**ADVANCED MACHINE LEARNING**

**Final Project Report**

**Introduction:**

The creation of environments and content, replicating real-world locations in virtual reality, and increasing interactions between VR viewers and virtual characters represent almost all of the deep learning technology in “StudioLAB”. One area of machine learning known as "deep learning" involves the use of artificial neural networks for processing and analyzing challenging data, allowing algorithms to develop from input data and predict the future and make decisions based on that information without requiring specific programming. The program creates the input information using techniques including speech and picture recognition, natural language processing, and predictive analytics. It also uses multilevel linear and nonlinear transformations to represent abstract concepts in data. You can analyze large data sets. It uses multiple layers in an artificial neural network, each built on top of a single layer of perceptron insight to achieve a high level of sensitivity. Deep learning can train models using unsupervised and supervised methods. Unlike deep learning, it automatically learns from data without the need for manual feature engineering. CNNs, DNNs, DBNs, and RNNs are the deep learning neural networks used in computer vision and predictive analytics, which give quick and accurate output. And it is used to solve different kinds of issues and it gives excellent performance in multiple benchmarks. There are also disadvantages such as the need for large amounts of data, vulnerability to biased attacks, and lack of interpretability. Aware of these shortcomings, deep learning is improving his field of AI research, which may lead to further advances in the future. Therefore, this report discusses the latest advancements and applications in deep learning. We examine the most advanced methods available today and evaluate how well they perform in solving real-world deep-learning application problems. Today, In every field there using artificial intelligence without deep learning development, we would not have technologies like digital assistants, recommendation systems, self-driving cars, voice-enabled TV remotes, fraud detection and multimedia software, etc...

**What deep learning techniques are used in “StudioLAB” technologies? And how there develop VR with these techniques.**

This report is providing information about how deep learning techniques have been involved in Walt’s Disney Company to develop virtual reality, to make reality experiences more realistic and entertaining. In early times Disney Company concentrate on deep learning to develop the concept of "metadata" which describes information about the plots, scenes, and characters in Disney's TV series and films. The team is developing deep learning tools that will recognize digital content with important metadata, which can speed up the data preservation process. By implementing the production of metadata among various types of Disney content, the team can concentrate more on creating deep-learning models. As animation makes it more difficult for a machine to recognize a character from its surroundings, solving the issues presented by animation recognition is one of the most successful deep-learning tasks. Nowadays many entertainment industries focus on virtual reality (VR). In, Disney is one of the industries which focus on VR to create a realistic experience for audiences. So there launch the “StudioLAB” application the main goal of the development of this application is to convey storytelling through 3D views by using advanced technologies like VR, AI, and Mixed Reality experiences. AI and deep learning techniques are being applied to the creative processes and production process to improve the both process at the studio.

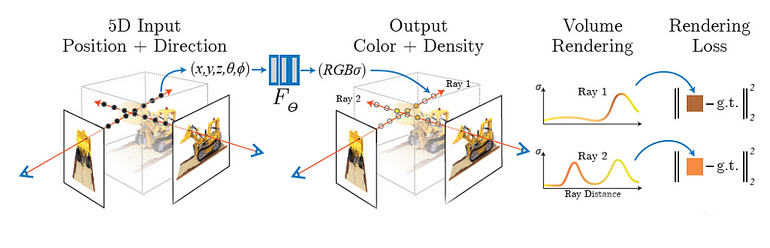
**Discovering the models in “StudioLaB” virtual reality technology:**

StudioLAB is using Virtual reality in various areas such as entertainment, marketing promotion, film production, and gaming. Every year Disney explores new creators to give better experiences for audiences. There develop the VR, and in the process, deep learning involves different techniques. There are convolutional neural networks, generative adversarial networks, reinforcement learning, natural language processing, and neural radiance fields.

CNN models are used to perform tasks to process the image and video, to increase the render quality of images and videos in the virtual environment. GANs models are used to produce high-resolution images and videos, to create virtual atmospheres and characters in virtual reality that are similar to their real-world versions. RL models are used to create dynamic virtual reality. The NLP model is used to interact with VR by using voice commands. And last model NeRF is used to create photorealistic 3D objects and environments.

**Algorithms behind the “StudioLaB” application:**

Disney's virtual reality experiences are probably a combination of several methods depending on the studio lab application, as the company performs. However, the Neural Radiance Fields (NeRF) approach received a lot of attention in recent times because of its capacity to produce extremely realistic 3D models of objects and environments by training a neural network on 2D image references. NeRF has been shown to produce images that are very similar to actual photography in various types of virtual reality applications, including gaming, simulated travel, and digital education. Still, now the research is ongoing to implement the speed of rendering the best output model and scenes. And there introduces a new approach to the neural radiance fields model the latest advanced method is Generative adversarial networks which there called generalization and scene complexity. This model is trained on specific data to manage challenging situations created by the model with dynamic aspects such as motion tracking and the condition of light according to motion. And NeRF needs additional research to further develop its generalization ability to render it flexible in a variety of environments and scenarios.



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**Limitations and Challenges in “StudioLAB”:**

The process of research to develop the “StudioLAB” technology, also have drawback and challenges in NeRF model due to the large quantity of data required to train effectively sufficient photographic coverage, real-time performance, and high computational to generate high-quality photorealistic images, difficulty to analyze and understand the issue made by model and we can improve performance and no errors fix in render output process its need efficient software like Unreal Engine. And “studio Lab” VR application required high memory and computational capacity, which is more expensive, and implementing neural networks in studio lab applications can be difficult since they demand a lot of computer power to train and render new images from multiple perspectives. To generate high-quality 3D realistic images by using deep learning. NeRF's uses in particular fields of virtual production might be restricted by Studiolab's current limitation to scenes of low to medium-level complexity. It can be difficult to implement Studiolab into current pipelines, especially when the technology demands updates to current hardware or software. The present limitations of Studiolab's implementation make it difficult to collect dynamic scenes and images.

**Solution:**

StudioLAB has to pre-trained models by collecting addition pictures from different perspectives by using high-resolution techniques to improve the quality of the 3D models VR environment with data, And it can be reducing the errors and give good accuracy. There have developed high train algorithms that can run efficiently on computing these approaches can identify more accurate error and computational optimization. StudioLab may focus to develop plugins like APIs that facilitate the transfer of data between NeRF and these software tools to provide smooth integration with present applications such as Unreal Engine. Deep learning models can be implemented in VR more effectively and with less power consumption because of developments in technology techniques like neuromorphic computing and deep learning-specific CPUs. To speed up training and provide real-time rendering, a possible approach is to invest in stronger hardware or cloud computing. This could reduce the time duration and expenditure required for training the network and producing a high-quality virtual reality environment. May be in the future it has to concentrate on all these issues by developing advanced deep learning techniques.

**Conclusion:**

The neural Radiance Field is a potential deep learning method for producing photorealistic 3D models of real-world objects and environments in the Virtual reality world. Various industries use this technique such as gaming, entertainment, Ads marketing promotion, and film production. And also there introduces a new approach in the neural radiance fields model the latest advanced method is Generative adversarial networks which there called generalization and scene complexity. By training the different models it reducing the cost and quantity of time needed to construct dimensional virtual worlds. It has the potential to revolutionize virtual production. Actual-time rendering and compatibility with current engines are two limitations and challenges that facing still now in NeRF model. Solutions like StudioLab's optimization framework are being developed to solve some of these issues as researchers perform well on this model to increase performance and efficacy.

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