Soyoung Yoo, Ph D

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Research Interests : Generative AI, AI-driven Design, Human-Computer Interaction(HCI)

My goal is to build engineering-aware generative AI that seamlessly connect 2D concept generation with 3D engineering optimization. Ultimately, I aim to create an AI co-design system that allows engineers and industrial designers to iterate faster while satisfying real-world constraints.

Homepage | Linkedin | ResearchGate | Google Scholar

Education

KAIST, Ph.D. in Mobility Engineering — Daejeon, Korea, Mar. 2022 - Aug. 2025
- **Advisor**: Prof. **Namwoo Kang**
- **Dissertation**: "Engineering-Aware Generative AI for Wheel Design: Bridging 2D Concept Generation and 3D Performance Optimization"

Sookmyung Women's University, M.S. in Mechanical Engineering — Seoul, Korea, Aug. 2018 - Aug. 2020
- **Advisor**: Prof. **Namwoo Kang**
- **Thesis:** "Explainable artificial intelligence for manufacturing cost estimation and machining feature visualization"

Tech University of Korea, B.S. in Electronics Engineering — Siheung, Korea, Mar. 2012 - Aug. 2017

Research Experience

Smart Design Lab

AI Researcher, Founding member — KAIST, Daejeon, Korea, Jun. 2022 - Present

Sookmyung women's University, Seoul, Korea, Jun. 2018 - 2021

- ❑ **Set up core lab infrastructure (Linux server, License, Lab wiki & tutorials)**
- ❑ **Government & corporate-funded projects :**
  1. Ministry of Trade, Industry and Energy, *"Generative manufacturing technology for turning ideas into reality."*, Apr 2024 – Present
  2. National Information Society Agency (NIA),*"AI learning data construction: 3D asset-image pair dataset."* Jun 2022 – Jan 2023
  3. Ministry of Science and ICT, *"AI-based generative design technology for the automatic generation of large-scale optimal engineering design."*, Apr 2022 – Dec 2025
  4. POSCO,*"Generative AI framework for improving styled steel wheel."*, Mar 2023 – Dec 2023
  5. Hyundai Motor Company,*"Multi-fidelity deep learning model development for integrated thermal management logic."*, Jun 2021 – May 2022
  6. LG Electronics, *"Generative AI-based design automation for TV stand design."*, Mar2021 - Dec 2021
  7. Hyundai Motor Company, *"AI-based generative design framework for wheel design recommendations : Considering wheel stiffness and aesthetics"*, Apr 2020– Feb 2021
  8. Hyundai Motor Company, *"Study on data-driven road wheel performance prediction technique using deep learning."*, Feb 2020 – Oct 2020
  9. Hyundai Motor Company, *"Development of an AI-based generative design framework: A case study on wheel design."*, Aug 2019– Feb 2020
  10. Hyundai Motor Company, *"Field study-based user experience research to improve autonomous driving technology acceptance."*, Oct 2018 – Mar 2019

Work Experience

Narnia Labs, Inc.

CTO, Co-founder — KAIST, Daejeon, Korea, Apr. 2022 - Aug. 2024

- ❑ **Responsibility : Product Owner**

  Led MVP Development (Aslan GD & Designer)

  1. Managed a multidisciplinary team including software engineers, designers, and AI researchers.
  2. Showcased a product demo at CES 2024 and several academic/industry conferences.

- ❑ **Responsibility : AI Researcher**

  Corporate Projects

  1. Kumho Tire,*"Proof-of-concept study on Generative AI-based tire pattern design"*, Sep 2023 – Nov 2023
  2. Hyundai Mobis.*"3D deep learning-based generative design for brake caliper shape implementation."*, Aug 2022 - Dec 2023

- ❑ **Invited Talks**

  1. 2023. 08. 한국슈퍼컴퓨팅 컨퍼런스 : 인공지능 기반 모빌리티 설계 : Deep Generative Design
  2. 2023. 08. 한국 자동차 공학회 워크샵 : 생성형 AI 기반의 모빌리티 설계 Deep Generative Design
  3. 2023. 11. 2023 KOSTECH한국 시뮬레이션 기술: 제조업을 위한 생성형 AI기반 제품설계 및 디자인
  4. 2023. 12. 신발소재연구원 : 제조산업에서의 AI 활용 현황과 신발산업의 적용가능성

Journal Publications

DeepWheel: Generating a 3D Synthetic Wheel Dataset for Design and Performance Evaluation. Submission 2025
Journal of Mechanical Design (JCR : Q1)
Authors : **Yoo, S.**, & Kang, N

Wheel impact test by deep learning: prediction of location and magnitude of maximum stress. Published 2023
Structural and Multidisciplinary Optimization, 66(1), 24, (JCR : Q1)
Authors : Shin, S., Jin, A., **Yoo, S.**, Lee, S., Kim, C.G., Heo, S., & Kang, N.

