COMPUTER VISION FOR HUMAN-MACHINE INTERACTION-REVIEW

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Abstract: The paper is a review on the computer vision that is helpful in the interaction between the human and the machines. The computer vision that is termed as the subfield of the artificial intelligence and the machine learning is capable of training the computer to visualize, interpret and respond back to the visual world in a similar way as the human vision does. Nowadays the computer vision has found its application in broader areas such as the heath care, safety security, surveillance etc. due to the progress, developments and latest innovations in the artificial intelligence, deep learning and neural networks. The paper presents the enhanced capabilities of the computer vision experienced in various applications related to the interactions between the human and machines involving the artificial intelligence, deep learning and the neural networks.

Keywords: Computer Vision, Human-Machine Interaction, Artificial Intelligence, Machine Learning, Deep Learning, Neural Networks

1. INTRODUCTION

The emergence of the internet and the multitudes of modern devices have turned the world more sophisticated and at the same time much faster. The cameras found in the smart phones captures the image in one end and coveys it to a person in the other end through the internet by the implausible growth of the modernized social network like Instagram, face book, etc. billions and trillions of videos are been uploaded and watched every second through the internet, causing an overflowing data in the internet [1-3]. The data's that are in the internet might be in the form of text or images or videos. The searching and indexing of the text can be done straightforwardly without any difficulties , but the searching and indexing of the images and videos requires specialized algorithms that enable the computer to visualize the content in it. It becomes essential for the computers to see and interpret the content of the images to provide a quality output as the search results.

The computer vision enables the computers to see and understand the content of the information and respond back in a similar way as a human does. The fundamental goal of the Computer-Vision is to interpret the values of the images, by involving the latest procedures that tries to replicate the human vision capability [4-5].

In other words the computer-vision [6-8] is defined as the "automated extraction of information's from the images, the information can mean anything from the three-dimensional models, camera positions, object detection and recognition to grouping and searching image content".

Before reviewing the enhanced capabilities of the computer vision it is necessary to understand the working and the principles behind the computer vision. The following section presents the working of the Computer vision [9-11].

1.1. COMPUTER VISION –HOW DOES IT WORK?

Based on views of many researchers the computer-vision is predicted as the automatic extraction analysis, and understanding of the more useful information's from a single images or a sequence of images with the aid of the theories and algorithms that helps to attain an visual interpretation that is automatic. It is also portrayed as a higher level of image processing technique that take in the image as input and returns out the interpretations related to images as results. Altogether the aim of the Computer-Vision is to provide a similar or an even better visualization of the world like human brains. The picture below in the fig.1 shows the working of the human vision and the computer vision [12-14].
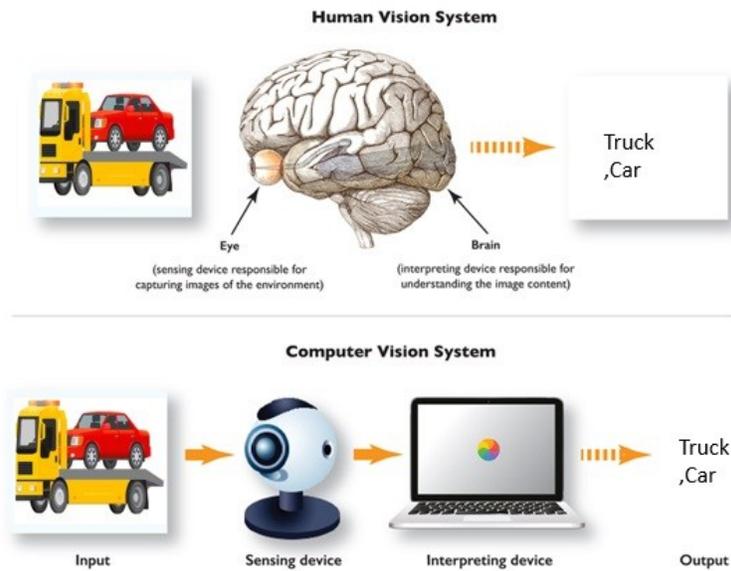
Fig. 1 Working of Human-Vision and Computer-Vision [3]

