

Hyeongwon Kang

Ph.D. Candidate, Industrial Management Engineering
Data Science & Business Analytics Lab., Korea University

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RESEARCH INTERESTS

Time-series Anomaly Detection, Time-series Forecasting, Multi-modality, Smart Manufacturing

EDUCATION

Korea University, College of Engineering

Seoul, Republic of Korea

Integrated M.S./Ph.D., Department of Industrial and Management Engineering

Mar. 2021 - Present

- **Advisor:** Prof. Pilsung Kang
- **GPA:** 4.38 / 4.5

Incheon National University, College of Engineering

Incheon, Republic of Korea

B.S., Department of Industrial and Management Engineering

Mar.2014 - Feb.2020

- **Advisor:** Prof. Kwanho Kim
- **GPA(Overall):** 4.31 / 4.5, **GPA(Major):** 4.38 / 4.5,
- Summa Cum Laude, Rank: 1st in the department, 2nd in the college

Incheon National University, College of Engineering

Incheon, Republic of Korea

B.S., Artificial Intelligence Software

Mar.2014 - Feb.2020

WORK EXPREIENCE

Korea Electronics Technology Institute

SeongNam, Republic of Korea

Researcher

Feb.2020 - Feb.2021

- Data analysis Software development, Intelligence Integrated Software Research Center
- Developed anomaly detection and forecasting models for connected vehicles
- **Technical Skills:** Python with PyTorch, NumPy, Matplotlib, Pandas, Scikit-learn, Ubuntu Linux, Linux tools, Docker, Apt, Scripting, Git
- **Soft Skills:** Teamwork, Time Management, Communication, Presentation skills

PUBLICATIONS

JOURNAL ARTICLES

Transformer-based multivariate time series anomaly detection using inter-variable attention mechanism

Hyeongwon Kang, Pilsung Kang

Knowledge-Based Systems 290 (2024) p. 111507. 2024

Training-free retrieval-based log anomaly detection with pre-trained language model considering token-level information

Gunho No, Yukyung Lee, Hyeongwon Kang, Pilsung Kang

Engineering Applications of Artificial Intelligence 133 (2024) p. 108613. 2024

Time-series anomaly detection with stacked Transformer representations and 1D convolutional network

Jina Kim*, Hyeongwon Kang*, Pilsung Kang

Engineering Applications of Artificial Intelligence 120 (2023) p. 105964. Elsevier, 2023

Deep Reinforcement Learning-Based Scheduler on Parallel Dedicated Machine Scheduling Problem towards Minimizing Total Tardiness

Donghun Lee, Hyeongwon Kang, Dongjin Lee, Jeonwoo Lee, Kwanho Kim

Sustainability 15.4 (2023) p. 2920. MDPI, 2023

Deep Learning-Based Multi-Horizon Forecasting for Automated Material Handling System Throughput in Semiconductor Fab

Jungwoo Choi, Hyeongwon Kang, Jeongseob Kim, Heejeong Choi, Yunseung Lee, Pilsung Kang

IEEE Transactions on Semiconductor Manufacturing 36.1 (2022) pp. 113–129. IEEE, 2022

Building an integrated framework for Korean document summarization and speech synthesis

Takyoung Kim, Jina Kim, Hyeongwon Kang, Subin Kim, Pilsung Kang

Journal of the Korean Society of Industrial Engineers 48.1 (2022) pp. 80–90. 2022

* = Both authors contributed equally to this work.

PROJECTS

Time-series anomaly detection for laser welding nondestructive testing systems

Granted by LG Electronics

Korea University

Apr.2023 - Present

- Developed technology to prevent mass rejects in battery welding through real-time automatic detection of defects/process anomalies
- Validate model fit and deploy models for field application

Error-free information infrastructure autonomous control technology based on modeling & optimization

Granted by KETI

Korea University

Jul.2021 - Present

- ML/DL-based anomaly detection - develop predictive and causal models
- Developed feature data augmentation models using GAN & VAE generation models

Multi-Modal Learning model for heterogeneous data

Granted by LG Innotek

Korea University

Apr.2023 - Feb.2024

- Predicting AA process performance using Multi-Modal Learning from time series and tabular data
- Build a framework for exploring methodologies for analyzing diverse multimodal data

Fake News Detection Dataset Construction Project - Development of Fake News Detection Model

Granted by NIA

Korea University

May.2022 - Dec.2022

- Developed algorithms to detect "title and body mismatch" and "body domain mismatch" based on Korean fake news
- Presented baseline algorithm performance for the development of a fake news detection model

AI-based Semiconductor Process Data Semi-Supervised Anomaly Detection

Granted by RTM

Korea University

Mar.2021 - Jun.2021

- Building anomaly detection models based on semi-supervised methodologies
- Generate an Anomaly Score distribution and extract Pseudo Normal data with an anomaly detection model

