INTELLIGENT MULTISCALE & MULTIFUNCTIONAL MANUFACTURING LAB.

부산대학교 PUSAN NATIONAL UNIVERSITY

Intelligent Multiscale & Multifunctional Manufacturing Technologies

Artificial Intelligence, Machine learning, Additive Manufacturing, Micro/nano fabrication

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Multiscale & Multifunctional Manufacturing

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- Additive manufacturing
- Lithographic pattering
- Thin-film deposition

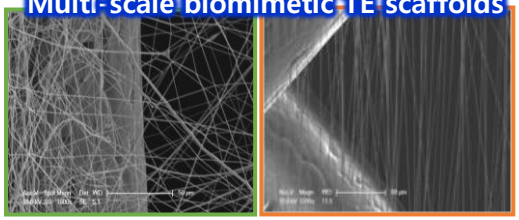
Multiscale/Multimaterial Fabrication

- 3D, 2D printing process
- Electrohydrodynamic jetting
- Leaching, Replicating process

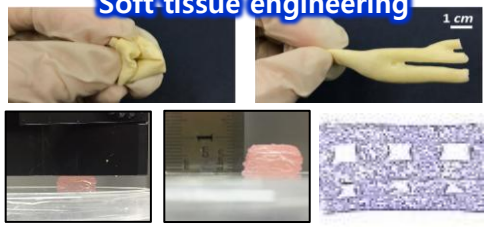
M1 Tissue Engineering / Implantable Biomedical Device

- Multiscale tissue engineering scaffold via 3D printing and electrospinning
- Patient-specific medical device based on medical imaging of CT/MRI
- Soft/Hard tissue engineering based on mechanical biocompatibility

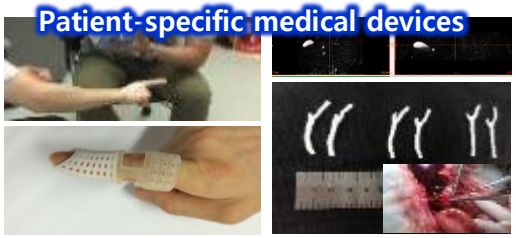
Multi-scale biomimetic TE scaffolds



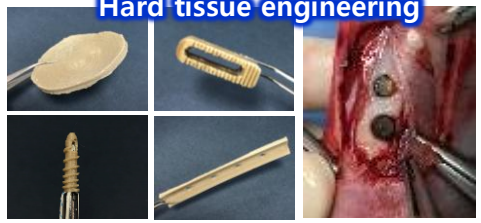
Soft tissue engineering



Patient-specific medical devices



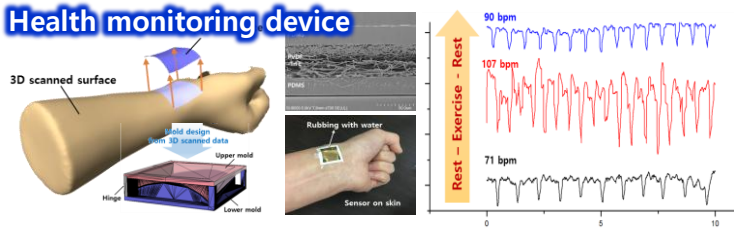
Hard tissue engineering



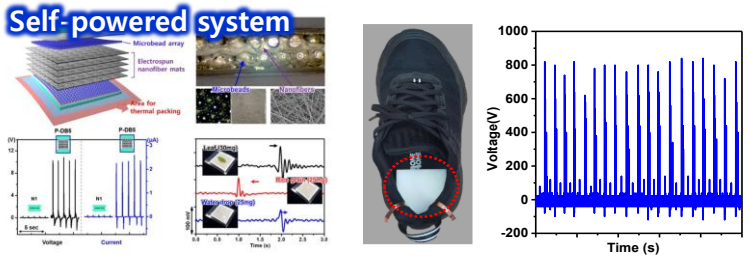
M2 Wearable Electronics / Health monitoring device

- Flexible physical sensor for pulse monitoring
- 3D customized interface for wearable device
- Self-powered system using piezo/triboelectricity

