

# COMPUTER VISION: A SENSE OF ARTIFICIAL INTELLIGENCE

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*Abstract:* Vision is a boon to human, which makes us to see shapes, colors, textures, identify objects, and focus on what we want to see, analyze and detect or predict any dangers and what not. Everything which happens in human is a biological mechanism which is controlled by our brain. With growing technology, almost every feature of our vision is needed to many machines today. This is the main reason to the computers, machines to mimic the human vision and discover many features that make our life smoother. As human vision is a part of natural intelligence computer vision is a part of Artificial intelligence, which is used for security, decision making, detecting objects, processing images, fraud detection, emotion detection, focus on specific details, capture images and many more.

**Keywords:** Computer Vision (CV), Artificial intelligence (AI).

## I. HISTORY

Computer Vision is a science that is hidden behind the Artificial Intelligence, which makes the computer or any device that uses artificial intelligence, to see and detect the image or video, through the camera, and makes it analyze what it is, through the art of machine learning.

Computer Vision is not a neophyte in the field of Artificial Intelligence today, as it first appeared in the form of 3d geometric information from 2d view, in Late 1960s, at MIT, in the Ph. d thesis of Larry Roberts, the Father of Computer Vision. Later it is developed by many researchers and scientists, like Thomas Oriel Binford, David Marr and many other scientists. It was meant to imitate human vision, and later it was believed that it could be done by attaching camera to the computer and “make it see, and describe what it saw”.

In 1970, MIT's AI lab opened a course on Machine Vision. Which lead to edge detection and segmentation.

In 1980s, OCR systems were developed and used in various applications to detect characters, letters, numbers, words, etc.,

In 1990s, The world of Computer vision has grown at large, as more than 100 companies were started selling Computer vision systems, advancements were brought like sensor function and control architecture.

Today, Computer vision is developed to an extent like, 3d vision systems that scan products at a very high speeds, thermal imaging, slope measurement, Gesture based technologies and interfaces, etc.,

## II. HOW CV IS EMERGED?

Computer vision was emerged from 2Dimensional image.. as sources say that, in 1950, a person named Gibson introduced optical flow, upon which, computation of optical flow, is developed on a pixel by pixel basis..

Later Larry Roberts started research on 3Dimensional geometric information from 2D views, which lead us to see computer vision in a context of blocks and objects.

Soon, David Marr found out the bottom up approach to understand a scene through computer vision, where the approach start from 2D sketch and finally gets a 3D image..

Later, in 1917 the first machine was developed by Emanuel to convert character into a standard telegraph code.

Smoothness based Image detection, In 1980's a technique called photometric stereo, it observes a object in different lighting condition to estimate its surface normals depending on amount of light reflected by a object surface

Grimpson presented a process of image information extraction called computational stereo, it is similar to Biological process 'stereopsis'. It extracts 3Dimensional information about relative objects in multi picture object.

SLAM Simultaneous localizing and mapping mostly used in navigation and robotic mapping for constructing or updating a map in a uncertain spatial environment while tracking its agent to reach.

SIFT Stands for scale-invariant feature transform. It detects and describes about image. This algorithm was patented by David Lowe in 1999.

Active stereo with structured light uses comparing images of different light patterns to assess the correspondence of robust.

Real-time Facial recognition, it has emerged to Facial recognition based on Deep Neural Networks (DNN), which exceeded human abilities to detect the human faces.

## III. WHY CV IS USED?

Computer vision is a part of Artificial intelligence, which is used to make the machine receive the data visually, detect images and objects, analyze them with the help of machine Learning.

It helps more than any other part of AI, just as Biological vision is important to human brain, Computer vision is essential to Artificial Intelligence.

It makes the machine look the various objects, differentiate them on the basis of color, size, shape, texture, opacity, by segmenting or sharpening the images, changing the color to grayscale, thermal temperature in the image, helping infrared sensors, facial recognition, and a lot more challenges faced by human biological vision, it is also used to make the visually impaired person understand what is around him.

#### IV. APPLICATION OF COMPUTER VISION

Application of CV has widely increasing as the new algorithms are introduced. In these days CV can able to suggest human vision, help human vision.

##### 4.1 MANUFACTURING APPLICATIONS

The CV is used in many manufacturing industries for inspecting the material used, manufactured.

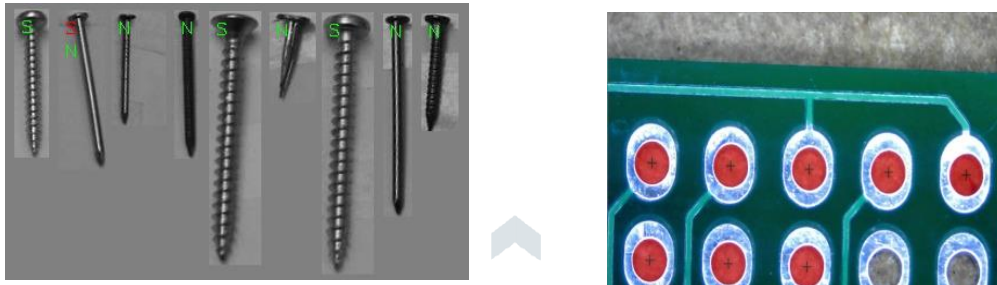


Fig.1: C.V detecting industrial materials

##### 4.2 SPECIES IDENTIFICATION

Computer vision can percept as same humans, sometimes more than human. Today's computer vision can identify species of animals, birds, fishes, plants.