Connected Vehicles (CV) Traffic Accident Detection

Korea Electronics Technology Institute

Aug.2020 - Dec.2020

- Developed an unsupervised learning-based traffic anomaly detection model using first-person dashcam footage
- Developed a traffic accident detection framework using object detection, tracking, optical flow, and ego trajectory detection techniques

Connected Vehicles (CV) Anomaly Detection

Korea Electronics Technology Institute

Jun.2020 - Aug.2020

- Detect and remove connected vehicle anomalies
- Developed an anomaly detection system using machine learning methods

Connected Vehicles (CV) coolant temperature, driving speed time series analysis and LSTM based forecast

Korea Electronics Technology Institute

Mar.2020 - Aug.2020

- Developed a service that predicts coolant temperature based on driving speed and alerts you before it reaches dangerous levels
- Proposed LSTM-based coolant temperature prediction framework

Scheduler based on the DQN that considers the following tasks to minimize tardiness

Granted by VMS Solutions

Incheon National University

Mar.2019 - Sep.2019

- Applied DQN & DDQN to the field of scheduling to propose scheduling techniques that consider setup and machine-specific job type constraints
- Proposed DQN-based optimization scheduling framework

AWARDS & HONORS

| | | |
|------|---|---------|
| 2022 | Grand Prize , 1st Dissertation Research Plan Idea Contest | Seoul |
| 2020 | College of Engineering President's Award , Incheon National University | Incheon |
| 2019 | Students honored Incheon National University , Incheon National University | Incheon |
| 2019 | Bronze , Korean Institute of Industrial Engineers Fall Meeting, Collegiate Project Competition | Seoul |
| 2019 | Gold , Engineering Portfolio Competition | Incheon |
| 2019 | Excellence , Industry Capstone Design Competition | Incheon |
| - | Merit-based Scholarship , Half tuition and fees for undergraduate student (Two and a half years) | Incheon |

PRESENTATIONS

Predicting anomalies with uncertainty in time series forecasting ensemble models

KDMS 2024

Hyeongwon Kang, Jinwoo Park, Seunghun Han, Pilsung Kang

Predicting anomalies with uncertainty in time series forecasting ensemble models

KIIE 2024

Hyeongwon Kang, Jinwoo Park, Seunghun Han, Pilsung Kang

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| Transformer-based multivariate time series outlier detection with cross-variable attachment mechanisms Hyeongwon Kang, Euisuk Chung, Kyoungchan Park, Pilsung Kang | KIIE 2022 |
| Deep learning-based semiconductor logistics return system multi-point throughput capacity prediction study Jungwoo Choi, Hyeongwon Kang, Jeongseob Kim, Pilsung Kang | KIIE 2022 |
| Building an integrated framework for Korean document summarization and speech synthesis Takyoun Kim, Jina Kim, Hyeongwon Kang, Subin Kim, Pilsung Kang | KIIE 2021 |

INVITED TALKS

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|---|----------|
| Transformer-based Multivariate Time Series Anomaly Detection using Inter-Variable Attention Mechanism SKT Market Top AI, Global Knowledge | Jun.2024 |
| Developing time series data-driven methodologies Korea University Data Science Society, Korea University | Nov.2022 |

TEACHING EXPERIENCES

PROGRAMMING INSTRUCTOR

| | |
|--|------|
| LG Energy Solution DX Expert Course | 2024 |
| • Deep Auto-Encoder, Transformer/Vision Transformer/Time-series Transformer, Deep learning for time series data analysis | |
| LG Electronics Digital transformation Intensive Course | 2024 |
| • Transformer-based time series data representation learning, Visualise time series data, Select Variables and Collapse Dimensions Lecture | |
| SK Hynix Developing a Data Center Storage Fail Prediction Model Course | 2023 |
| • Time series Anomaly Detection Lecture | |
| LG Energy Solution DX Expert Course | 2023 |
| • Deep learning for time series data analysis, Select Variables and Collapse Dimensions Lecture | |

TEACHING ASSISTANT

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|---|------|
| LG Energy Solution DX Expert Course | 2022 |
| • Python Basic, Anomaly Detection, Select Variables and Collapse Dimensions Lecture | |
| LG Innnotek Machine Learning Course | 2022 |
| • Python Basic, Artificial Neural Network Basic, DNN, CNN Lecture | |
| HYUNDAI STEEL Data Analytics Course | 2021 |
| • Anomaly Detection Lecture | |
| SK Hynix Data Analytics Course | 2021 |
| • Anomaly Detection Lecture | |

PROJECT ASSISTANT

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| Fast Campus Advanced Data Analytics Semi-professional Course | 2022 |
| SK Hynix Data Analytics Course | 2021 |

TECHNICAL SKILLS

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| Language | Python, R, C/C++, HTML/CSS, SQL |
| Libraries | PyTorch, Tensorflow, Keras, Pandas, NumPy, Scikit-learn |
| Miscellaneous | Linux, Shell, Git, Docker, LaTeX |
| Soft Skills | Time Management, Teamwork, Problem-solving, Documentation, Engaging Presentation |

References available upon request.