Health monitoring device



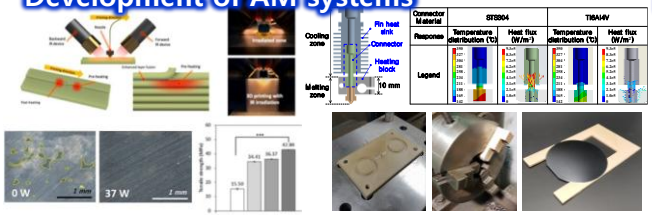
Self-powered system



M3 Process Development

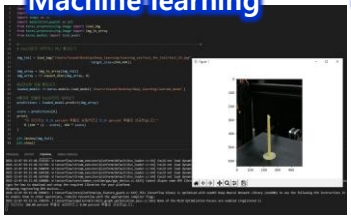
- Development of AM
- Industrial applications
- 4DP & Machine learning

Development of AM systems



Industrial application

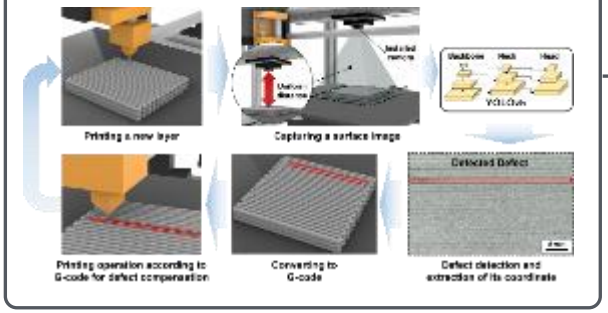
Machine learning



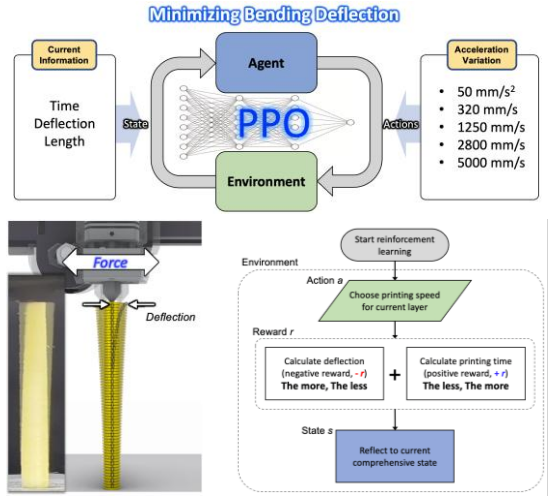
4D printing

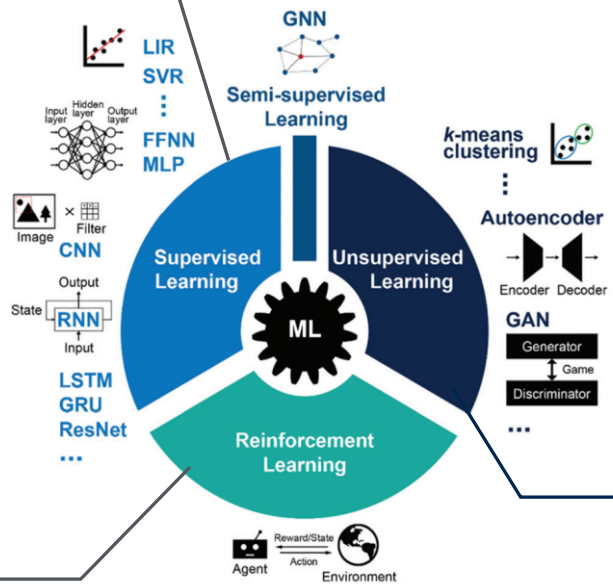
AI-based intelligent manufacturing

Object Detection (YOLO, etc.)

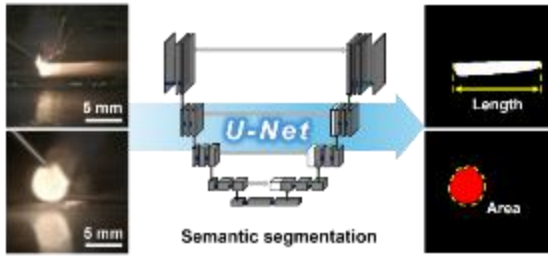


Reinforcement learning (PPO, etc.)