###### 4.2.1 Leaf snap: An APP to identify plants

It identifies tree species from photographs of leaves. It discards non-leaf images by segmenting the leaf from untutored background, Extracting features representing the curvature of the leaf's contour over multiple scales, and identifying the species from a dataset of the 184 trees in the North-eastern United States.<sup>[1]</sup>

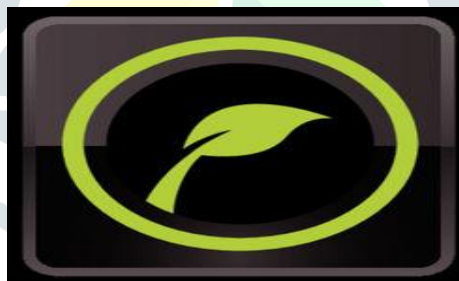


Fig.2: Leaf snap APP icon

###### 4.2.2 Fish Verify: Instant Fish identification



Fig.3: Fish verify app icon

This APP classifies species of fish by analyzing its texture, color. This app helps even in diagnosing fish diseases.

### 4.3 NAVIGATION

Computer vision is capable beyond human vision. It can help to navigate using navigation. Tech Giant Google is working to combine the power of camera and computer vision to navigate for walking navigation.

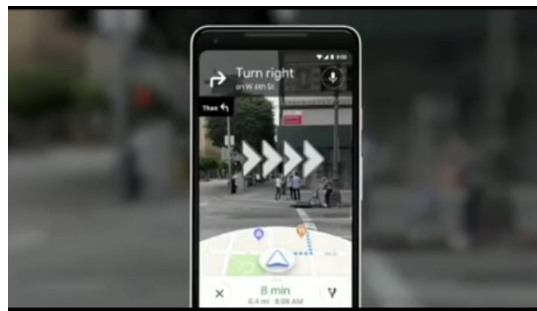


Fig.4: Google's navigation using

computer vision

### 4.4 VISUAL SURVEILLANCE

A Costliest government project in china is on Visual Surveillance to track the citizens using street cameras. This project uses computer vision and Artificial Intelligence. They track people using facial recognition and location.



Fig.5: China govt. visual surveillance Footage using computer vision

### 4.5 MEDICAL IMAGE ANALYSIS

Computer Vision enables extensive use of medical image analysis to diagnose and predict diseases. A 13 year old young Scientist Rishab Jain from India invented Tool based artificial Intelligence in computer vision to detect pancreatic cancer and heal them.



Fig.5: Indian young scientist rishab Jain

#### 4.6 BANKING

In digital banking CV have a crucial role to call it as a digital banking. Bank users can deposit cheques by snapping it and upload it their banks. CV then verifies the signature on the cheque, then the transaction proceeds

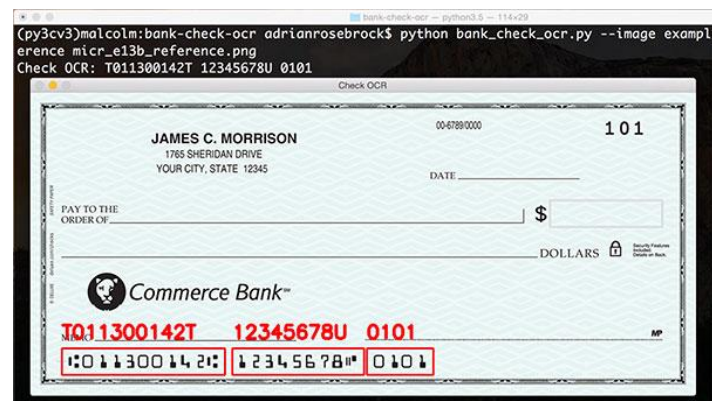


Fig.6: Detecting cheque number using computer vision

#### 4.7 AUTONOMOUS VEHICLE

Self driving cars are completely depends on Computer Vision. Many cameras will be fixed to every self driving vehicle to collect inputs. Those inputs has to be detected what they and where they are. They can able to detect traffic lights, traffic signs, estimating road curvatures. Tesla motors had fixed 8 cameras to get 360 degree view.



Fig.7: Autonomous vehicle with cameras for computer vision

#### 4.8 AGRICULTURAL APPLICATIONS

A company called BLUERIVER, developed computer vision technology able detects unwanted plants in a field during pesticide spray to avoid them from pesticide coating.<sup>[2]</sup>



Fig.8: using computer vision to detect plant to coat pesticide



#### 4.9 OCR

Optical character recognition is an oldest CV application. OCR mechanism converts the image of typed text, hand written into a machine encoded text by scanning it. Today Microsoft's Office lens can convert printed document into MS DOCX by scanning. Based on this OCR the reading machines are build to facilitate the blind to read.

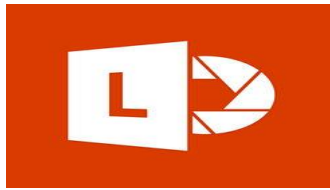


Fig.9: Microsoft office lens APP icon

#### CONCLUSION

As far as biological vision to a human, computer vision is to a machine. It may overlap the benefits of human vision in future technology, and in today's technology, it is the one of the fastest improving technology that is essential to the world.

#### REFERENCES

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