

# Keven Villeneuve

## Graphics Software Engineer

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## Skills

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**Languages:** C++, C, Rust, Python, JavaScript, GLSL, HLSL, x86 assembly, RISC-V assembly, MATLAB, Mathematica, LaTeX.

**Libraries:** OpenGL, Vulkan, DirectX 12, CUDA, TBB, OpenMP, WebGL, Three.js, Qt, STL, OpenCV, PyTorch, NumPy, SymPy, SciPy.

**Tools:** CLion, Visual Studio, CMake, VTune, Tracy, Renderdoc, PIX, Nsight, Git, Perforce, Maya, Arnold, Mitsuba, PBRT.

## Education

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**M.Eng. Computer Engineering (Thesis)**, McGill University, Montréal, Canada

Jan. 2017 - May 2019

- Specialization in Computer Graphics & Machine Learning.

**B.Eng. Computer Engineering**, Université de Sherbrooke, Sherbrooke, Canada

Sep. 2012 - Dec. 2016

- Specialization in Digital Signal Processing & Artificial Intelligence.

## Work Experience

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**Senior Software Engineer**, NVIDIA

Mar. 2022 - Present

- Work on Omniverse MEGA, a cloud simulation framework (C++, Python) for training AI agents such as self-driving cars, robots, factories and smart cities.
- Investigate and fix various issues in MEGA, requiring debugging a distributed system via logging, telemetry and dashboards.
- Create internal releases of MEGA, requiring a complex orchestration of docker microservices spawning multiple git repos.
- Add an end-to-end testing framework with code coverage to MEGA CI/CD pipeline.
- Create and maintain the OmniGraph and Warp benchmarks to automatically detect performance regressions.

Mar. 2020 - Mar. 2022

**R&D Software Developer**, Electronic Arts - SEED

- Develop a GPU implementation (DirectX 12, HLSL, Compute) of "Direct Delta Mush", a cutting edge real-time skinning animation technique to significantly improve the quality of characters animation in video games and reduce artists time.
- Collaborate on major improvements to the algorithm to increase the runtime efficiency, leading to a publication at SIGGRAPH.
- Research on using deep neural networks (PyTorch) to sample from the lighting distribution of arbitrary mesh lights.
- Implement GGX environment prefiltering in SEED's real-time research renderer (C++) to improve the realism of shiny surfaces.
- Implement 4D mesh streaming in the renderer to support ongoing research on hyper-realistic characters in video games.

June 2019 - Mar. 2020

**Software Developer**, Maxon Computer

- Develop new features in Cinema4D, a 3D animation software (C++, OpenGL), to improve various modeling workflows.
- Resolve important software defects encountered by the users and internally on Windows and Mac.

Jan. 2019 - May 2019

**Software Developer (Intern)**, Autodesk

- Develop a new C++ plugin as key support for the Bifrost procedural generation system in Arnold, a film quality renderer.
- Act as the principal communication point between two teams of vastly different backgrounds and development pipelines involved in this project.
- Debug tricky low-level crashes on linux related to smart pointers using custom memory allocators within shared libraries.

Fall 2014, 2015, 2016

**Software Developer (Intern)**, Autodesk

- Develop a new tool in Maya (C++, Qt) using a skinning decomposition algorithm to allow importing complex animated characters into game engines without the usual tedious and time-consuming intermediate steps.
- Optimize the FBX importer of Maya using the Intel VTune profiler, giving 6x performance improvement.
- Optimize a module in Maya using hardware accelerated graphics (OpenGL), giving 4x performance improvement.
- Develop an automated test suite with Python to detect performance and usability regressions in Maya.

Jan. 2014 - Apr. 2014

**Engine Programmer (Intern)**, Ubisoft

- Develop and debug features of a AAA game engine in C++ and C# to meet the changing demands of a game production.
- Collaborate with a team of hundreds of developers, artists and producers to ensure their problems are solved correctly.

