ARTIFICIAL INTELLIGENCE FOR VISION APPLICATIONS

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ABSTRACT:

The primary objective of this paper is to demonstrate that artificial intelligence can surely do more than just read us the daily news headlines or tell us if we should wear red or blue. They are surely far more advanced than that, especially if a person like Elon Musk thinks AI is what will eventually end the human race. There are many reasons to use and improve AI. Some of them include health, education, helping with disabilities, industrial applications, computing applications etc..

Artificial intelligence, in terms of vision will most probably refer to computer vision. Computer Vision uses AI to convert physical objects to digital data using an AI algorithm. It is this computer vision that we use for the various vision applications. Computer vision infused with AI can be used to help the blind to virtually see and help robots to better understand the world around them. It is this vision that we will concentrate on, in this paper.

KEYWORDS: Artificial Intelligence, AI, Machine Learning, Deep Learning, Neural Network, Computer Vision, Machine vision, Blind, Eyes.

INTRODUCTION:

Artificial Intelligence is basically programming a very powerful computer to do human tasks. But what is different is that this program will learn from it's experience doing the job and will eventually improve at it's task without anyone teaching it to. It will learn from real world experiences and feed the circumstances to it's source code and will use that information when it is in need of it in a future application. You have probably heard of Artificial Intelligence before, because it is a very popular buzz word. Those set of words come bundled with Machine Learning,

Deep Learning, Neural Network etc.. That's because they are also a partition of AI. Personally I think AI will have a big role to play in the future of technology. It is bigger right now than ever before. It is a 190.61 BILLION dollar industry. And it will only get more vital in the future. A lot of the highest paying jobs on the planet are related to AI. The world's most influential companies and brands are working day and night to achieve they're next milestone in AI. That is because they know that this particular field will become extremely profitable in the future and whoever successfully hits the general market will virtually have a complete monopoly. So there is obviously a pretty big market in this field.

COMPUTER VISION:

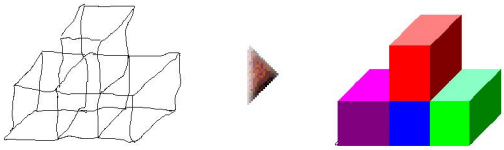
Computer Vision is the science and technology of obtaining models, meaning and control information from visual data. The two main fields of computer vision are computational vision and machine vision. Computational vision has to do with simply recording and analysing the visual perception, and trying to understand it. Machine vision has to do with using what is found from computational vision and applying it to benefit people, animals, environment, etc.

Computer Vision has influenced the field of Artificial Intelligence greatly. The Robocup tournament and ASIMO are examples of Artificial Intelligence using Computer Vision to its greatest extent. The Robocup tournament is a tournament for robot dogs playing soccer. To be able to play soccer, these dogs must be able to see the ball, then react to it accordingly. Engineers of these robot dogs have been challenged to create robot dogs who can beat the best soccer players at soccer in around fifty years.

ASIMO, seen below, is another example of how computer vision is an important part of Artificial Intelligence. ASIMO is a robot created by Honda, but of course, all robots need to be able to know where to move around and what is in its surroundings. To be able to do this, ASIMO uses cameras to visualize computationally what is in its surroundings, then uses it to achieve its goal.

Artificial Intelligence can also use computer vision to communicate with humans. GRACE the robot, shown below, is a robot who could communicate slightly with humans to be able to recognize her surroundings and achieve a specific goal. For example, GRACE attended a conference through a lobby and up an elevator by communicating with humans. Communications included understanding that she had to wait in line, and asking others to press the elevator button for her. She also has a binocular vision system allowing her to react to human gestures as well.

Artificial Intelligence also uses computer vision to recognize handwriting text and drawings. Text typed down on a document can be read by the computer easily, but handwritten text cannot. Computer vision fixes this by converting handwritten figures into figures that can be used by a computer. An example is shown below. The attempted drawing of a rectangular prism resting on three other rectangular prism is converted by computer vision to a 3-D picture of the same thing, but in a format usable by the computer and more readable by users.



Another important part of Artificial Intelligence is passive observation and analysis. Passive observation and analysis is using computer vision to observe and analyse certain objects over time. For example, in the pictures below, on the first one, the passing cars are being observed and analysed as what type of car by the computer. This can be done by outlining the car shape and recording it. On the second picture, the flock of geese are observed and analyzed over time. The record could serve to predict when geese would come

again, for how long they would stay, and how many of them there could be.

