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Computer Vision

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Abstract: ***Computer vision may be a field of computer science that trains computers to interpret and perceive the visual world. exploitation digital pictures from cameras and videos and deep learning models, machines will accurately determine and classify objects — and so react to what they "see.". Computer vision is Associate in Nursing knowledge domain scientific field that deals with however computers will gain high-level understanding from digital pictures or videos. From the angle of engineering, it seeks to grasp and alter tasks that the human sensory system will do. Computer vision tasks embrace strategies for exploit, processing, analyzing and understanding digital pictures, and extraction of high-dimensional knowledge from the important world so as to supply numerical or symbolic info, e.g. within the styles of selections. Understanding during this context suggests that the transformation of visual pictures (the input of the retina) into descriptions of the planet that be to thought processes and might elicit acceptable action. This image understanding will be seen because the disentangling of symbolic info from image knowledge mistreatment models created with the help of pure mathematics, physics, statistics, and learning theory.***
Keywords: ***Artificial Intelligence, Computer Vision***

I. INTRODUCTION

Computer vision is a field of study focused on the problem of helping computers to see. At an abstract level, the goal of computer vision problems is to use the observed image data to infer something about the world. It is a multidisciplinary field that could broadly be called a subfield of artificial intelligence and machine learning, which may involve the use of specialized methods and make use of general learning algorithms. As a multidisciplinary area of study, it can look messy, with techniques borrowed and reused from a range of disparate engineering and computer science fields. One particular problem in vision may be easily addressed with a hand-crafted statistical method, whereas another may require a large and complex ensemble of generalized machine learning algorithms. Computer vision as a field is an intellectual frontier. Like any frontier, it is exciting and disorganized, and there is often no reliable authority to appeal to. Many useful ideas have no theoretical grounding, and some theories are useless in practice; developed areas are widely scattered, and often one looks completely inaccessible from the other.

A. Computer Vision and Image Processing

Computer vision is distinct from image processing.
Image processing is the process of creating a new image from an existing image, typically simplifying or enhancing the content in some way. It is a type of digital signal processing and is not concerned with understanding the content of an image.
A given computer vision system may require image processing to be applied to raw input, e.g. pre-processing images.

B. Examples Of Image Processing Include

1) Normalizing photometric properties of the image, such as brightness or color.
2) Cropping the bounds of the image, such as centering an object in a photograph.
3) Removing digital noise from an image, such as digital artifacts from low light levels.

II. ARCHITECTURE

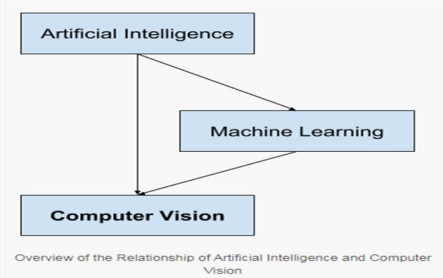


Figure 1. Architecture

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III. HISTORY

There are several computer vision components involved in making computer vision what it is today. Deep Learning is a big factor that has made computer vision so useful. But, even before Deep Learning came into being, computer vision was in use. However, it was not very powerful and required manually coding a lot of rules so that an application can derive some insights out of images. This technique involved a few steps:

A. Creating a Database

In this step, we try to capture a lot of images of objects we wish for our application or model to be able to process. For example, if we are building a facial recognition system, then we would capture images of human faces.

B. Annotating Images

From all the images that we stored in our database, we need to get measurements of some crucial features, such as the distance between eyes, the length of the nose bridge, the width of lips, etc. These measurements are the unique characteristics that help us identify the face in each image. Using these, we will be able to build a simple model that can perform the task of facial recognition.

C. Adding New Images

After annotating images, we need to add more of them, either from photographs or from videos. We would have to annotate these images by going through the same measurement process and capturing all the features of the new data that we have gathered. This process needs to be repeated multiple times so that our database can grow large enough for our system to be able to extract some meaningful insights out of it. After all this tedious and manual work of capturing images, annotating them, and repeating the previous steps to build a large database of images annotated with their features, now we need to analyse the acquired data, figure out the rules that can reasonably classify our data, and then write code so that these rules that we have come up with after so much work can be used in our system. Even after all this manual work, our systems would still perform with a good level of accuracy, but the error margin was high. These problems persisted for a long time and stagnated the capabilities of computer vision in Machine Learning

IV. APPLICATIONS OF COMPUTER VISION

Computer Vision has been incredibly useful and is being used in many applications that people use in their everyday lives. Let's take a look at a few of these.

A. Self-driving Cars

Self-driving cars are one of the most exciting applications of Machine Learning and computer vision. Cars driving themselves has always been one of the tasks that were deemed impossible to be solved by computer programming. This was because multiple things could go wrong in the real world, and these issues cannot be put into abstract concepts for which we can write code. However, as we know that Machine Learning takes a different approach and learns from already available data, we do not need to provide any rules for the machine to follow as it figures those rules out automatically. Companies such as Google and Tesla are making heavy use of these technologies to improve the capabilities of their self-driving car models. In Tesla, the self-driving feature is already available to be used.