May 2013 - Aug. 2013

**Software Developer (Intern)**, Canadian Space Agency (CSA)

- Extend the 3D simulator (C++, Ogre3D) of the ISS robotic arm (CANADARM) to provide various networking functionalities using boost::asio and the STL.
- Design a robust multithreaded client/server architecture to handle many TCP clients at the same time.

## Publications

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<b>Direct Delta Mush Skinning Compression with Continuous Examples</b> , SIGGRAPH 2021	2021
Binh Huy Le, Keven Villeneuve, and Carlos Gonzalez-Ochoa	
<b>Practical Product Sampling for Single Scattering in Media</b> , EGSR 2021	2021
Keven Villeneuve, Adrien Gruson, Iliyan Georgiev, Derek Nowrouzezahrai	
<b>Importance Sampling Polygonal Lights in Participating Media</b> , Master's thesis, McGill University	2019
Keven Villeneuve	

## Projects

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<b>Deep Learning framework</b>	Jun 2024 - Present
<ul style="list-style-type: none"><li>Develop a Deep Learning framework from scratch in C++ with a PyTorch-like API.</li><li>Train a simple deep neural network (MLP) on the MNIST dataset.</li><li>Add a GPU compute backend via the CUDA C++ API.</li></ul>	
<b>CUDA exercises</b>	May 2024 - Present
<ul style="list-style-type: none"><li>Read and complete the exercises of the PMPP textbook (Programming Massively Parallel Processors).</li><li>Implement CUDA kernels for image conversion, image blur and matrix multiplication.</li></ul>	
<b>Operating System for PC</b>	Jan 2022 - Present
<ul style="list-style-type: none"><li>Create an OS from scratch for the x86-64 platform, boot using the UEFI firmware on real hardware and QEMU PC emulator.</li><li>Composed of a higher-half kernel with 64-bit virtual memory, physical memory allocator, kernel threads.</li><li>Implement drivers for the PIC interrupts controller, UART and PS/2 keyboard.</li><li>Start to implement support for PCI express and ACPI.</li><li>Optimize the console with SSE/SIMD for fast framebuffer scrolling.</li></ul>	
<b>Path Tracer</b>	May 2017 - Oct 2022
<ul style="list-style-type: none"><li>Develop a surface &amp; volumetric unbiased Monte Carlo path tracer in C++ accelerated using a BVH.</li><li>Add support for area and mesh lights with adequate multiple importance sampling (MIS) techniques.</li><li>Implement diffuse, Phong, mirror, glass and dielectric BSDFs.</li><li>Implement bidirectional light transport algorithms such as progressive photon mapping, volumetric VPLs and volumetric Lightcuts.</li><li>Create a tests suite in Python to catch regressions by comparing images rendered to a reference renderer (Mitsuba).</li></ul>	
<b>Master's Thesis</b>	May 2017 - Jan. 2021
<ul style="list-style-type: none"><li>Develop a new importance sampling scheme using Mathematica to improve the rendering efficiency of scenes involving polygonal lights in participating media.</li><li>Research on learning scene visibility via a deep neural network (MLP) using PyTorch.</li></ul>	

## Awards

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<b>Graduate Excellence Fellowship (GEF)</b> , Electrical & Computer Engineering, McGill University.	2017, 2018
<b>Winner of "Most retro hack"</b> , McHacks: video game using Myo hand gestures controller.	2018
<b>Second place</b> , McGill Physics Hackathon: 3D waves simulator in Three.js.	2017
<b>Second place</b> , Startup Weekend Montréal: Android app as an "Airbnb" for parking spots.	2014

## Additional Experiences

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<b>Reviewer</b> , Eurographics 2025.	2024
<b>Reviewer</b> , SIGGRAPH Asia 2020.	2020
<b>Organizer</b> , McGill's computer graphics papers reading group.	2018
<b>Teacher Assistant (TA)</b> , ECSE 446/546: Realistic & Advanced Image Synthesis, McGill University.	2018
<b>Student Volunteer</b> , SIGGRAPH 2016.	2016