International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 04 | April -2020 ISSN: 2582-3930

Computer Vision

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Abstract—Research on Computer Vision started in late 1960's which was pioneering AI (Artificial Intelligence), it was to copy human visual system, and it was a stepping stone in robotics with intelligent behavior. They believed that by connecting camera to computer, this can be achieved. They named this experiment has "describe what it saw".Based on the survey on computer vision which is related human eye from past two decades, they are concentrating on taxonomy of system functionalities , which can be divided into four processes, initialization, tracking, pose estimation and recognition. This main have sub processes or categories to give reference to cover the publications covered by the survey where publication number crosses 130. This is to tell the important and relations between the topics and simplify the paper. Numbers are given to every reference so that we will know at what stage is the research paper. Many application areas are mentioned.[4]

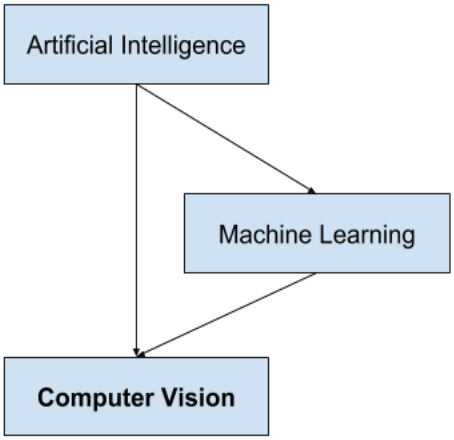
INTRODUCTION

Computer vision is a new technology where computer can have automated visual system which works similar to human visual system that can identify images and videos through methods like acquiring, processing, analyzing and understanding images. These real-world images are converted to numerical and symbolic information. This can be done using models constructed with physics, learning theory, statistics and geometry.

Computer Vision is concerned with artificial system that take information from real world images. Images may take many forms like video sequences, views from digital cameras, etc. Sub-domain technologies of computer vision include image restoration, object recognition, event detection, 3D scene modeling, scene reconstruction, learning, motion estimation, video tracking etc.

The goal was to achieve digital image processing by extracting three-dimensional structure from images. They built algorithms in1970 including flow estimation, images, representation of object as interconnections of smaller structures, optical flow, labeling of lines, polyhedral modeling and non-polyhedral modeling.

Experiments were done fast during next decade using mathematical and quantitative aspects of physics. This include shade, view, scale, focus, texture. Researchers found some similar experiments which led to understanding of camera calibration. This led to multiple image formation in 3D. They also found image segmentation technique using graph variations. This led recognition of faces in images. Now they are using machine learning, deep learning techniques, Artificial Intelligence, IOT etc. All these new technologies have led to advancement in Computer Vision.



Application of Computer Vision

Application depends on variance in features and range between the type of tasks and all computer vision applications are programmed early with all possible images with shapes. Computer vision is a combination of pre-processed digital images and mathematical algorithms that can identify real world images.

- In manufacturing field especially during automobile check-ups, they use computer vision applications to check all parts of an auto-mobile is proper.
- Another example is while manufacturing bottles and other similar structured objects, when you feed one shape machine will cut all objects with the same shape.

- Using in automated cars to recognize other objects while travelling.
- It is also used in robots in controlling processes.
- It helps interaction between computers and humans as interaction machine.
- It can be used in restaurant industry for detecting events.
- Major application is in medical field to know the anatomy helping in diagnosing the patient.
- It also helps in detecting cancer cells and detecting tumors.
- It helps in machine industry for manufacturing automobiles.
- It helps to build android applications like google lens to recognize objects.
- Used in agriculture industry for removing weeds and unwanted plants.
- Largest application area is military applications to detect enemy army, military vehicles and modern application is automated vehicles which delivery ordered items to their door step. They are small robotic cars with wheels where the route is pre-programmed before delivery.

Recognitions in Computer Vision

In spite of many experiments being conducted and technology has been improved still we find problems in Computer Vision. The very main problem is to determine the image data like feature, activity etc. Some recognition problems are:

Object recognition:

Recognizing more than few images in a single frame is a difficult task. That too in 2D and 3D poses in a scene is the most difficult task. This problem is also known as Object Classification.

