Deep generative models for engineering design

Fan, J.

Acknowledgment

At the outset, this work began as a blank slate. Long before GenAI became part of mainstream discourse, we embarked on experimenting with machine learning methods to generate recognizable engineering designs. What began as a bold idea soon revealed itself to be a transformative endeavor—one of profound significance, yet accompanied by uncertainty and formidable challenges. This journey, demanding both perseverance and belief, became possible only through the unwavering support, guidance, and encouragement of many exceptional individuals.

I first express my deepest gratitude to my supervisors: Prof. Thomas Bäck, Dr. Babak Gholami, Dr. Hao Wang, and Laure Vuaille. Your vision laid the foundation for this research, and through moments of doubt, complexity, and discovery, your guidance continuously illuminated the path forward. I am profoundly grateful for your patience, trust, and belief in this work. I also extend heartfelt thanks to my co-author Amal Trigui, with whom I collaborated tirelessly over countless days. Our shared passion, curiosity, and determination to push the boundaries of this research transformed challenges into milestones and made this journey truly rewarding. Furthermore, I sincerely thank the BMW Group for its generous support, which provided the essential infrastructure, resources, and funding that enabled both my research and international conference participation.

This journey has been enriched by joy, learning, and unforgettable memories: traveling to Singapore with Dr. Roy de Winter and Dr. Anna Kononova to attend the CAI 2024 conference and present my first publication; joining my co-author Amal Trigui in Milan for the ECCV 2024 conference to demonstrate our newly accepted work; leading 30 BMW doctoral students on an educational tour of Shenyang, Shanghai, and Nanjing; and being invited to the BMW 2024 Summer School on Fraueninsel, Chiemsee. These experiences not only shaped my academic growth but also left lasting personal impressions. I am deeply thankful to my colleagues Gabriela Barrón Loeza, Andrea

Bonfanti, Fabia Schito, Duarte Madeira, Mohammad Rashed and Srishti Dasgupta for the precious moments we shared in our “lab” (BMW office), for moments of laughter and respite amid intense work, and for the mutual support that carried us through this demanding adventure.

Last but certainly not least, I owe my deepest gratitude to my parents for their unconditional love and unwavering support, and to my friends in Germany. Their presence gave me strength during the pandemic and comfort during moments of distance, uncertainty, and self-doubt while living in a foreign country. This PhD journey has been one of the most meaningful and fulfilling periods of my life thus far. They kept me grounded, celebrated my joys, and listened patiently when the journey felt overwhelming. My dear friends and family, you fill my life with joy and remind me to make time for my passions, friendships, and well-deserved moments of rest. To everyone mentioned above, thank you for being an inseparable part of this journey.

Curriculum Vitae

Jiajie Fan was born in 1996 in Wenzhou, China. After completing his undergraduate studies in Automotive Engineering at Wuhan University of Technology, he pursued a Master's degree in Mechanical Engineering at Technische Universität Darmstadt, which he obtained in 2022. Following his master's studies, he began his doctoral studies in Computer Science at Leiden University's Leiden Institute of Advanced Computer Science (LIACS), in cooperation with BMW. There, he conducts research on generative design and machine learning methods under the supervision of Prof. Thomas Bäck, Dr. Babak Gholami, Dr. Hao Wang, and Laure Vuaille. During his PhD studies he took several courses, including the Scientific Conduct.

Recently, Jiajie joined the newly established startup Kyrall as a founding engineer, where he works on bringing AI for CAD from zero to one, enabling generative artificial intelligence for engineering CAD generation. In this role, he contributes to the development of core technologies that bridge cutting-edge research in generative models with practical, industry-ready engineering design workflows. His goal is to advance the integration of generative AI into real-world engineering processes, making design more efficient, creative, and accessible.