The evolution of the AI (Artificial Intelligence) and the ML (Machine Learning) is causing more improvements and up gradation in the Computer-Vision technology [15-18] providing a more reliable and an enhanced visualizing. The CV with the machine learning provides a deep analysis of the information's of an image, and enables to recognize the patterns. The fig .2 below shows the pattern-recognition by the computer-vision.
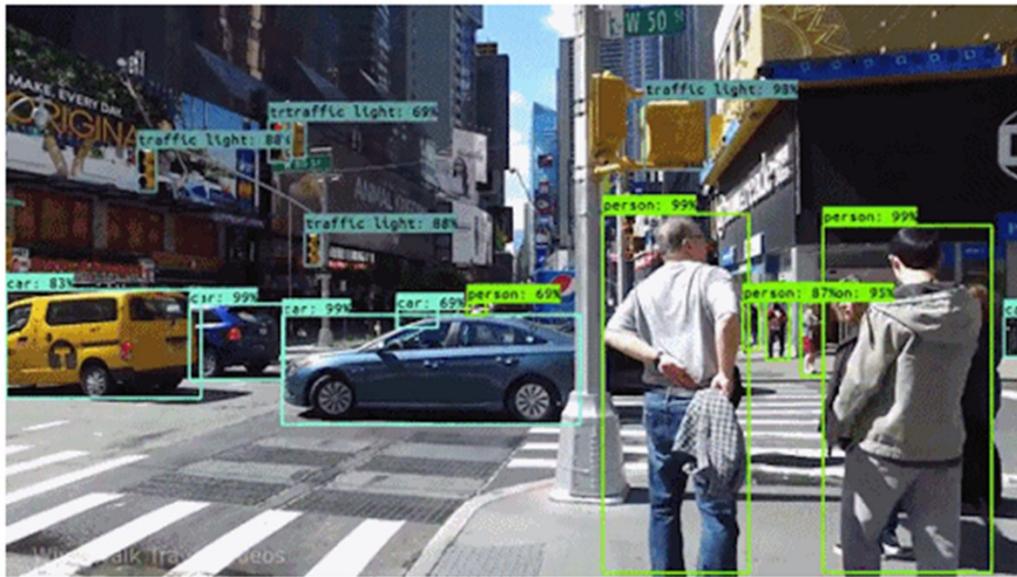
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Fig.2 Computer-Vision –Object Recognition [22]

This is made possible by the various algorithms and the techniques that aid the computers to recognize the patterns of the object and predict the accurate results in the future. So this is widely used nowadays in the human machine interaction.

The paper presents the review of the computer-visions in the applications that are related to the interactions between the humans and machines. The paper is organized with the section 2 presenting the literature survey, section 3 providing the application of the computer vision for the human machine interaction, the challenges of the computer vision in section 4 and the conclusion in the section 5.

2. LITERATURE SURVEY

The computer-vision [19-20] is becoming a promising technology in the recent decades as it focusses on the emerging and the refining methodologies that ensure the machines the capability to visualize and interpret the

images in the digital format as well as the contents found in the videos. It is actually about the pattern recognition as shown in the fig .2 above, the technology mainly operates recognizing the different components in the image by analyzing them. As shown in the fig .1 the computers also recognize the image in a similar way as the human brain does. The human brain gains the semantic meaning of the images set whereas the CV visualizes the image into digital depictions i.e. the computer views an object in pixels.

The human brain naturally finds out an object and the computers utilize the neural networks that function similar to a human brain in identifying the where every neuron in the network holds responsible information's associated with the particular information.