Identification:

Identification examples are identifying person's individuality features like person's face, iris detection, finger print, identification of handwritten digits and identification of vehicle.

Detection:

In this process the image is scanned for a specific purpose. This technique is mainly used in cell or tissue detection which are abnormal, for example cancer cell detection or tumor detection.

Need of Computer Vision

We all use smart phones and android applications which contains data in the form of images and videos and most content in social network are images because we humans are more connected to things that we see. So, we search for something in text in future this will be the most difficult task to search the related objects so instead what if computer had vision like humans? And understand it.

The main features of human eye are:

They can describe the feature of a photograph once seen, remember the video and recognize a person's face seen before.

Image processing in computer vision

There are many methods in image processing, they are:

1. Stitching:
   Combination of two dimensional or three-dimensional images. This method is also known as registration.
2. Filtering:
   It is a technique for analyzing mathematical structures like graph, calculating surface for solids. This is based on mathematical theories like random numbers, sets and numbers, lattice theory, random functions etc.
3. Thresholding:
   Here the image is converted to grey and depending on shades of grey depending upon values else they are converted to black and white picture depending upon grayscale values.
4. Pixel Counting:

When a picture is converted to black and white or grey, it counts the number of light and dark pixels.

5. Edge Detection:
   Edge detection is a process of counting edges in an object to be processed.
6. Color analysis:
   Differentiating parts, features, products, quality depending on the colors in the object.
7. Pattern recognition:
   Recognition of patterns like barcode, data matrix, digital characters, metrology etc. [1]

Feature Detection

Feature Detection in computer vision, is a technology to gain image information and storing this image feature as subset of image subdomain like edges, curves, pixels, regions etc. It exactly depends on type of problem or application. If a feature is repeatedly occurred it is known as the desirable property. Sometimes the same feature will be detected in two different images. It's not that effective as other techniques, it recognizes the feature by dividing image into number of pixels. Deep learning higher algorithm are used for this process. As many algorithms have been developed, there are many feature detectors are invented. There are many kinds depending upon the application.[3]

Types of image features

Edges:
It is a single dimensional structure, when two edges meet a point is created. They form boundary of an object. It is also defined as a set of points. Sometimes many points come together to form a single edge. There are many algorithms written for edges to calculate features of object such as shape, smoothness, number of points etc.

Corners:
They are also known as interest points. They are the feature similar to points with a two-dimensional structure. Edges and corners are two different features corners are rapid changes in edges. And edges have one dimension but corners have two dimensions. Observers use gradient for detecting changes in corners. Sometimes corners also found on image which are literally called corners. So, they are called interest points.

Blobs:
It is also called as region of interest points. Blobs describe regions which are opposite to corners which are similar to points. Blob detectors are used to detect blobs and corner detectors are used to detect corners. When an original image is shrinking, and when we perform corner detection only sharp points are detected and smooth points are not detected. Now we will know the difference between corner detection and blob detection.

Ridges:
For long objects, ridges are natural features. From a point ridge is one dimensional curve and there are many algorithms that have axis of symmetry. And every ridge has a local ridge point. It is difficult to extract the features from grey or white and black images. This process is called ridge detection. This technique is normally used for road extraction in aerial images.

Feature extraction:
The result obtained from this process is called feature descriptor or feature vector. Example is a histogram descriptor. In addition to some attributes are complementary like attribute information etc.

Foreground detection:
This is one of the important methods in image processing of computer vision. It is a method which allows to extract foreground image for processing. It separates foreground from background based on few features. This can also be done through a process called background subtraction.[2]

Background subtraction:
It is applied based on static background technique which is not applicable to real environment. Reflections, background scenes etc. lead to change in background changes. Sometimes the outside scenes also have problems like rain, heavy wind, and all changes by weather. That is the reason static backgrounds have problems in outdoor scenes.

