Carlos Lopez Garces
carloslg@seas.upenn.edu, **linkedin.com/in/clopezgarces,** twitter.com/clopezgarces, (669) 265 – 7242
Portfolio and blog carlos-lopez-garces.github.io

RE: 2024 **US Summer Internship** - Computer Graphics

Dear Hiring Manager, Activision,

I'm a graduate student in the MSE in Computer Graphics and Game Technology program at the **University of Pennsylvania**. A rendering engineer that aspires to join the AAA game industry and who is passionate about physically based rendering, real-time graphics, and games with gorgeous graphics and amazing stories to tell (like the single-player campaign of Modern Warfare). A software engineer with 13 years of professional experience, working for companies big and small in Silicon Valley, in senior-level roles ranging from kernel-level systems programming and distributed systems to interactive graphics. I'm also a mathematician with research experience in the physically based rendering domain.

My graduate studies at UPenn represent my latest effort to become a competent rendering engineer. For a few years now, I've developed my skills by writing and building **3 renderers** in **C++**: *CDX*, a DirectX 12 renderer featuring a few rasterized, real-time techniques, such as shadow mapping and stencil mirrors; *CDXR*, a hybrid rasterization-raytracing pipeline that uses the DirectX Raytracing API and Nvidia's Falcor framework, featuring deferred rendering via G-Buffer, temporal antialiasing, unidirectional path tracing, a microfacet reflection model, and the Ashikhmin-Shirley BRDF; and *CPBRT*, my implementation from scratch of the famous PBRT offline physically-based renderer. More recently, I began studying the modern rendering techniques of the book *Mastering Graphics Programming with Vulkan* with the intention of implementing some of them in CDX, starting with variable rate shading, framegraphs, DDGI, and clustered deferred rendering (as described in Infinity Ward's *Improved Culling for Tiled and Clustered Rendering* SIGGRAPH presentation). I invite you to read more about these projects on my blog and portfolio website, carlos-lopez-garces.github.io.

This internship at Activision means to me the **perfect opportunity to hone the skills** in real-time rendering and systems programming that I currently possess, and extend, shape, and adapt them to the demands of a world-class game engine with the guidance of true experts. During my time at Oracle working on the RDBMS kernel (in **C**), I implemented features for **efficient memory allocation**, process management, synchronization primitives, and multi-threading; all of these were part of a layer of fundamental OS-level services on top of which the SQL execution, data management, and clustering layers were built. I was also responsible for maintaining the Shared Server architecture and the kernel's diagnostic framework, and I designed and led the implementation of features for both, often with the needs in mind of notorious clients in the online retail business; **profiling and optimization** were part of my daily routine. Out of curiosity about distributed systems, I joined Apcera Inc., a startup in **Silicon Valley** that competed with Docker and Kubernetes in the race to become the leading platform for containerized applications. During this period, I **led the implementation** of the autoscaling feature for container replicas and the rolling update mechanism; I was also involved in the maintenance of the container runtime (in Go and Cgo) and the consensus protocol. Finally, at HOVER Inc., which does 3D reconstruction of houses captured with smartphones, I worked on challenging problems in real-time 3D with a dataset of **millions of 3D models** generated automatically and that grew every day; my geometry processing algorithms had to work on all of them and my rendering algorithms had to be efficient so that customers could see the 3D models rendered in real-time on practically any device.

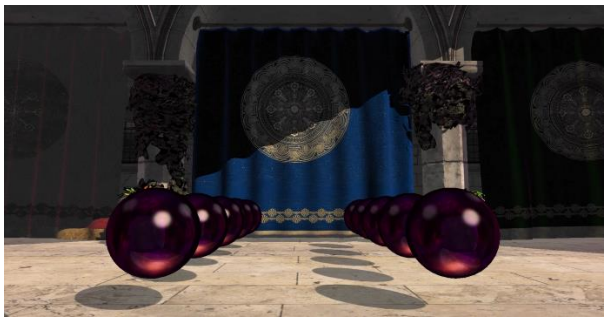
These professional experiences have taught me how to work effectively on large-scale projects with huge and complex codebases in very large organizations (at Oracle, in particular). From very talented engineers, I have learned and cultivated the abilities and discipline that one needs to deliver high-quality and robust features in a fast-paced environment with demanding product release schedules (especially at Apcera). Finally, as we set off to provide a delightful interactive experience for homeowners at HOVER, I experienced both the excitement of partnering with artists and the intellectual joy of applying mathematics to problems in engineering. I'm convinced that these experiences have prepared me well for an internship at Activision.

I hope you will consider my application and please know that I will devote all my energy to making the best out of this extraordinary experience if I'm selected.

Sincerely,

Carlos Lopez Garces

CDX, my DirectX 12 real-time renderer



Shadow mapping

CDXR, my DirectX Raytracing real-time renderer

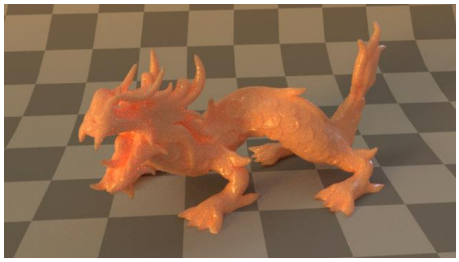
Unidirectional path tracing, Ashikhmin-Shirley BRDF

Ray-traced GI on a microfacet reflection model

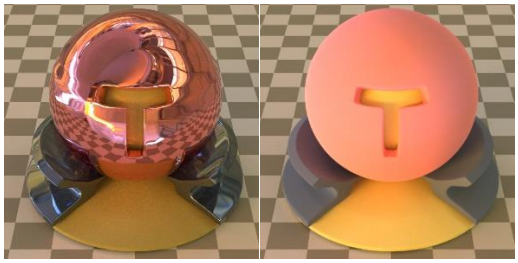
Direct lighting on a microfacet reflection model

Lambertian diffuse reflection and depth of field

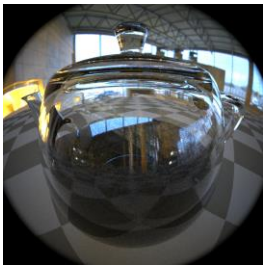
CPBRT, my implementation from scratch of the PBRT offline renderer



Subsurface scattering



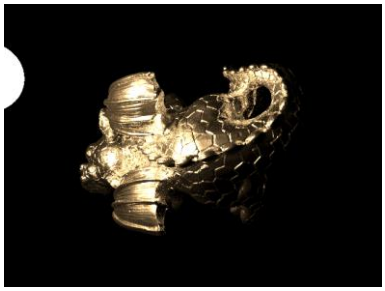
Disney BSDF



10mm fish-eye lens and IBL

Volumetric rendering

Oren-Nayar diffuse reflection



Gold material, microfacets