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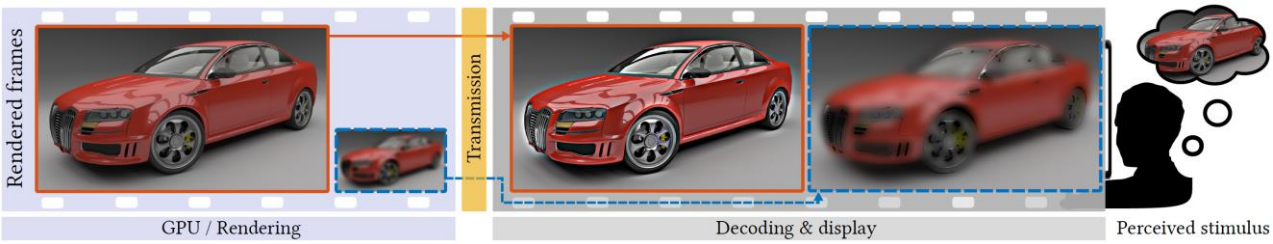
Reduce VR rendering time by 40%

Exploiting the limits of the visual system to reduce rendering and bandwidth requirements for the next generation of VR.



The advent of **wireless VR** is pushing the limits of rendering quality and framerate over a more limited cordless connection. By optimizing the frame delivery method and rendering time using Temporal Resolution Multiplexing (**TRM**), VR component manufacturers can bridge the gap between quality and transmission rates required for a truly wireless virtual experience.

By studying the human visual system and its limitations, Dr Rafal Mantiuk and Gyorgy Denes from the Dept. of Computer Science, University of Cambridge have developed an optimized VR rendering process that minimizes rendering time and transmission bandwidth whilst maintaining high visual quality.

Benefits

- Savings on computation, transmission and rendering
- Blur reduction
- Improved smoothness of motion
- Unlocks limits on wireless VR

Features

- Integrates with existing rasterization pipelines
- Reduction in number of rendered pixels (by up to 49%)
- Requires ≥90 fps

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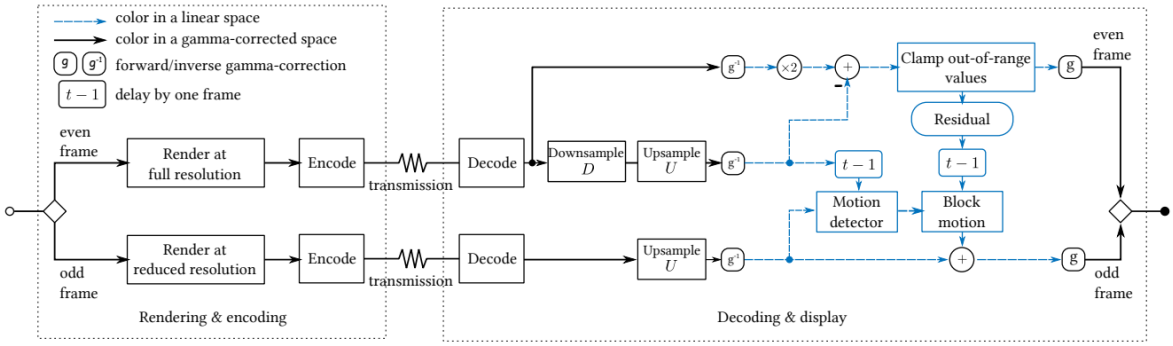
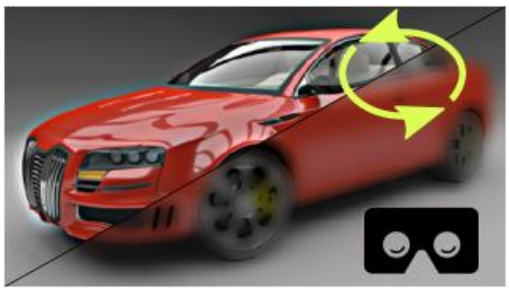


The processing diagram for TRM. Full- and reduced-resolution frames are rendered sequentially, thus reducing rendering time and bandwidth for reduced resolution frames. Both types of frames are processed so that when they are displayed in rapid succession, they appear the same as the full resolution frames.

What problem does this technique solve?

Rendering in virtual reality (VR) requires substantial computational power to generate 90 frames per second at high resolution with good-quality antialiasing. The video data sent to a VR headset requires high bandwidth, achievable only on dedicated links. With Temporal Resolution Multiplexing (TRM), rendering requirements and transmission bandwidth can be reduced using a conceptually simple technique that integrates well with existing rendering pipelines.



How it works

Every even-numbered frame is rendered at a lower resolution, and every odd-numbered frame is kept at high resolution but is modified in order to compensate for the previous loss of high spatial frequencies. When the frames are seen at a high frame rate, they are fused and perceived as high resolution and high-frame-rate animation. The technique relies on the limited ability of the visual system to perceive high spatio-temporal frequencies.

TRM is conceptually simple, but correct execution of the technique requires a number of steps that have been optimised and are well understood by the inventors: display photometric temporal response must be modeled, flicker and motion artifacts must be avoided, and the generated signal must not exceed the dynamic range of the display. The technique is an attractive alternative to both reprojection and resolution reduction of all frames.

Next steps

This technology is protected by an international patent (PCT application GB2019/050529) and we are now looking for commercial partners interested in integrating this technology. Please get in touch if you would like more information.

Comparison of TRM with other performance saving techniques

Technique	Peak Luminance	Motion Blur	Flicker	Artifacts	Performance Saving
Full frame rate	100%	none	none	none	0%
Half frame rate	100%	strong	none	judder	50%
Interlace	50%	reduced	moderate	combing	50%
BFI	50%	reduced	severe	none	50%
NCSFI	100%	reduced	mild	ghosting	50%
TRM	**100%**	**reduced**	**mild**	**minor**	**37-49%**