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Eurographics Symposium on Geometry Processing 2021
K. Crane and J. Digne
(Guest Editors)

Volume 40 (2021), Number 5

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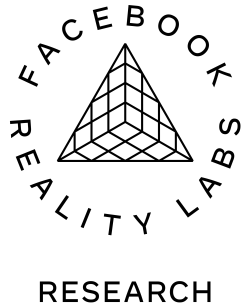

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Keynote

Engineering-driven Design: a new Foundation

Bradley Rothenberg
CEO, nTopology

Abstract

nTopology (nTop) solves some of the most difficult problems in shape design, especially those emerging due to additive manufacturing. In doing so, nTop enables new processes for design – it empowers engineers to design parts that are impossible with older software. To achieve these goals, we use some interesting technologies that are new to engineering software – specifically basing our modeling tech on Signed Distance Fields (SDFs). This talk describes the new design problems that engineers today face and the software we have developed for solving them.

Short Biography

Bradley Rothenberg is the founder and CEO of nTopology, an engineering software company based in New York City built to enable engineers to design transformative products. nTopology's breakthrough technology unifies geometry and physics into finely tuned digital models, supporting engineers as they collaborate to develop lightweight, optimized parts with the requirements built right in. Bradley studied architecture at Pratt Institute in Brooklyn, New York, and has been developing computational design tools for advanced manufacturing for the last 10-plus years.

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Keynote

How to Represent Part-whole Hierarchies in a Neural net

Geoffrey Hinton
University of Toronto/Google Research

Abstract

I will present a single idea about representation which allows advances made by several different groups to be combined into an imaginary system called GLOM. The advances include transformers, neural fields, contrastive representation learning, distillation and capsules. GLOM answers the question: How can a neural network with a fixed architecture parse an image into a part-whole hierarchy which has a different structure for each image? The idea is simply to use islands of identical vectors to represent the nodes in the parse tree. The talk will discuss the many ramifications of this idea. If GLOM can be made to work, it should significantly improve the interpretability of the representations produced by transformer-like systems when applied to vision or language.

Short Biography

Geoffrey Hinton received his BA in Experimental Psychology from Cambridge in 1970 and his PhD in Artificial Intelligence from Edinburgh in 1978. He did postdoctoral work at Sussex University and the University of California San Diego and spent five years as a faculty member in the Computer Science department at Carnegie-Mellon University. He then became a fellow of the Canadian Institute for Advanced Research and moved to the Department of Computer Science at the University of Toronto. He spent three years from 1998 until 2001 setting up the Gatsby Computational Neuroscience Unit at University College London and then returned to the University of Toronto where he is now an emeritus distinguished professor. From 2004 until 2013 he was the director of the program on "Neural Computation and Adaptive Perception" which is funded by the Canadian Institute for Advanced Research. Since 2013 he has been working half-time for Google in Mountain View and Toronto. Geoffrey Hinton is a fellow of the Royal Society, the Royal Society of Canada, and the Association for the Advancement of Artificial Intelligence. He is an honorary foreign member of the American Academy of Arts and Sciences and the National Academy of Engineering, and a former president of the Cognitive Science Society. He has received honorary doctorates from the University of Edinburgh, the University of Sussex, and the University of Sherbrooke. He was awarded the first David E. Rumelhart prize (2001), the IJCAI award for research excellence (2005), the Killam prize for Engineering (2012), The IEEE James Clerk Maxwell Gold medal (2016), and the NSERC Herzberg Gold Medal (2010) which is Canada's top award in Science and Engineering. Geoffrey Hinton designs machine learning algorithms. His aim is to discover a learning procedure that is efficient at finding complex structure in large, high-dimensional datasets and to show that this is how the brain learns to see. He was one of the researchers who introduced the back-propagation algorithm and the first to use backpropagation for learning word embeddings. His other contributions to neural network research include Boltzmann machines, distributed representations, time-delay neural nets, mixtures of experts, variational learning, products of experts and deep belief nets. His research group in Toronto made major breakthroughs in deep learning that have revolutionized speech recognition and object classification.

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Keynote

Computing Morphing Matter: the Marriage of Geometry and Hidden Forces

Lining Yao
Carnegie Mellon University

Abstract

Morphing Matter is an interplay of geometry and hidden forces. Lining Yao, the director of Morphing Matter Lab, will share her team's experiences of computing, designing, and fabricating morphing mechanisms that leverage both geometrical and physical knowledge of materials. Lining will unfold a few marriages of geometry and forces in the talk: a conformal map interconnecting beams shrinking and fighting for the lowest entropy, a frustum-shaped groove interfering disks swelling with differential diffusion rate, and a triangulated filler path affecting spacer fabric deforming with biased shear forces. Novel morphing mechanisms and applications also come from these marriages, such as self-assembling furniture, crawling soft robots, and morphing pasta.

Short Biography

Lining Yao is an Assistant Professor of Human-Computer Interaction Institute at Carnegie Mellon University (CMU), School of Computer Science, directing the Morphing Matter Lab. Lining also holds courtesy appointments at Mechanical Engineering and Material Sciences and Engineering at CMU. Morphing Matter lab develops processes, materials, tools, and applications of adaptive, dynamic, and intelligent morphing matter from nano to macro scales. Research often combines material science, computational fabrication, and creative design practices. The mission is to advance both science and society with the design of morphing matter. Lining and her lab work anti-disciplinarily, publishing and exhibiting across science, engineering, design, and art. Lining gained her Ph.D. from the MIT Media Lab. She is a Wired UK fellow, CMU Provost's Inclusive Teaching Fellow, and a recipient of the NSF CAREER Award.