The most basic work of the CV is to classify the images, and this is enabled by the deep learning [21-24] procedures for recognizing and classifying the images that allows the computer to learn the fundamental attributes of the elements in the image. Based on the variety of the features the computer predicts the content of the image and also displays the probability as shown in the fig.2. The fig.3 provides the steps on how a computer recognizes an object.
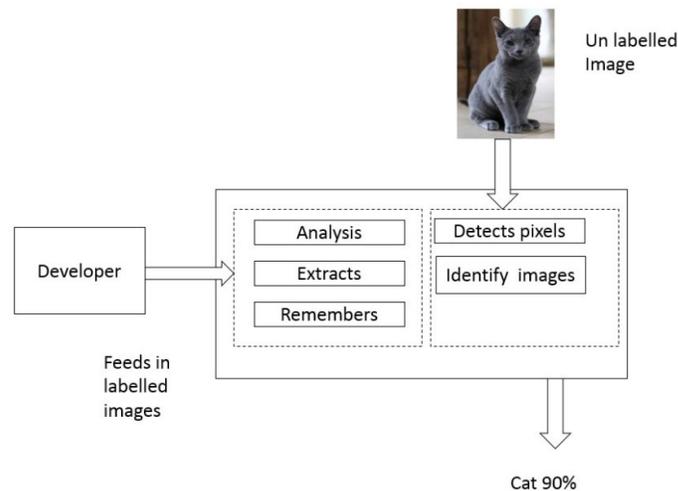

Fig .3 The computer-Vision in Object Recognition

Thus far the section provided the basic details based on the functioning of the computer-vision and further the section provides the details of the role of the computer-vision in the human machine interaction.

3. ROLE of COMPUTER-VISION IN THE HUMAN MACHINE INTERACTION

In the recent decades the scientist have concentrated more in the developing technologies that help in the improving the interactions between the humans and the machines by integrating novel resourceful procedures with the computers. This caused a significant breakthrough in the computer-vision [26-27] and enabled the computers to operate or control the machine by monitoring the gestures and the expression of the humans. The face, hands, arms, the palm, the fingers of the human are monitored and their gestures as well as the expressions are classified and utilized to control the actions of the machine by engaging the computer vision. The CV-technology eludes the necessity special gloves or the makers to make possible the interaction between the human and the machine. The basic step of computer vision for H-M interaction is given below in the fig .4
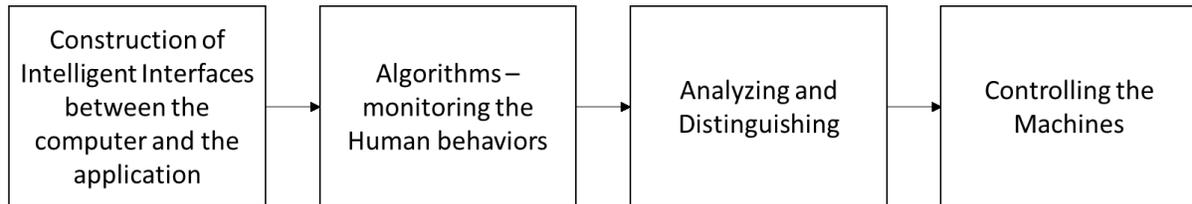

Fig .4 CV for H-M Interaction [3]

