tom's HARDWARE

Adshir: Using Ray Tracing For Better AR Quality

Seth Colaner • January 9, 2018 at 10:00 AM

LAS VEGAS, NV -- A small company called Adshir promises to bring ray tracing to AR, thus significantly increasing the quality of the images we see. It promises movie studio-quality rendering, but in real time, all on mobile hardware, with a software product called LocalRay.

Towards Total Realism

You can read a primer of ray tracing here, but for the purposes of AR, suffice it to say that it provides superior lighting, reflections, and shadows, which affords much more realism than rasterized images. It's often used in rendering animations for films. Adshir reps described rasterized AR images as being disconnected from their environment--lively and lovely animations awkwardly crammed into the real world. By contrast, they want to use ray tracing to make an AR object part of the scene. The goal is total realism.

And indeed, the film industry tends to do a fabulous job of realism in animation, and ray tracing is a key technique to use to that end. The tricky part, for AR, is that movie studios use powerful machines to do all that rendering, and it takes a long time to complete; Adshir wants to do it in real time.

Another Dino Demo

Seeing is believing, so Adshir showed us a demo of a dinosaur stomping on a tabletop. They used a Microsoft Surface tablet to run it. As you can see, the dinosaur reflects the real light in the room, and his shadow obeys it as well. When the dinosaur moves, it all changes accordingly. (Our favorite bit in the demo was when the dinosaur "walked" across a phone lying on the table--and left little dino footprints on the black touchscreen.)

The dinosaur itself was sometimes jagged and jittery, but the lighting, reflections, and shadows persisted, and there was no certainly no observable lag otherwise. The image was running at 60 fps.

The Adshir reps readily admitted that the tabletop and lighting were set up explicitly to help this demo run--in that way it was sort of a lab environment--but even so, it was an effective demonstration.

Adshir also said that LocalRay is "battery power aware," but claimed that performance isn't affected by the feature.

How?

So they can do it; the question is how. The company describes its secret sauce thusly:

> LocalRay uses proprietary, patented algorithms designed from the bottom up for VR/AR physically accurate ray tracing technology. This new approach is based on the elimination of the acceleration structures (AS), which are a core component in every ray tracing system today. This elimination reduces the expensive traversals time, and saves the repeating reconstructions of AS for every major change in the scene. Both, traversals and reconstruction, which are stoppages for real-time, are now a thing of the past.

Simply, it requires fewer rays. This AS replacement is called the DAS (dynamically aligned structures), and it's proprietary to Adshir, but it just uses a conventional GPU pipeline.

Adshir said it has 10 granted patents and another 11 pending around LocalRay. The company expects to have an SDK for licensing ready soon. The software is designed to be a plug-in to Unity, Unreal, ARkit, ARcore, Vuforia, and more, and as demonstrated, it can run on existing hardware. Adshir reps wouldn't say precisely, but it's apparent to us that they're courting all the big names in XR.

This isn't the first time that we've seen ray tracing appear on surprisingly light hardware; a year ago, Imagination demoed ray tracing on mobile hardware, too. Adshir, though, intends to use LocalRay on mobile XR hardware.

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RENDERING

Photorealism for the masses gets closer

With increased performance and clever algorithms

By Jon Peddie

Ray tracing has been one of the white whales of computer graphics. Since its introduction in the early 1980s, ray tracing has promised to bring photorealistic rendering on a broadscale, and it's always been two-years in the future. In those years, we have nonetheless seen it get faster, while screen resolutions have also increased. In the 1990s if you could render a ray-traced 512 × 512 image in five to ten seconds you thought you really had something. We did just such a thing using 16 transputers, a 32-bit processor configured in a SIMD, cost a mere $10,000.

The movie studios use ray tracing extensively as special effect using CG becomes prevalent, so much so you no longer know when you are looking at a simulation and the real thing. Those images are rendered in 5K or 8K and scaled down to 4K for digital projectors in modern theaters—and one day your home. In addition to super high-resolution, the film industry operates in a minimum of 10-bits per color channel, and most of the time in 12-bit color (30 or 36-bit RGB or YCbCr) up to 16-bits, with a server that supports the DCI DCP. Rendering time at such a scale can take an hour and half per frame.

But what about more everyday is-

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sues? The next step down could be a PC game being displayed on a nice wide-screen 3440 × 1440 monitor, which currently is limited to 8-bit color. Many games, in particular racing games, are using hybrid ray tracing where just a portion (the shiny car bits) are ray-traced, and they manage to run at 30 to 45 fps, which is quite satisfying. But racing games are in very constrained worlds with limited FOV and scope.

Ray-tracing can however, be employed in realtme in a more practical application, one that is near and dear to my heart—augmented reality. However, for AR, you can't use the brute-force techniques that are used in other applications.