Temporal average filter:
In this process it estimates the number of pixels in the previous image. System uses buffer, it also examines all images given in training period. In training period, they only determine the median pixel by pixel. After this process each pixel value is compared for new each frame. And the input pixel value should be within threshold and it should match the background model. It should be within pixbuf, if the value is not within threshold it is considered as foreground by not including it in the buffer.

Fields that are related to computer vision

Artificial Intelligence:
Most of uses of artificial intelligence include fields like robotics to navigate through an environment. Information about this environment is provided by Computer Vision System through techniques like acting as a vision sensor, which gives high level information about the robot and the environment. Artificial intelligence and Computer Vision are through topics like pattern recognition. Computer Vision is a part of Artificial Intelligence.

Information Engineering:
It is a part of engineering that deals with use of data, information, knowledge and analysis, generation, distribution etc. It includes more theoretical components like machine learning, artificial intelligence, signal processing and information theory, computer vision, telecommunications, natural language processing, mobile robotics, bioinformatics, autonomous robotics, computer engineering, medical image computing, bioengineering, cheminformatics, electrical engineering and mathematics fields like trigonometry, algebra, arithmetic, geometry, calculus, statistics and linear algebra.

Solid state physics:
This is a major another field which is closely related to computer vision, because they depend on image sensors which recognize electromagnetic radiation that range from visible light to infrared light. Most of the technique used here is quantum physics and quantum mechanics. Because can give solution to many problems in computer vision like through fluid mechanics.

Neurobiology:
Neurobiology helps in studying human vision system like eyes, neurons, and the brain. This also helps finding difference between human eyes and animal eyes, which is heavily complicated. Research have shown that experiment result tells that computer vision is very similar to biological vision.

Literature survey

Computer vision, this thought first came when they were pioneering artificial intelligence in late 1960's. They tried achieving it through a summer project. In their project they fixed a camera to a computer and asked it to describe what it saw. In 1970's they formed foundations for computer vision algorithms which includes points, structure, background, edge, quality, pattern, ridges etc.

The very next year they studied on mathematical analysis and quantitative study on computer vision that include mathematical and physics related features like space, texture, shading, and contour models known as snakes. These concepts were similar to regularization and Markov random fields. In 1990's old works came into life, where research in 3-D field let to better understanding of computer vision.

3-D images helped in scenes of multiple images and that decade led to many inventions in computer vision. Progress was made in graphs cuts that was used for image segmentation and also to recognize faces. [5]

The future of computer vision

Computer vision has lot of applications when it is combined with technologies of AI(Artificial Intelligence),For example image captioning feature and natural language generation feature can be combined and made as a single application to recognize objects for visually blind people.

Computer vision technologies and features can also be used to developed artificial general intelligence and artificial super intelligence where processing information is even better than the human visual system.

At present there are more applications of computer vision that are left unexplored. This will make a huge change in the field of AI,but there are some challenges to overcome. First is the demystification of the black box of AI the workings hat happen inside computer vision are unpredictable.[6]

Conclusion

The benefits of applications of computer vision can be used to detect the quality evaluation of rice. It can be applied to both raw and boiled rice through near-infrared spectroscopic imaging and ultra-weak photon-emission imaging. As computer vision is still progressing as hardware and software, many characteristics are yet to invent. This can be done not only with real image techniques but along with virtual image techniques to find hardness and texture.

So there are many applications like these that are yet to be seen and they change world of technology. Computer vision combined as the subsets of artificial intelligence and machine learning is about to make huge changes in every field and industry.[7]

REFERENCES

[1] https://en.wikipedia.org/wiki/Computer_vision
[2] https://en.wikipedia.org/wiki/Foreground_detection
[3] https://en.wikipedia.org/wiki/Feature_detection_(computer_vision)
[4] https://www.sciencedirect.com/science/article/pii/S107731420090897X
[5] https://en.wikipedia.org/wiki/Computer_vision#History
[6] https://www.forbes.com/sites/cognitiveworld/2019/06/26/the-present-and-future-of-computer-vision/#5ce3f112517d
[7] https://www.sciencedirect.com/topics/food-science/computer-vision-technology