The CV for the H-M interaction is utilized in wide range of application from developing smart homes to smart cities. The tabulation below in the table.1 provides the usage of the computer vision in different applications.
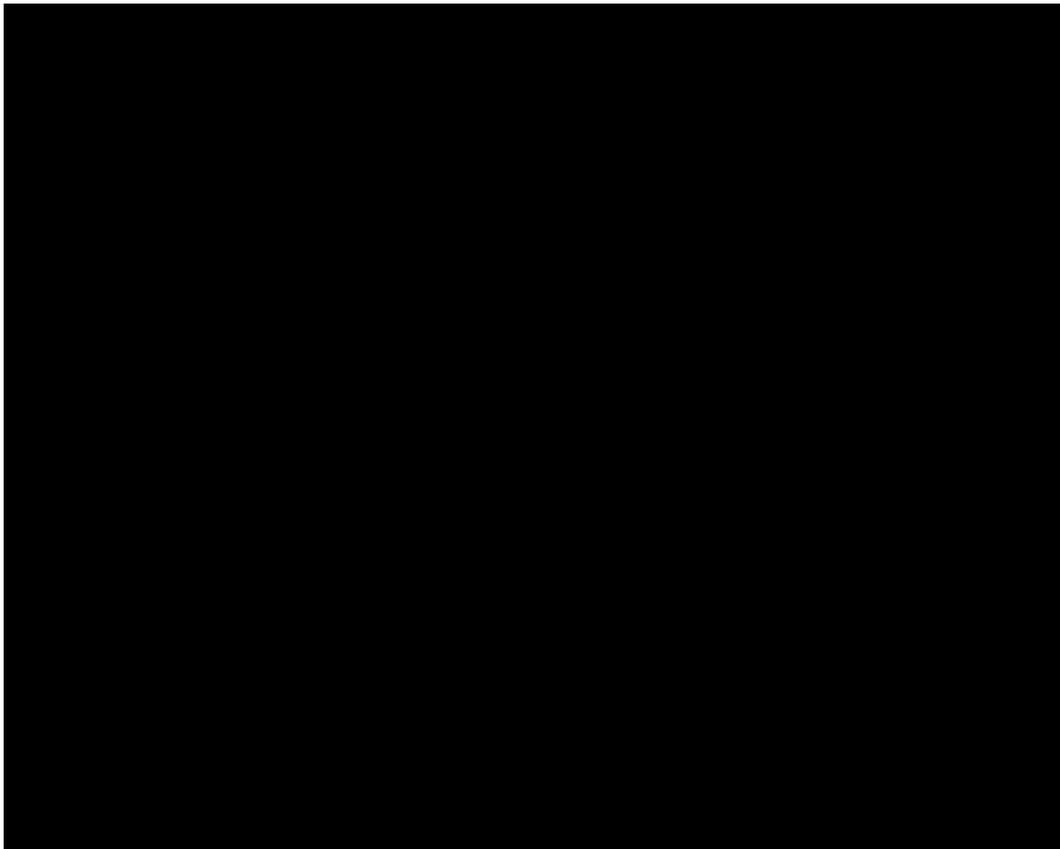
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Table.1 Applications of CV for H-M interactions [1], [9], [16], [19-23]

4. ADVANTAGES AND CHALLENGES OF COMPUTER-VISION

i.   ADVANTAGES

a. Enhances the mobile technology and improves the computer power.

b. Capable of processing huge set of information's

c. Visualizes the inputs at a higher speed than the humans.

d. Provides accurate image as well as the video interpretations.

e. Defect detections enables to assist corrective actions.

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f.   The images are analyzed based on various parameters.

g.   Enhances the safety as well as the quality.

h.   Improves the accuracy and the reliability.

i.   Provides a real time analysis.

ii.   CHALLENGES

a.   The computers sometimes fail to recognize the minute changes in the facial expressions and hand gestures, when too many expressions and gestures are shown at the same time.

b.   Cost of the initial research for the industrial specific tasks can be quiet costly.

c.   Integrating CV systems are highly complex due to the rapidly changing technologies.

d.   The algorithms might not be upgraded or accurate and the results produced might not match the actual expected results.

e.   The learning models can be affected by using faulty inputs or purposely altered images.

f.   Recognizing the handwriting documents are very difficult due the different styles and the curves in the handwriting.

g.   The object detection as well as the classification are more complex when compared with the image classification.

5. CONCLUSION

The review presented in the paper elaborates the emergence of the computer-vision followed by the working of the compute-vision and the way it recognizes the objects. Further its role in the human-machine interaction are discussed presenting the area of application were they are engaged and ends with the advantages and the limitations still prevailing in the computer-vision. The use of the artificial intelligence, deep learning and the neural network remain as the brain of the computer-vision system and allow them to identify the objects as a human brain does. In future the paper aims in developing an autonomous ROBOT that could very efficient perform the surveillance of the food industry.

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