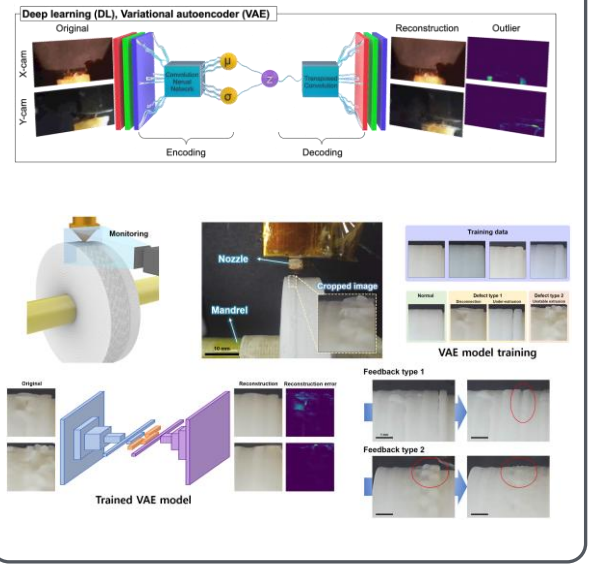




Semantic segmentation (U-Net, etc.)



Anomaly detection (VAE, etc.)



AI-assisted manufacturing processes

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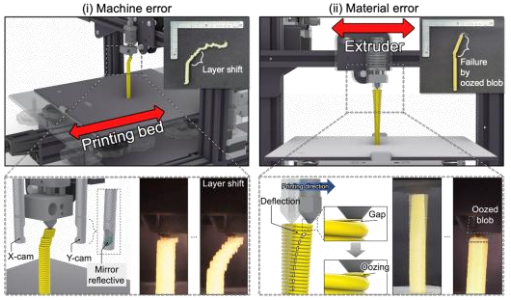
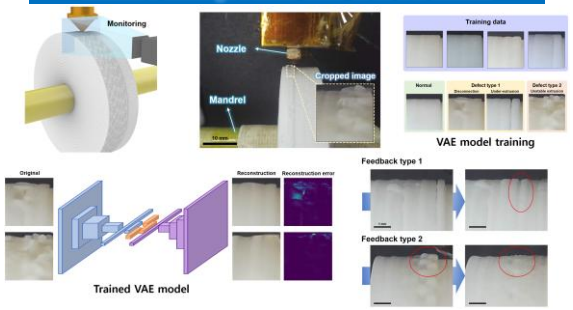
AI-assisted manufacturing with autonomous defect detection and correction

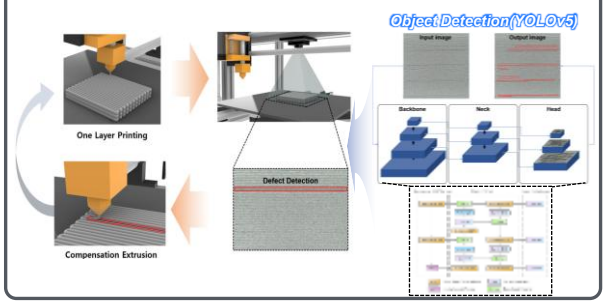
Image-based anomaly detection With VAE-deep learning model



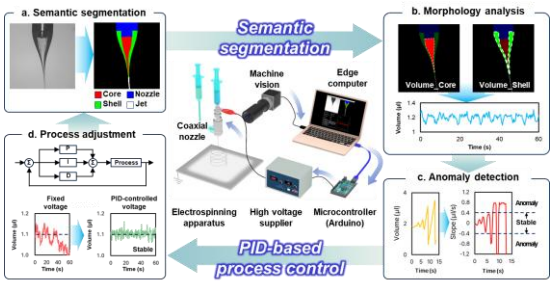
Anomaly detection and feedback system in additive lathe process with VAE-DL model