B. Facial Recognition

Facial recognition is another good use case of computer vision. Computer vision uses Deep Learning neural networks that can extract common features from multiple images and then learn how to identify and differentiate one image from the other. Facial recognition is a feature available in many systems. Nowadays, even smartphones have this feature. This has been made possible by computer vision.

C. Healthcare

Computer vision has been a major part of the success of several advanced healthcare systems that are used for several medical purposes. These purposes include analyzing the results of a patient's tests and figuring out if the patient has cancer, looking at MRI scans of a person's brain and figuring out if a person has brain damage, looking at an image of a person's vital organs, like kidney or heart, and figuring out if they have any abnormality, etc. In many cases, these systems are found to be more accurate than a doctor's opinion. However, these systems are rarely used on their own. They are used to assist a qualified doctor to make more informed decisions.

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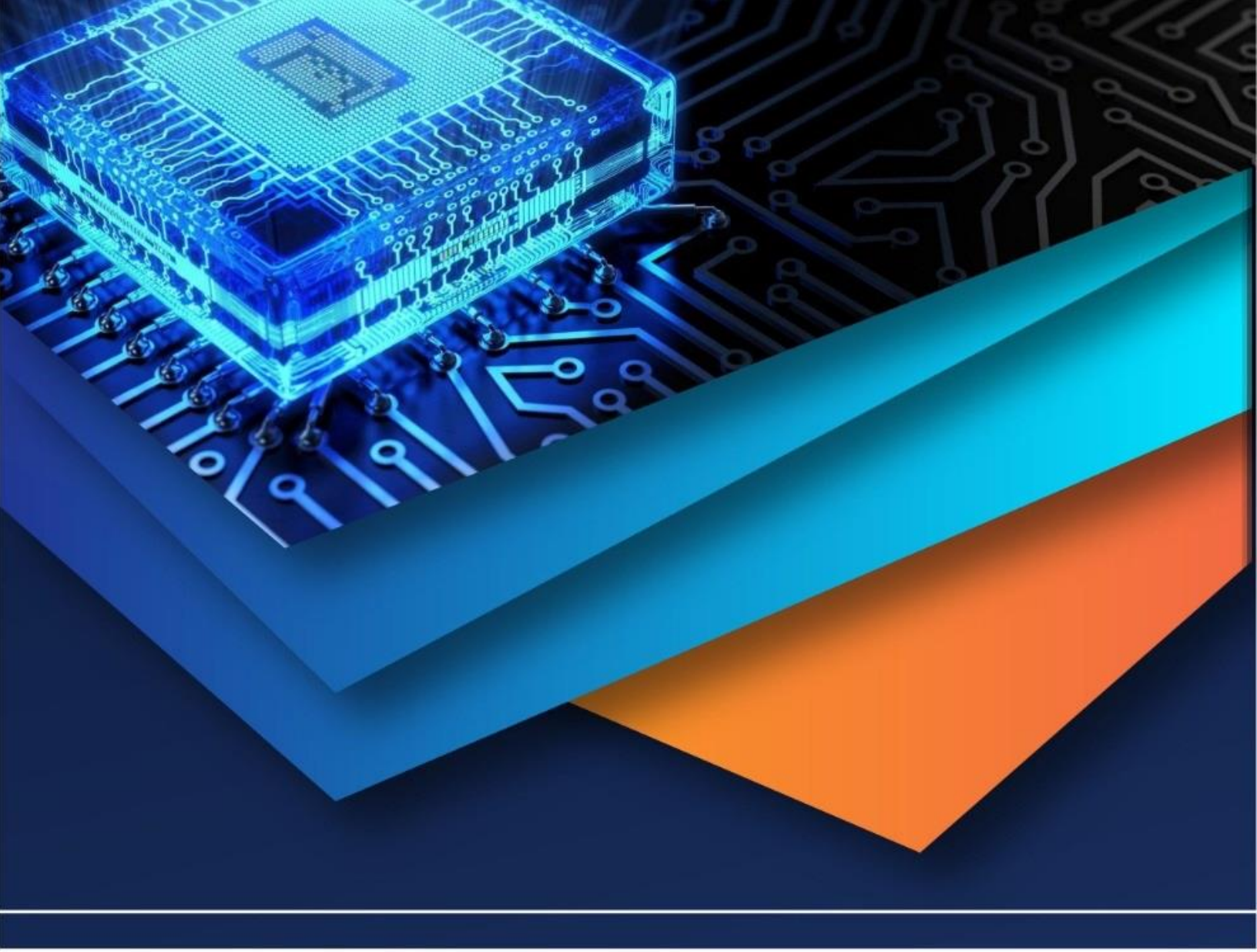
V. CONCLUSION

Computer vision is quite a vast field with its own set of rules and challenges. Because of the immense scope of the applications of computer vision, computer vision jobs are one of the most sought-after skills in today's job market. It is also one of the most popular research topics

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