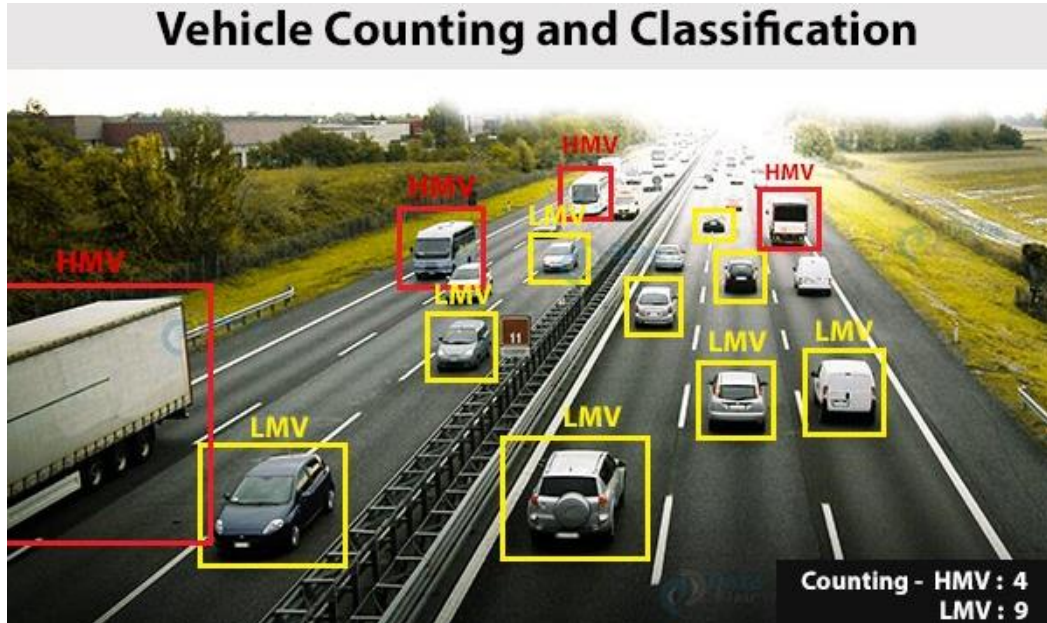
10. **Selfie Capture when the User Smiles**

Everyone loves a smiling picture, so how about making a camera app project which will capture images every time you smile. So for this, you need to build a model to identify whether a person is smiling or not.

11. **Some other interesting topics are as follows:**
   - Person Synthesis under Different Clothing Style
   - Person Recognition from Aerial View
   - Hyperspectral Image Classification
   - Histopathological Colon Cancer Recognition
   - Identity Recognition using Palmprint
   - Identity Recognition using Knuckleprint
   - Action Recognition
   - Transformer based COVID19 Recognition from X-Ray

Some Interesting Computer Vision Links are:

Links of the top-rated Computer Vision Courses running all over the worldwide universities:

1) https://homepages.inf.ed.ac.uk/rbf/IAPR/researchers/D2PAGES/d2courses.htm
2) http://szeliski.org/Book/
3) https://cs.brown.edu/courses/csci1430/
4) https://www.cc.gatech.edu/~hays/compvision/
5) http://www.cs.cmu.edu/~16385/
6) http://vision.stanford.edu/teaching/cs131_fall1718/syllabus.html
7) http://crcv.ucf.edu/courses/CAP5415/Fall2014/index.php
8) http://vision.stanford.edu/teaching/cs131_fall1415/schedule.html
9) http://www.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html
10) https://canvas.instructure.com/courses/904706/pages/lecture-slides
11) https://www.dropbox.com/sh/26xgy96py8itk14/AAD-2-WPE6-W4c7jznMqQxXBa?dl=0
12) http://www.wisdom.weizmann.ac.il/~vision/courses.html
13) http://slazebni.cs.illinois.edu/spring18/
14) https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-801-machine-vision-fall-2004/lecture-notes/
15) https://courses.cs.washington.edu/courses/cse576/17sp/
16) https://courses.cs.washington.edu/courses/cse576/17sp/notes/index.html
17) https://github.com/cs763/Spring2018
18) http://pages.cs.wisc.edu/~mohitg/courses/CS766/
19) http://3dvision.princeton.edu/datasets.html
20) http://www.cs.princeton.edu/courses/archive/fall17/cos429/outline.html
21) http://www.cse.psu.edu/~rtc12/CSE486/
22) https://istd.sutd.edu.sg/undergraduate/courses/50035-computer-vision
23) http://ci2cv.net/16623/
24) http://ci2cv.net/16623/final-project/
25) https://alliance.seas.upenn.edu/~cis581/wiki/index.php?title=CIS_581:_Computer_Vision_%26_Computational_Photography

Online Free Course on Computer Vision

https://www.class-central.com/course/udacity-introduction-to-computer-vision-1022

1) https://classroom.udacity.com/courses/ud810
2) https://www.youtube.com/watch?v=Z78zbnLlPUA&list=PLQVvvaa0QuDdttJXlLtAJxJetJcqmqlQq
3) https://www.youtube.com/watch?v=dWeWCQmewLc&list=PLiHa1s-EL3vjr0Z02ihr6Lcu4Q0rnRvjm
4) https://www.youtube.com/watch?v=9hb0gYCv3YI&list=PL-cS6ZwDCr6rnUfSO2Wc5iR-UPKyMHCsn
5) https://www.youtube.com/watch?v=1Jz24sVsLE4&list=PLnjEM1fs09cGGjdCLSue8Kw7GmWDhGlMh

Links related to Programming and Code sections

1) http://vision.ucla.edu/MASKS/
2) https://cs.gmu.edu/~kosecka/bookcode.html

3) https://thecodacus.com/opencv-python-face-detection/
4) https://pythonprogramming.net/loading-images-python-opencv-tutorial/
5) http://mi.eng.cam.ac.uk/~cipolla/research.htm
6) https://www.youtube.com/channel/UCnI13MRx6uqa0XrTj6asapw
7) https://www.youtube.com/watch?v=9iEPzbG-xLE&list=PLMoSUbG1Q_r8jFS04rot-3NzidnV54Z2q
8) https://www.youtube.com/watch?v=-cSVGwAwZZ4&list=PLv9sHECmUks-7D_aZSC7kNWy7FmtiIOUG

Submission Deadline: 18th Sept. 2022 (Sunday) till 11:59 IST

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