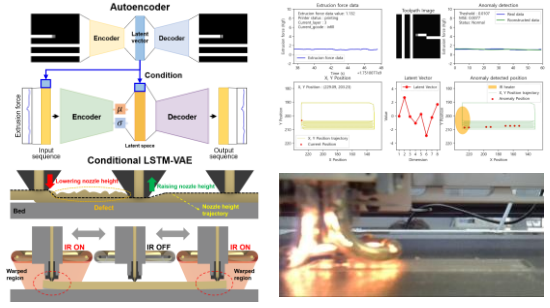
In-situ selective defect correction in MEX process using object detection



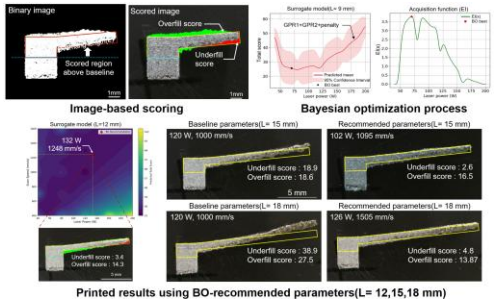
Semantic segmentation for realtime process control in electrohydrodynamic printing



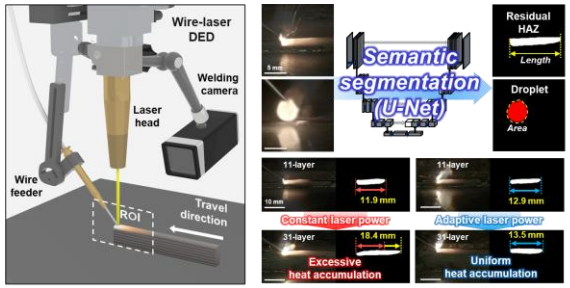
Digital twin system with feedback strategy using conditional LSTM-VAE model



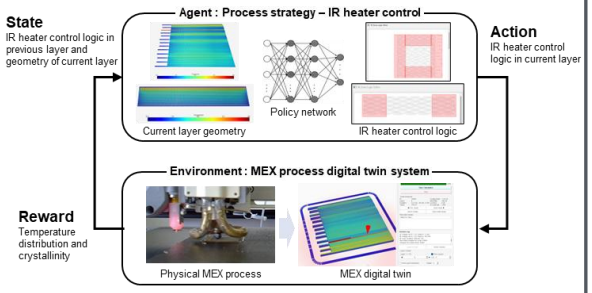
Autonomous setting of process parameters using Bayesian optimization



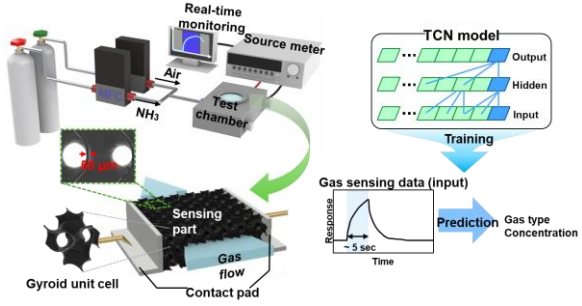
Semantic segmentation for real-time process monitoring in directed energy deposition(DED)



Reinforcement learning based process strategy optimization in material extrusion using a digital twin



Gas sensor fabrication with high surface-to-volume ratio using 3D printing and gas prediction with TCN



AI-assisted engineering design

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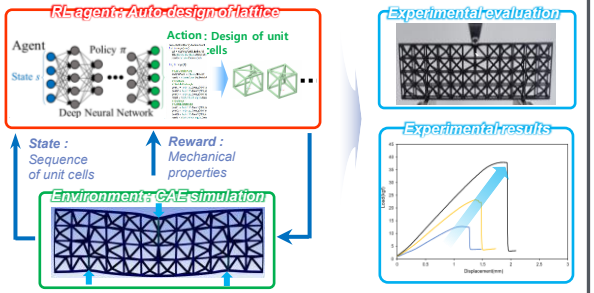
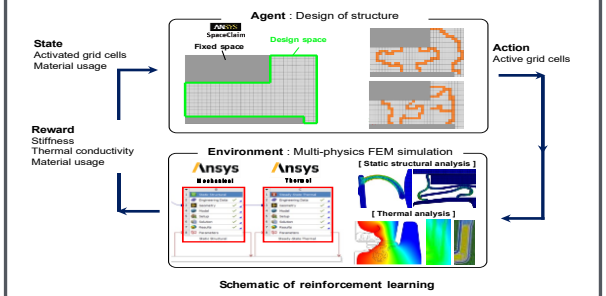
AI-assisted design optimization with autonomous adjustment of geometry parameters

