SKY ENGINE
Advancing Artificial Intelligence

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RAYTRACING ENGINE DEDICATED TO DEEP NEURAL NETWORKS TRAINING IN VIRTUAL REALITY.

INTRODUCTION

Deep neural networks (DNN) compose the most flexible and accurate family of machine learning algorithms used in computer vision. However, they require high computational power and large data volume for training process. Although the problem of computation power has been solved by using the latest GPUs, data gathering and labelling processes remain the most expensive and time-consuming activity when developing new deep learning-based solutions. Moreover, in many cases it is nearly impossible to gather enough data to train the deep network. For example, such situation happens in the domains like medical imaging where acquisition of sufficient amount of data of a certain type a disease requires significant number of patients, which need to be examined.

On the other hand, animation and rendering techniques are advanced enough to generate image sets with a photo realistic quality. It has been proven in [1], [2] and [3], that for deep models training, synthetic, rendered data can be used instead of real pictures for a pre-training stage or even for end-to-end training of the network. We present a first ray-tracing engine and deep learning pipeline designed from scratch, which is dedicated to train AI models in virtual reality.

TECHNOLOGY

Sky Engine combines a ray-tracing technology with Generative Adversarial Network (GAN) based modules and deep integration with the PyTorch framework. The technology enables rendering of virtual scenes including all the information required to train a neural network model, i.e. labels, semantic masks or depth maps. Using python bindings, Sky Engine enables preparation of a training data originating from virtual scenes designed by an artist in one of the popular CGI tools. Sky Engine is also able to automatically balance the dataset. For each model, the engine can quickly capture the most confusing situations and generate more pictures with similar configuration, by changing parameters of a scene like camera or light positions, material properties or environmental maps. Moreover, it is possible to generate almost infinite number of simulated images of any particular scene not only in visual light but also in the infrared or even x-rays range of spectrum.

Sky Engine is implemented on top of NVIDIA OptiX [4] library. OptiX buffers share GPU memory with PyTorch tensors, making it possible to render data directly to the model input structures, without the need to transfer data over PCIe. The rendering engine also supports Material Definition Language and Adobe Substance generative textures.

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Key features of Sky Engine:

- Multispectral, physics-based raytracing, optimised for NVIDA RTX architectures,
- Render passes dedicated for deep learning,
- Animation and motion capture systems support,
- GAN based materials and images postprocessing,
- Support for Nvidia Material Definition Language and Adobe Substance textures,
- Multi GPU and Network level distributed rendering and neural networks training,
- Self-balancing dataset by feedback loop between rendering and training,
- GPU memory level integration with PyTorch and TensorFlow.
- Implemented popular neural network models with render data sources.

EXAMPLES:

Sky Engine technology has been tested yet in a field of Computer Vision by companies like Scania, Jinshan Group or Husqvarna Group in a field of Medical Imaging, Robotics and Manufacturing.

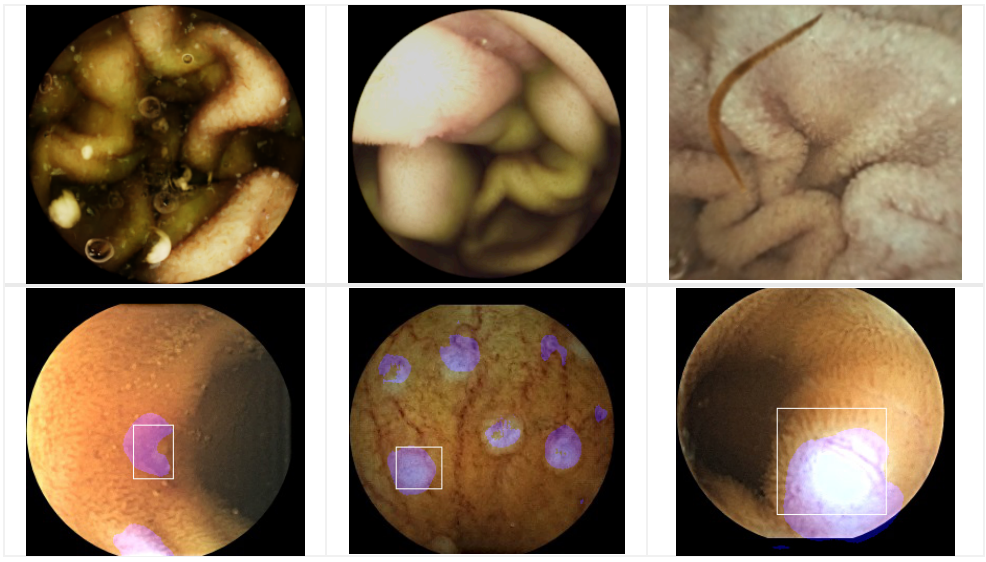

Table 1: First row: examples of synthetic used for deep neural network training, second row: Inference of a model trained on synthetic data only made on real medical images. For two selected type of cancers model achieved recall and precision values on a level of 0.95.

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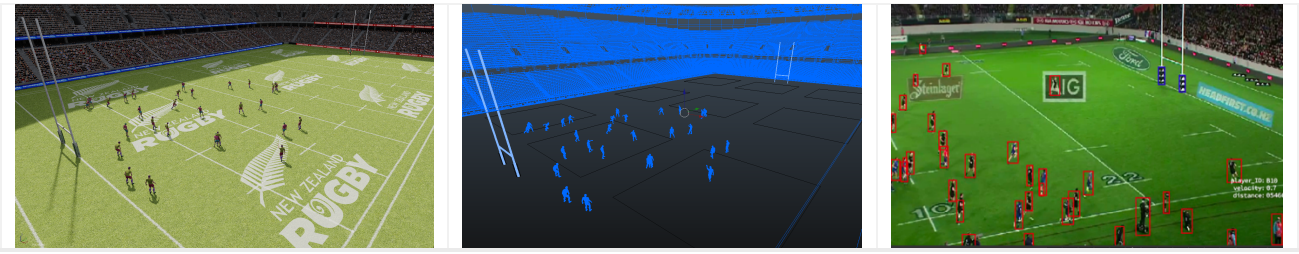

Table 2: First two images shows examples of synthetic rugby footage used to train model to find players, estimate their position in 3d and detect their action. Third image shows the inference of a model on real data from broadcast camera.

Figure: Sky engine shader ball with MDL carbon material

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REFERENCES

[1] Su, H., Qi, C. R., Li, Y., & Guibas, L. J. (2016). Render for CNN: Viewpoint estimation in images using CNNs trained with rendered 3D model views. *Proceedings of the IEEE International Conference on Computer Vision*, *11–18–Dece*, 2686–2694.

[2] T. Surazhsky, Acceleration of Multi-Object Detection and Classification Training Process with NVIDIA Iray SDK, GTC Silicon Valley 2017

[3] S. Bhokre, Synthetic Data Generation for an All-in-One Driver Monitoring System, GTC Silicon Valley 2018

[4] Parker, S. G., Bigler, J., Dietrich, A., Friedrich, H., Hoberock, J., Luebke, D., … Stich, M. (2010). OptiX: A general : A general purpose ray tracing engine. *ACM Transactions on Graphics TOG*, *29*(4), 1–13.

[5] Long, J., Shelhamer, E., & Darrell, T. (2015). Fully convolutional networks for semantic segmentation. *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, *07–12–June*, 3431–3440.

[6] Wu, S., Zhong, S., & Liu, Y. (2017). Deep residual learning for image recognition. *Multimedia Tools and Applications*, 1–17.

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