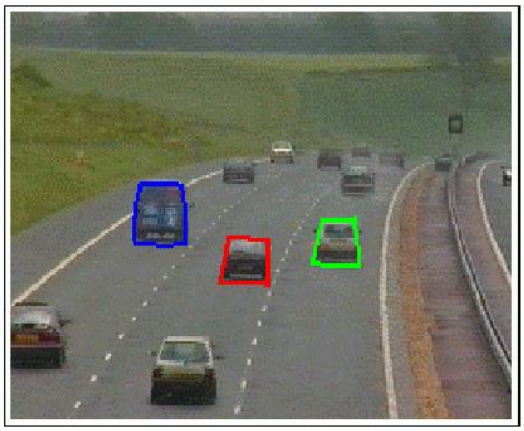
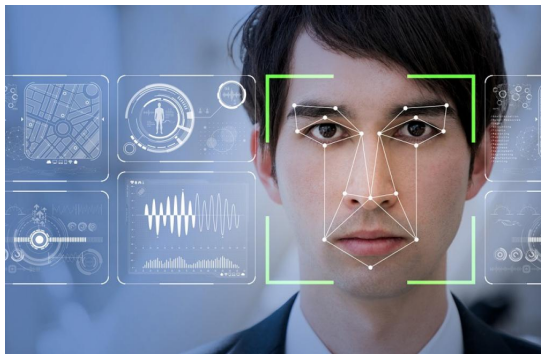


IMAGE RECOGNITION:

Image recognition, in the context of machine vision, is the ability of software to identify objects, places, people, writing and actions in images. Computers can use machine vision technologies in combination with a camera and artificial intelligence software to achieve image recognition.

Image recognition is used to perform a large number of machine-based visual tasks, such as labelling the content of images with meta-tags, performing image content search and guiding autonomous robots, self-driving cars and accident avoidance systems.

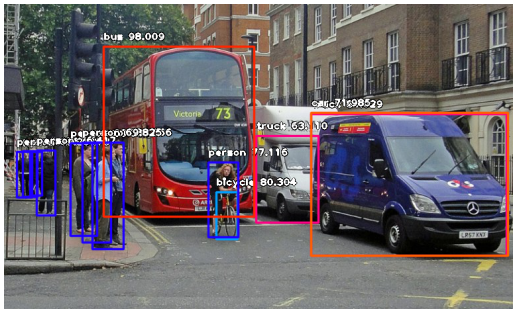


OBJECT DETECTION:

Object detection refers to the capability of computer and software systems to locate objects in an image/scene and identify each object. Object detection has been widely used for face detection, vehicle detection, pedestrian counting, web images, security systems and driver less cars. There are many ways object detection can be used as well in many fields of practice. Like every other computer technology, a wide range of creative and amazing uses of object detection will definitely come from the efforts of computer programmers and software developers.

Getting to use modern object detection methods in applications and systems, as well as building new applications based on these methods is

not a straight forward task. Early implementations of object detection involved the use of classical algorithms, like the ones supported in OpenCV, the popular computer vision library. However, these classical algorithms could not achieve enough performance to work under different conditions.



AUTONOMOUS NAVIGATION:

Let us first look at the human perspective of driving a car with the use of sensory functions such as vision and sound to watch the road and the other cars on the road. When we stop at a red light or wait for a pedestrian to cross the road, we are using our memory to make these quick decisions. The years of driving experience habituate us to look for the little things that we encounter often on the roads—it could be a better route to the office or just a big bump in the road.

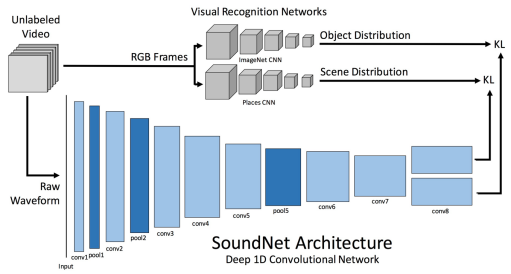
We are building autonomous vehicles that drive themselves, but we want them to drive like human drivers do. That means we need to provide these vehicles with the sensory functions, cognitive functions (memory, logical thinking, decision-making and learning) and executive capabilities that humans use to drive vehicles. The automotive industry is continuously evolving to achieve exactly this over the last few years.

As the amount of information being fed into IVI (in-vehicle infotainment) units or telematrics systems grows, vehicles will be able to capture and share not only internal system status and location data but also the changes in its surroundings, all in real time. Autonomous vehicles are being fitted with cameras, sensors and communication systems to enable the vehicle to generate massive amounts of data which, when applied with AI, enables the vehicle to see, hear, think and make decisions just like human drivers do.

SOUNDNET:

SoundNet is a neural network algorithm that basically figures out a scene or a circumstance just based on the input audio data. In other words, if we feed it only the audio of a video of a park, the AI will output a percentage of what it

thinks the video is. And it is mostly right. This isn't a strictly a vision application, but the AI is able to create a visual scene just from audio. So, I think that counts too.



PREDICTING VIDEOS:

The AI that MIT developed, which will be presented at the International Conference on Computer Vision and Pattern Recognition (CVPR), was able to correctly decide, after just one second of a scene, whether two people would hug, kiss, shake hands, or high-five. It was also able to anticipate what kind of object would appear in the video after five seconds. For instance, when presented with a microwave, the system could predict that a coffee mug may appear.

The machine learning system—an AI system that relies on neural-network based algorithms to train itself on large sets of data—was applied to visual training data that included more than 600 hours of video from shows like "The Office" and "Desperate Housewives."

CONCLUSION:

To conclude this paper, I'd like to state that it is very exciting to see such amazing advancements in Artificial Intelligence. It is only going to get better in the future and I am personally very sure that AI will play a very vital role in our day to day lives. We will eventually depend on computers to perhaps find cancers in our bodies and help the blind to finally see the world. We must provide our avid support towards this cause.