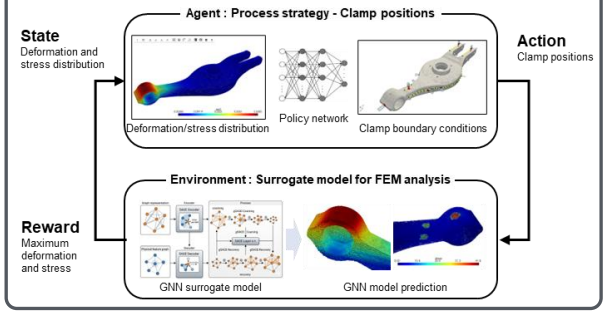
Reinforcement learning based lattice design for optimized performance



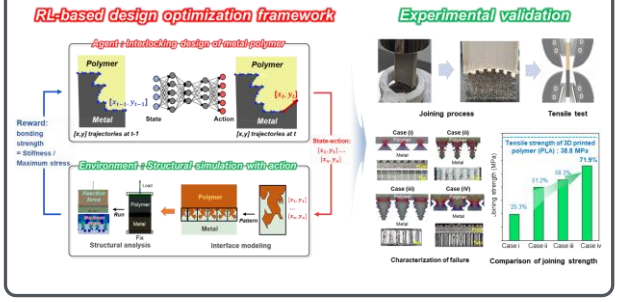
Design optimization via reinforcement learning and multi-physics FEA



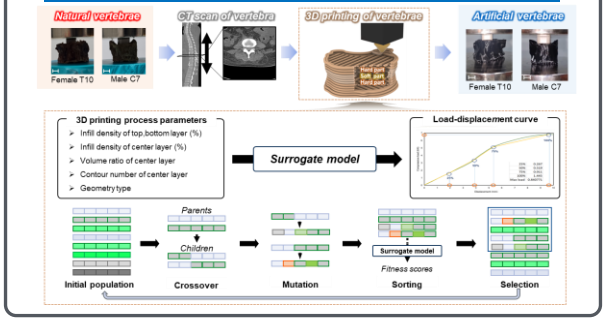
Reinforcement learning based clamp position optimization in machining process



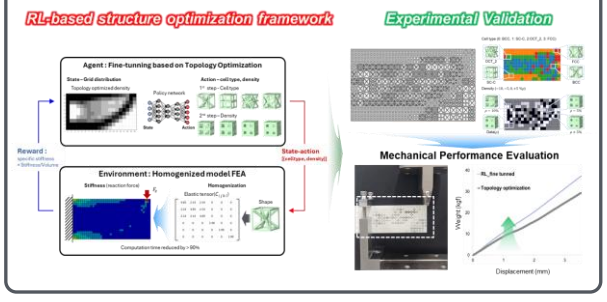
Reinforcement learning-based design of interlocking interfaces of metal-polymer parts



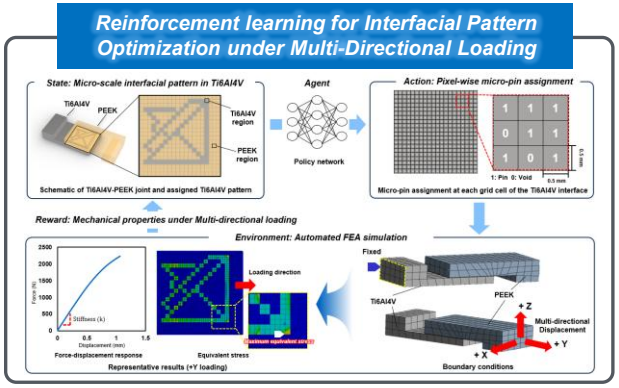
Machine learning-based design of 3D-printed artificial vertebrae for evaluation of spinal implant



