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Short Communications

NVIDIA research: Pushing AI forwards

Leif Nordlund
NVIDIA Nordics, Sweden

ABSTRACT

Self-driving cars is currently a hot research topic. Deep learning revolutionized computer vision and is behind the rapid progress in the field of autonomous vehicles. NVIDIA is a key player in the area of self-driving cars and provides both hardware (NVIDIA DRIVE) and software platforms (DriveWorks) as support for the development of autonomous vehicles. NVIDIA GPUs also allow training deep neural networks significantly faster compared to any other means. Cars are expected to become computer on wheels as reaching full autonomy (e.g. Level-5) will require significant unprecedented amount of computing power in a vehicle. At NVIDIA Helsinki, our deep learning engineers – as part of our global R&D effort on autonomous vehicles – focus on obstacle perception for self-driving cars. R&D ranges from object detection, lane detection, free-space segmentation and depth estimation, based on multiple sensors such e.g. as cameras and Lidar.

INTRODUCTION

Game and film creators may soon be able to leverage the same GPUs that put games on your screen to harness the power of AI to let them move faster, spend less, and create richer experiences. NVIDIA is showing research at SIGGRAPH 2017 this week that makes it easier to animate realistic human faces, model how light interacts with objects in a scene, and render realistic images more fast. NVIDIA is advancing 3D graphics for games, virtual reality, movies, and product design by integrating our AI expertise with our long background in computer graphics.

Video of actors reciting every line of dialogue for each character in a game is recorded by game developers to create animated faces.

They employ software to convert the video into a digital twin of the performer, which is then used to create the animated face. Existing software necessitates artists spending hundreds of hours retouching artificial faces to make them more like the real actors. It's time-consuming for artists and expensive for studios, and it's difficult to change once it's completed. Reducing the amount of time it takes to create facial animation would allow game creators to incorporate more character dialogue and supporting characters as well as iterate on script changes more quickly.

NVIDIA researchers Samuli Laine, Tero Karras, Timo Aila, and Jaakko Lehtinen built a neural network to construct facial animations straight from actor videos using Remedy's enormous archive of animation data, NVIDIA GPUs, and deep learning. NVIDIA's method requires only five minutes of training data

instead of hours of labor-intensive data conversion and touch-up for hours of actor films. From a single video feed, the trained network generates all of the facial animation required for an entire game. NVIDIA's AI solution creates more consistent animation with the same fidelity as traditional methods.

According to Antti Herva, Remedy's lead character technical artist, the new technologies will allow the studio to create larger, richer gaming worlds with more characters in the future than is currently conceivable. Already, the company is producing high-quality facial animation in a fraction of the time it used to take. "We're certain AI will change video creation based on the NVIDIA Research work we've seen in AI-driven face animation," Herva said. "Complex facial animation for digital doubles, such as that seen in Quantum Break, can take years to construct." We can reduce that time by 80% in big scale projects after partnering with NVIDIA to construct video- and audio-driven deep neural networks for facial animation, allowing our artists to focus on other duties."

Rendering 3D graphics, the process that transforms digital worlds into the lifelike images you see on the computer, could also benefit from AI. Ray tracing is a technique used by filmmakers and designers to replicate light bouncing off surfaces in a virtual world

Correspondence to: Leif Nordlund, NVIDIA Nordics, Sweden, **E-mail:** lnordlund@nvidia.com

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NVIDIA is employing artificial intelligence to improve both ray tracing and rasterization, a less expensive rendering technique used in video games. Despite the fact that ray tracing produces incredibly realistic images, creating millions of virtual light rays for each image has a huge processing cost. Images that have been partially calculated appear noisy, similar to a photograph taken in low light

Researchers employed deep learning with GPUs to anticipate final, rendered images from partially finished results in order to denoise the output image. The study team, led by Chakravarty R. Alla Chaitanya, an NVIDIA research intern from McGill University, developed an AI solution that produces high-quality photos from noisier, more approximate input images in a quarter of the time it takes to do so using conventional methods. This isn't only a research project for me. It'll be a product shortly. The NVIDIA OptiX 5.0 software development

kit, the latest iteration of our ray tracing engine, was released today. In November, registered developers will be able to download OptiX 5.0, which includes NVIDIA Research AI denoising technology.

Anti-aliasing is a problem in computer game rendering that NVIDIA researchers employed AI to solve. Another technique to eliminate noise — in this case, the jagged edges in the partially generated images — is to use anti-aliasing. These stair-like lines, known as "jaggies," appear instead of smooth lines. (See the image below for the left inset.) Marco Salvi and Anjul Patney, NVIDIA researchers, developed a neural network to recognise these artefacts and replace them with smooth anti-aliased pixels. Existing algorithms create crisper photographs than the AI-based approach

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