

Implementation of Augmented Reality and Virtual Reality in Different Fields

Deepankar Sharma,
Student BCA,
Department of Computer Science and Engineering,
Graphic Era Hill University, Haldwani
DEEPANKARSHARMA.20041299@gehu.ac.in

Sujata Negi Thakur,
Assistant Professor,
Department of Computer Science and Engineering,
Graphic Era Hill University, Haldwani
sujatanegi@gehu.ac.in

Manoj Kumar Singh,
Assistant Professor,
School of Computing,
Graphic Era Hill University, Bhimtal
mthakur@gehu.ac.in

Abstract:

In the era Twenty First century, Artificial Intelligence (AI) have established as a well-known technology being the baseline of every commercial industry with tremendous amount of power the data holds within. And it can be noticed by exponentially increasing market of AI based and AI powered applications, for example, Augmented Reality(AR) and Virtual Reality(VR) are constantly changing the perspective and way of the world that we can experience while sitting at home. A very powerful domain in the field of Artificial Intelligence is Computer Vision (CV), which helps the AI boosted applications to achieve a next level experience allowing them to make inference like human eyes. Computer Vision has been widely used in various areas including medical, security monitoring, transportation, industrial production, Internet, games, military and other fields. In the area of Augmented Reality, in order to improve efficiency we need our applications to be smart enough to understand various types of information and critically the visual information , among which computer vision technology plays an important role. We have managed to pass this gift to the computers to a great extent. Still computer vision is not like human vision , the images need to go through a lots of seriously complex mathematical as well as logical operations in order to process a result based on it. After the efforts of great minds over almost half a century, computer vision has been in image recognition, classification, detection and segmentation, search, synthetic made great achievements. This paper discusses the areas where Augmented Reality(AR) and Virtual Reality(VR) could be introduced

to replace the traditional old-fashioned ways in order to yield efficient and effective results as well as the potential dangers at stake.

Keywords:

Artificial Intelligence , Computer Vision, Augmented Reality, Virtual Reality

1. Introduction

Having intelligent machines is a big demand for every sector of the society. Augmented Reality(AR) and Virtual Reality(VR) are technologies that use Artificial Intelligence to superimpose a simulated environment over the real one. VR technologies are sophisticated to replace the original real environment with an artificial environment. AR technologies take this one step further where this virtual environment is able to exist in parallel to the real one. This enables us to create a more informative environment where real and artificial environments overlay on top of each other. Such technologies are very helpful in real world scenarios.

Being able to interpret visual information might be one of the greatest possession in gifts to humans or any other living organism out there, and it has become incredible when we have managed to pass this gift to the computers to a great extent. Still computer vision is not like human vision , the images need to go through a lots of seriously complex mathematical as well as logical operations in order to process a result based on it. After the efforts of scientists for decades, computer vision has been in image recognition, classification, detection and segmentation, search, synthetic made great achievements. This paper discusses the related concepts and applications of computer vision (CV) for augmented reality that enables computers to obtain, process, analyze and understand digital videos and images as well as the potential downsides that might be experienced.

1. Computer Vision and Augmented Reality

1.1 Computer Vision

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information^[3]. Computer Vision is a simulation of human vision , however it

does not necessarily work like human vision instead it goes through a series of steps involving lots of complicated mathematical computation. The neural networks that are best at this task are called convolutional neural networks (convnet or CNN). Convolution is the mathematical operation that gives the layers of a convnet their unique structure.^[5] The domain of Computer Vision extends to a variety of tasks.

1.1.1 Image Classification

Image Classification is one of the most basic tasks where computer vision might be applied. In Image Classification, we try to extract features from input images and judge them in order to classify them in various classes.

1.1.2 Target Detection

Target Detection is a similar task like image classification but it focuses on specific target within the image.

1.1.3 Target Segmentation

Image segmentation is a traditional field of computer vision, which is based on the unit of pixel. Each pixel is classified and divided according to the characteristics such as color and texture, and the image is divided into different sub-regions^[6].

1.2 Augmented Reality

Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.

“The ability to overlay computer graphics onto the real world is commonly called Augmented Reality (AR). Unlike immersive Virtual Reality, AR interfaces allow users to see the real world at the same time as virtual imagery attached to real locations and objects. In an AR interface, the user views the world through a handheld or head mounted display (HMD) that is either see-through or overlays graphics on video of the surrounding environment. AR interfaces enhance the real world experience, unlike other computer interfaces that draw users away from the real world and onto the screen.”^[7]

2. Applications of Augmented Reality and Virtual Reality^[8]

AR is set to have a huge impact on various areas and domains of applications, some of the major ones might include:

2.1 Medical Training

Students from various universities and educational institutions have been using AR facilitated techs for effective medical training including operating MRI equipment to performing complex surgeries.

2.2 Retail

Shoppers today usually use their smartphones to look up for any information about the product they are about to purchase or to compare the prices. World famous motorcycle brand Harley Davidson is one great instance of a brand making the most of this trend, by developing an an AR app^[9] that shoppers can use in-store.