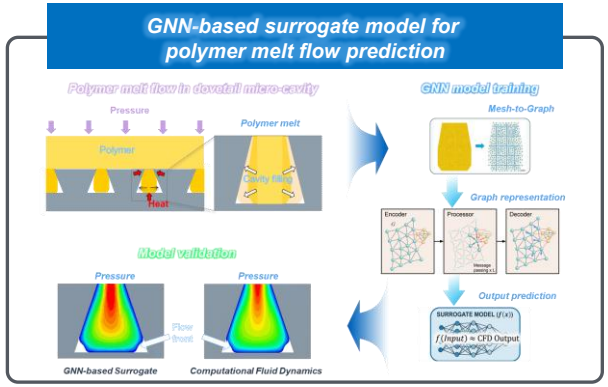
Reinforcement learning based fine-tunning for lattice structure optimization



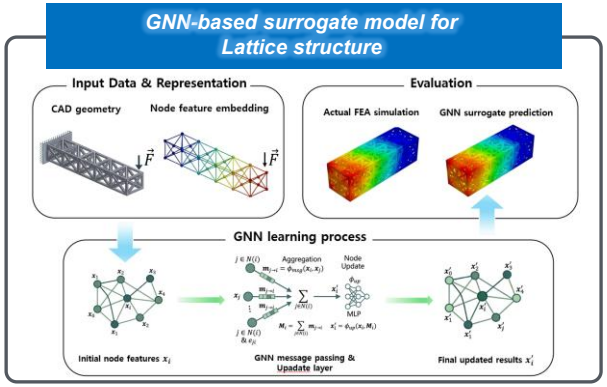
Reinforcement learning for Interfacial Pattern Optimization under Multi-Directional Loading



GNN-based surrogate model for polymer melt flow prediction

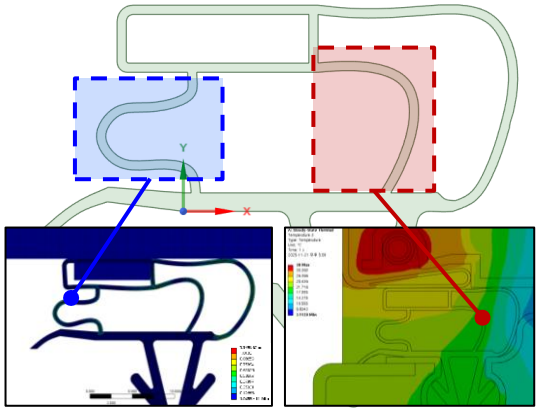


GNN-based surrogate model for Lattice structure

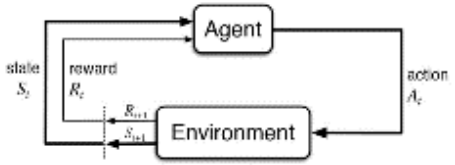


AI-based industrial applications

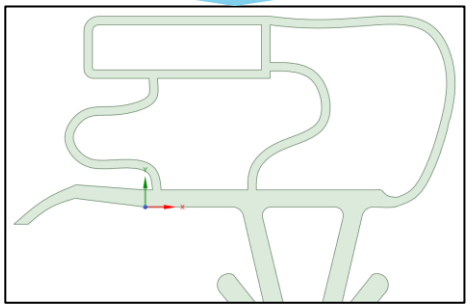
Thermal/Mechanical design (Home applicance parts)



AI-based design optimization



Reinforcement learning

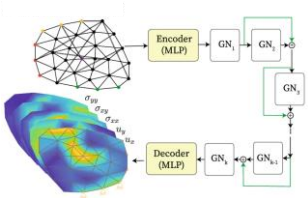


Optimization for parametric design of gasket shape

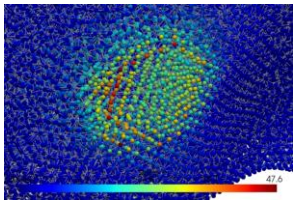
Process optimization (Automotive component manufacturing)

Automobile part machining process

Graph data-based analytic surrogate model



Graph neural network (GNN)