Generative design by reinforcement learning: enhancing the diversity of topology optimization designs. Published 2022
Computer-Aided Design, 146, 103225, (JCR : Q1)
Authors: Jang, S., **Yoo, S**., & Kang, N.

Explainable artificial intelligence for manufacturing cost estimation and machining feature visualization. Published 2021
Expert Systems with Applications, 183, 115430. (JCR : Q1)
Authors : **Yoo, S.**, & Kang, N

Integrating deep learning into CAD/CAE system: generative design and evaluation of 3D conceptual wheel. Published 2021
Structural and Multidisciplinary Optimization, 64(4), 2725–2747. (JCR : Q1)
Authors : **Yoo, S.**, Lee, S., Kim, S., Hwang, K.H., Park, J.H., & Kang, N

The Anxiety Consumers Feel About Using Robotaxis: HMI Design for Anxiety Factor Analysis and Anxiety Relief Based on Field Tests. Publication 2025
Archives of Design Research, 37(3), 47–36.
Authors : **Yoo, S**., Lee, S., Kim, S., Kim, E., Hwangbo, H., & Kang, N

Effect of robo-taxi user experience on user acceptance: Field test data analysis. Publication 2022
Transportation Research Record, 2676(2), 350–366. (JCR : Q3)
Authors : Lee, S., **Yoo, S.**, Kim, S., Kim, E., & Kang, N

가상 제품 개발과 메타버스를 위한 3D 합성 데이터 생성 Publication 2023
기계저널 , 62(11), 32-37.
Authors : **유소영** , 이성희, 김은지, 강남우

Conference Publications

산업 디자이너 및 엔지니어를 위한 생성형 AI기반 co-design 프레임 워크 Oral Presentation 2024
대한기계학회 춘추학술대회 , 277-278, (2024)
Authors : **유소영** , 강남우

Generative AI-based Co-design Framework for Industrial and Engineering Designers Oral Presentation 2024
실용인공지능학회 (AAiCON), (2024)
Authors : **유소영** , 강남우

Stable Diffusion 기반의 컨셉 휠 디자인 프로세스 : 공학적 패턴에서 실사적 렌더링까지 Oral Presentation 2023
대한기계학회 춘추학술대회
Authors : **유소영** , 강남우.

3D 딥러닝 기반의 제너레이티브 디자인 :잠재공간에서 수행하는 생성 , 탐색 , 예측 및 최적화 . Oral Presentation 2023
대한기계학회 춘추학술대회
Authors : **유소영** , 권용민, 김은지, 신동주, 유호건, 이성희, 임병성, 장자은, ...

전기자동차의 통합열관리 시스템을 위한 물리 기반 인공신경망 . Oral Presentation 2022
한국자동차공학회 추계학술대회 및 전시회
Authors : **유소영** , 신동주, 박우성, 양욱일, 강남우.

도메인 적응을 이용한 설계성능 예측 기초 연구 Poster Presentation 2020
대한기계학회 춘추학술대회
Authors : **유소영** , 강남우.

설명가능한 인공지능 기반의 3D CAD 모델 제조원가 예측. Oral Presentation 2020
대한기계학회 CAE 및 응용역학 부문 춘계학술대회
Authors : **유소영** , 강남우.

딥러닝 기반의 CAD/CAE 프레임워크 . Oral Presentation 2020
대한기계학회 CAE 및 응용역학부문 춘계학술대회
Authors : **유소영** , 이성희, 김성신, 황광현, 박종호, 강남우.

Predicting Manufacturing Cost of CAD Models Using 3D CNN. Asian Congress of Structural and Multidisciplinary Optimization, ACSMO2020 Poster Presentation 2020
Authors : **Yoo, S.**, & Kang, N.

자율주행 불안감 해소를 위한 Human-AI Interaction 설계 . Oral Presentation 2019
대한기계학회 춘추학술대회
Authors : **유소영 ,** 이성희, 김성신, 김은지, 강남우.

Patents

- 인공지능 기반 생성적 설계 방법, 장치 및 컴퓨터 프로그램 (특허 번호: **10-2021-0092928**)
- **Apparatus for predicting wheel performance in vehicle and method therefor (US** 특허 번호: **17/235,362)**
- 설명 가능한 인공지능을 이용한 **CAD** 모델 제조원가 예측 방법 (특허 번호: **10-2023-0159667)**

Honors

- **2024 AAICON** - Best Oral Presentation Award
- **2023 KAIST** - Q-Day Special Student Award
- **2020 Sookmyung Women's University -** Master's Best Thesis Award

Skills

- **Machine Learning :** Generative Models(Diffusion, VAE, GAN), Supervised learning, AutoML, XAI, Multimodal AI, Foundation Models
- **Coding & AI Framework :** Python, Matlab, Pytorch, Tensorflow, Keras
- **DevOps :** Docker, Git
- **Modeling & CAE Software :** Rhino Grasshopper, Fusion 360, Ansys, Altair Simlab, Altair Inspire
- **Communication :** LaTeX, Scientific & Technical writing, Research presentations