For some AR applications the visual quality and full integration of augmented content is critical for an immersive user's experience. The superimposed content over the real world must appear so realistic and integrative to be part of the real-world scene. Unfortunately, with the conventional graphics, the photo-realistic AR visualization is still in its infancy. "*People are using today AR primitive tools because we're still early on the journey to creating better tools. Tomorrow, AR is going to help us mix the digital and physical in new ways*" Mark Zuckerberg, April 2017.

Our friends at Adshir in Tel Aviv have developed a new approach to an AR/VR oriented ray tracing. If judiciously applied to an augmented object, it delivers realtme photorealistic ray tracing. It offers speedup of over 150x that of conventional approaches.

Similarly, to traditional ray-tracers, it uses path-tracing, which can provide physically accurate results.

The most basic operation in path tracing is the solving for visibility between each ray and millions of 3D scene polygons.

The cost of testing each ray against each polygon is prohibitive, therefore accelerating structures are used to reduce the number of ray/polygon intersection tests. But still, traversals of billions of rays are the most expensive tasks in path tracing, making it one of the most complex applications.

The human way of solving visibility is different. A simple sight toward an object can tell whether it is visible or obstructed. The human sight can be simulated by the prevalent graphics pipeline. Adshir invented a unique technology to exploit the graphics pipeline in path tracing for visibility, replacing the expensive accelerating structures. It has been applied in their LocalRay technology.

Adshir has developed a technique they call Dynamically Aligned Structures, and productized it into a toolkit they call LocalRay.

In LocalRay the costly traversals and reconstructions of acceleration structures are replaced by Dynamically Aligned Structures (DAS), a proprietary software mechanism based on graphics pipeline, for radical reduction of complexity.

The DAS structure is a novel method for seeking ray/polygon intersections, specifically adjusted to augmented and virtual reality. It is based on a proprietary handling of hundreds of rays, enabling high utilization of the massive parallelism of the GPU graphics pipeline. Random samples assist in correctness of global illumination.

Key Points of Adshir's AR/VR Path

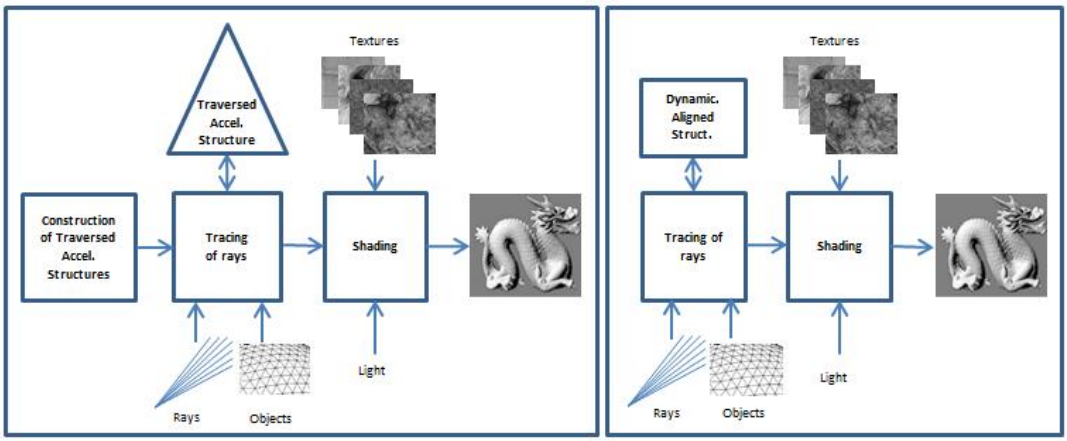
Tracing Technology are:

1. Path Tracing. Proprietary quasi Monte-Carlo ray tracing technology, implementing global illumination, produces photo-realistic integration of augmented objects in real life environment.
2. No traversals. The conventional traversals of accelerating structures are replaced by a novel, software based, ray hit mechanism (Dynamically Aligned Structures), gaining reduced computational complexity, high performance and low power consumption.
3. Fast animation.There is no need to reconstruct acceleration structures for frequent scene changes
4. Image convergence.Fast image convergence of milliseconds replaces the typical image convergence of seconds and minutes.
5. Data space parallelism.Processing rays in data space, rather than in image space, takes advantage of GPU parallelism.
6. Performance.The performance increases by two levels of magnitude over commercial ray tracers, on consumer class computing devices.
7. Power consumption. The energy consumption drops down, matching the power budget of consumer devices.

Adshir's technology is a Software Development Kit, that will be available in Q3 2018, and will function as a plug-in to leading graphics platforms (Unity, Unreal, ARcore, ARKit, etc.), enabling the developers to create an immersive user's experience in VR/AR applications. It runs 100% on the GPU.

What do we think?

Soon you will be able to wear a pair of AR smart glasses, or use your phone and see photorealistic superimposed images in real time. When that happens, which BTW will coincide nicely with the AR developments and new products coming out in 2018, we will begin to enjoy the promise of consumer AR. I can't wait.



Conventional ray tracing

LocalRay™ ray tracing

DYNAMICALLY ALIGNED Structures vs conventional path tracing