2.3 Repair and Maintenance

Repair and Maintenance might be one of the biggest industrial use cases of AR facilitated technology. Most industrial purposes involve beginning to use AR headsets and glasses in order to spot, suggest potential fixes, and point out potential trouble areas.

2.4 Design and Modelling

AR helps professionals to visualize the product during the creative process from interior design to architecture and construction. Use of headsets enables architects, engineers, and design professionals step directly into their buildings^[10] and spaces to see how their designs might look, and even make virtual on the spot changes.

2.5 Business Logistics

AR presents a variety of opportunities to increase efficiency and cost savings across many areas of business logistics. This includes transportation, warehousing, and route-optimization. Shipping company DHL^[12] has already implemented smart AR glasses in some of its warehouses, where lenses display to workers the shortest route within a warehouse to locate and pick a certain item that needs to be shipping.

2.6 Classroom Education

After the global pandemic since last year technology like tablets have become totally widespread in many schools and classrooms, teachers and educators are now ramping up student's learning experience with AR. The Aurasma^[11] app, for example, is already being used in classrooms so that students can view their classes via a smartphone or tablet for a more rich learning environment. Students learning about astronomy might see a full map of the solar system, or

those in a music class might be able to see musical notes in real time as they learn to play an instrument.

2.7 Tourism Industry

AR presents a huge opportunity for travel brands and agents to give potential tourists an even more immersive experience before they travel.

2.8 Public Safety

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In the event of an emergency today, people will immediately reach for their smartphone to find out what's going on, where to go, and whether their loved ones are safe. Moreover, first responders arrive on the scene of a fire or earthquake trying to figure out who needs help, and the best way to get them to safety. AR is showing promise in solving both pieces of the public safety puzzle. First responders wearing AR glasses can be alerted to danger areas, and show in real-time individuals that need assistance while enabling to still be aware of their surroundings. For those in need, geolocation enabled AR can show them directions, and the best route to, safe zones and areas with firefighters or medics.

3. Potential Threats by AR and VR

AR and VR presents us with contextual information transparently but also in a way that lets you explore the world safely without actually going anywhere. But we still haven't reached to a position of full safety , there might be lots of areas to work on , as well as many reasons to be concerned. Turns out that there are lots of areas to work on, some of them might be:

3.1 AR could (further) privatize public spaces [\[13\]](#)

With the proliferation of AR glasses in public spaces, we risk stumbling into a situation where these same companies control an unregulated “augmented sphere” imposed on our public spaces.

A number of companies are already developing their own digital version of the world – often called “Mirrorworlds” or “AR clouds”[\[14\]](#). To limit the amount of processing your device would have to do when you enter a public space, the companies would store maps of different places in an AR cloud that your device would access. Companies would compete to serve you the most

detailed and up-to-date maps to provide you with the fastest and most advanced AR experience.

3.2 Autonomous Driving

Augmented Reality can cause you to misjudge the speed of oncoming cars, underestimate your reaction time, and unintentionally ignore the hazards of navigating in the real world.^[4]

3.3 AR threatens our rights

It's possible for uses of AR to harm rights beyond privacy and data protection. There will be content governance issues in AR spaces, with implications for free expression. For example, mixing deepfakes with AR which is also called Synthetic Reality^[15].

For advanced AR technology to work, it has to create a 3D model of the real world, and this can mean gathering huge amounts of information about us and our surroundings. This allows the system to place overlay objects on the physical world in a convincing manner. For example, to make an animated object such as a Pokémon appear to be standing on your table, the AR system needs to recognize the dimensions and depth of the table. For photo filters to work on Snapchat and Instagram, a detailed 3D map of your face needs to be created onto which the filter will be applied.^[13]

3.4 Reality Distortion^[1]

Having so much complex mixed reality, possibly we could reach a time where it is difficult to distinguish between what is real and what is virtual while interacting through AR or VR. And there should possibly be an obligation put on developers to make this distinction apparent. There is also the potential for misleading advertising. Advertisers selling property could augment it with nice features, so it looks better than it actually is. Augmented reality could be used to distort actual reality in a misleading way.

4. Conclusion

With this much development of science and technology, specially in the era of Artificial Intelligence, various intelligent products come into people's life. Among them, Computer Vision technology is highly appreciated, especially the reference of deep learning and neural network, which makes it advance by leaps and bounds. This paper introduces the basic knowledge of computer vision and its application in the field of Augmented Reality, hoping to help

readers understand the relevant knowledge and get involved in relevant research. Augmented Reality(AR) and Virtual Reality(VR) technologies are not a new concept, their potential in various areas is just beginning to be explored. Unlike the other hardcoded computing technologies, AR and VR interfaces offer seamless interaction between the real and virtual worlds, a tangible interface metaphor and a means for transitioning between real and virtual worlds. Educators and Collaborators should work with researchers in the field to explore how these characteristics can best be applied in a environment ensuring that something good and better can brought out of it. We can certainly hope for a better and advanced future with such great technology in hands but at the same time being very powerful also makes it very risky if that is exploited in a non efficient way.

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