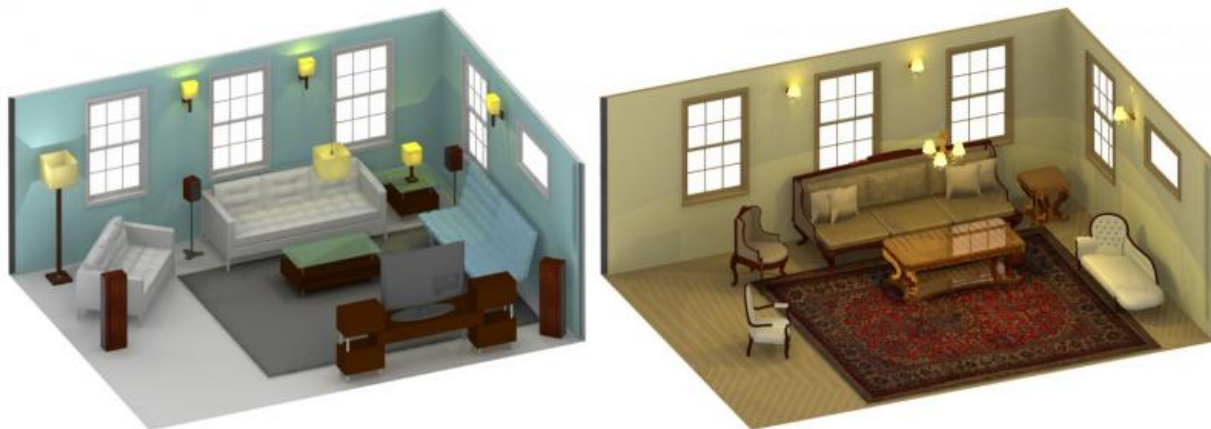# Computer scientists introduce new graphics software

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As the researchers explain, humans can perceive stylistic similarity between objects that transcends structure and function. For example, we can see a common style such as Danish modern' in both a table and chair, though they have different structures. Until now, machines have found it difficult to do the same. Credit: UMass Amherst

Computer scientists from the University of Massachusetts Amherst led by Evangelos Kalogerakis today unveiled a new software modeling program that uses sophisticated geometric matching and machine learning to successfully mimic the human perception of style, giving users powerful new tools to compare the style similarity of three-dimensional (3D) objects.

Kalogerakis and his doctoral student Zhaoliang Lun in the College of Information and Computer Sciences at UMass Amherst, with Alla Sheffer from the University of British Columbia, presented their new algorithm at one of the world's largest computer graphics conferences, the annual Association for Computing Machinery's (ACM) Special Interest Group on Computer Graphics and Interactive Techniques (SIGGRAPH) 2015, going on this week in Los Angeles.

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The new first-of-its-kind structure-transcending software can benefit several computer graphics applications, Kalogerakis says. "We hope that future 3D modeling software tools will incorporate our approach to help designers create aesthetically and stylistically plausible 3D scenes, such as indoor environments. Our approach could also be used by 3D search engines on the web to help users retrieve 3D models according to style tags. For example, if you wanted to search for 'Gothic church,' our software tools can help. It will be exciting to see all the ways people will find to use it."

Kalogerakis is an expert in developing computational techniques that analyze and synthesize visual content, focusing on machine learning algorithms that help people to create 3D models. To develop the new software, he and colleagues drew on observations about style similarity in art history and appraisal literature, which provided geometric elements including shape, proportion and lines, and visual motifs as key indicators of stylistic similarity.

They also used crowdsourcing to present object's style comparisons to

more than 2,500 people, including artists, who volunteered via Amazon Mechanical Turk on the Internet. This yielded more than 50,000 responses on seven structurally diverse categories, buildings, furniture, lamps, coffee sets, architectural pillars, cutlery and dishes. The human respondents agreed on style similarity on average 85 percent of the time.

As for the software tool, the researchers evaluated it by comparing its responses to the human evaluations and found that it achieves "a surprising agreement rate" of 90 percent, Kalogerakis reports, "making it your next-to-best alternative style expert for providing you with suggestions of objects to populate your home, dining table, or virtual reality environment."

As he explains, computer graphics algorithms help people create movies, visual effects, games, virtual and augmented reality environments. They are also useful in manufacturing real objects and designing architectural scenery. More generally, the new algorithm is expected to be useful to those exploring databases of digital representations of buildings, pillars and other objects according to style attributes for designing virtual or real environments, creating content for a computer game, and populating an augmented reality environment with virtual objects.

Computer algorithms also run in the background on many devices, as well, he says, such as spell and grammar checkers, programs that deblur photographs or focus on faces. Robots run computer algorithms to recognize their environment to move around and pick up objects. Online search engines run computer algorithms to help users find documents, pictures and videos.

SIGGRAPH members include researchers, developers and users from the technical, academic, business and art communities who use computer graphics and interactive techniques. ACM is the world's largest educational and scientific computing society for educators, researchers

and professionals to inspire dialogue, share resources and address the field's challenges.

More information: Paper: people.cs.umass.edu/~zlun/pape …
/StyleSimilarity.pdf

Provided by University of Massachusetts Amherst