Major cinema breakthrough could allow for glasses-free 3D

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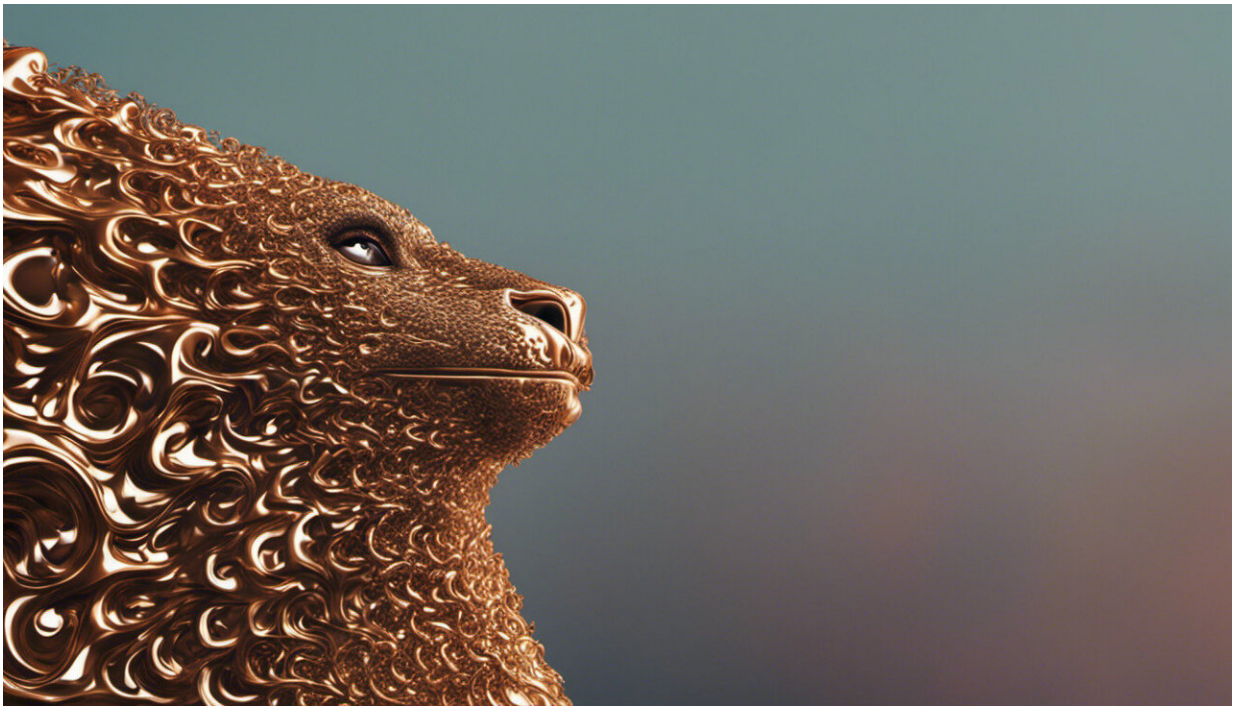

Credit: AI-generated image (disclaimer)

A team of US and Israeli researchers, partly funded by the EU, have developed a truly pioneering cinema screen that can show 3-D films without the need for glasses.

In a new paper, the team from MIT's Computer Science and Artificial

Intelligence Lab (CSAIL) and Israel's Weizmann Institute of Science have demonstrated a display that allows cinemagoers to watch 3-D films without the need for the cumbersome accompanying glasses. The paper has been presented at the SIGGRAPH computer-graphics conference that took place in Anaheim, California, from 24 to 28 July 2016.

Introducing Cinema 3-D

Dubbed 'Cinema 3-D', the prototype system uses a special array of lenses and mirrors to enable viewers to watch the same film in 3-D from any seat in the cinema. In a regular 3-D cinema which requires the use of glasses, only one barrier is utilised. 'Existing approaches to glasses-free 3-D require screens whose resolution requirements are so enormous that they are completely impractical,' commented Professor Wojciech Matusik from MIT. 'This is the first technical approach that allows for glasses-free 3-D on a large scale.'

Although this is a major breakthrough that could revolutionise the 21st century cinema experience, the research team are keen to stress that the technology is currently not market-ready. However, they are optimistic that future versions will allow the technology to advance to a stage where the majority of cinemas will be able to offer glasses-free alternatives for 3-D films.

Glasses-free 3-D already exists but not in a way that allows it to be scaled down to cinemas. Traditional 3-D methods for televisions use a series of slits in front of the screen (a 'parallax barrier') that allows each eye to see a different set of pixels, resulting in the creation of a simulated sense of depth. But because parallax barriers have to be at a consistent distance from the viewer, this approach is not practical for cinemas, where viewers are sat at different angles and distances from the screen.

Other methods, including one also developed at MIT, involve developing completely new physical projectors that cover the entire angular range of the audience, but this often comes at a cost of reduced image resolution.

How Cinema 3-D works

The key insight with Cinema 3-D is that people in cinemas move their heads only over a very small range of angles limited by the width of their seat. As a result, it's enough to merely display a narrow range of angles and replicate it to all seats in the cinema.

In effect, the Cinema 3-D system encodes multiple parallax barriers in one display, such that each viewer sees a parallax barrier tailored to their exact position in the cinema. That range of views is then replicated across the cinema by a series of lenses and mirrors within the system's special optics system. This takes advantage of the fact that the cinema experience is set in a fixed position (sitting down in one seat), whilst a 3-D television has to account for people moving around to watch from different angles, which means that there has to be a dividing up of a limited number of pixels projected. This is so the viewer can see the image from wherever they are in relation to the television.

However, Cinema 3-D is currently not particularly practical, with the team's prototype requiring 50 sets of mirrors and lenses, but yet is barely larger than a standard pad of paper. Prof. Matusik says that the team now hopes to build a larger version of the display and to refine the optics further to improve the image resolution. 'It remains to be seen whether the approach is financially feasible enough to scale-up to a full-blown cinema,' he stated. 'But we are optimistic that this is an important next step in developing glasses-free 3-D for larger spaces, such as movie theatres and auditoriums.'

More information: Project page:

cordis.europa.eu/project/rcn/96846_en.html

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