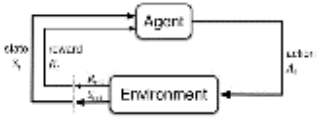


Graph data

Machining condition

Reward calculation

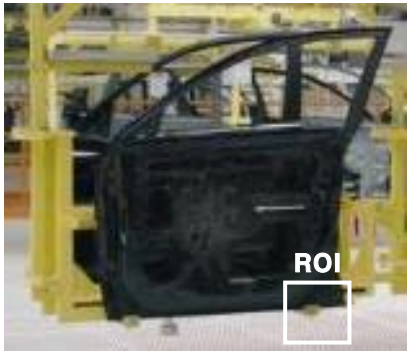
AI-based optimization



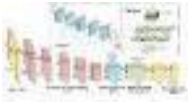
Reinforcement learning

Genetic algorithm

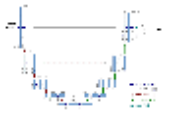
Process monitoring (Automotive production)



Vision-AI

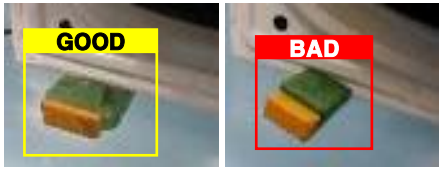


Object detection

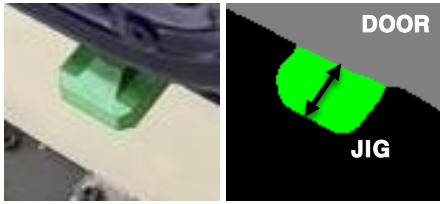


Semantic segmentation

Object detection



Semantic segmentation



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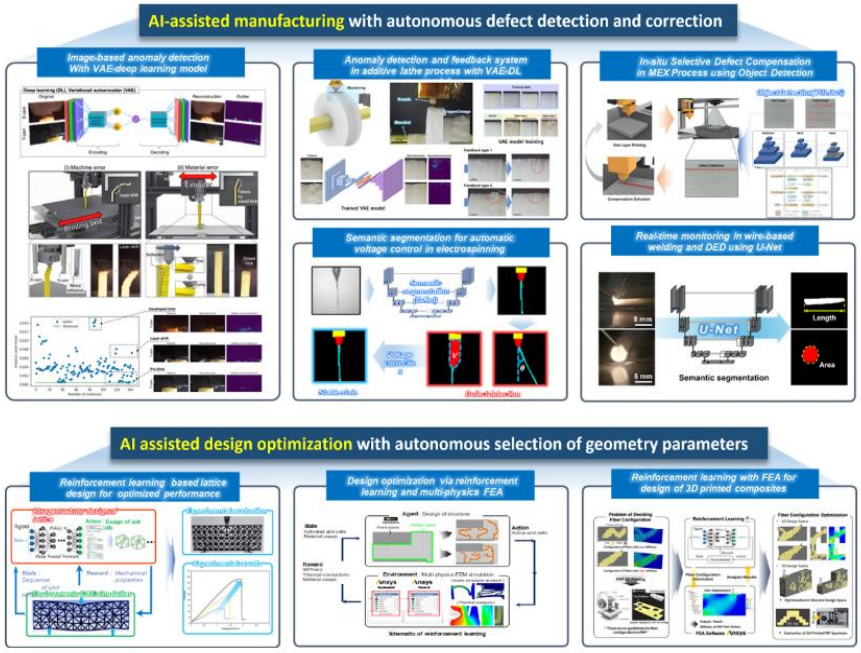

ANNOUNCEMENTS

▪ **연구분야**

- AI 기반 제조공정 결함검출/개선, 생산성 향상 및 지능화 공정개발
- AI 기반 지능형 최적설계 기술
- 다중소재/다중스케일 적층제조 공정개발 및 산업응용
- 방위산업/바이오/의료/자동차/항공우주 등 산업활용 적층제조기술
- 나노/바이오소재 기반 센서 제조기술

※ 대학원생, 학부연구생 문의 및 면담 (박석희 교수, selome815@pusan.ac.kr)