Sungil Kim

Department of Industrial Engineering
Ulsan National Institute of Science and Technology
Ulsan, Republic of Korea, 44919

Email: sungil.kim@unist.ac.kr
Office: (052) 217-3195
http://analytics.unist.ac.kr

RESEARCH INTEREST

Industrial statistics and data analytics, Quality engineering and management, Machine learning and data mining, Statistical process monitoring and anomaly detection, Demand forecasting, Smart manufacturing/logistics technology

ACADEMIC APPOINTMENT

Ulsan National Institute of Science and Technology, Ulsan, Korea

Associate Professor, Department of Industrial Engineering	September 2020-present
Adjunct Professor, Artificial Intelligence Graduate School	September 2020-present
Director, Center for Industrial Data Science	April 2021-present
Principal Investigator, Data Analytics Lab	July 2016-present
Director, Center for Maritime Data Science	February 2019-April 2021
Assistant Professor, School of Management Engineering	July 2016-August 2020
Director, Center for Advanced Analytics	March 2018-February 2019

EDUCATION

Georgia Institute of Technology, Atlanta, Georgia, USA
H. Milton Stewart School of Industrial and Systems Engineering

Ph.D. in Industrial Engineering (with specialization in Statistics)	December 2011
Minor: Supply Chain Management	
M.S. in Statistics	December 2007
M.S. in Industrial Engineering	May 2007

Yonsei University, Seoul, Korea
Department of Computer Science and Industrial Systems Engineering

B.S. in Industrial Engineering, Magna Cum Laude	February 2005

Hansung Science High School, Seoul, Korea	February 1998

EMPLOYMENT

Associate Professor, **UNIST**	September 2020-present
Assistant Professor, **UNIST**	July 2016-August 2020
Senior Engineer, **Samsung SDS**	January 2014-June 2016
Consultant, **Terra Technology**	September 2011-December 2013
Data Scientist Intern, **Predictix**	May 2009-December 2009, May 2008-August 2008
Research/Teaching Assistant, **Georgia Institute of Technology**	May 2006-August 2011

PUBLICATIONS

JOURNALS PAPERS or REFEREED CONFERENCES (Under Review)

1. Juhui Lee, Giheon Koh, and Sungil Kim** (2021), Data quality improvement for imbalanced classification through noise reduction by singular value shrinkage, under review.
2. YongKyung Oh and Sungil Kim** (2021), Detection of abnormal vessel behaviors from AIS data using the Bayesian bootstrap, under review.
3. YongKyung Oh, JiIn Kwak, JuYoung Lee, and Sungil Kim** (2021), Time delay estimation of traffic congestion propagation based on transfer entropy, under review.
4. JuYoung Lee, JiIn Kwak, YongKyung Oh, and Sungil Kim** (2021), A propagation prediction method for non-recurrent traffic congestion, under review.

JOURNALS PAPERS (Published)

1. Sungil Kim* (2021), Maximum feasibility estimation, *Information Sciences*, accepted.
2. YongKyung Oh, Hanjoo Kim, Deokjung Lee, and Sungil Kim** (2021), Simulation-based Anomaly Detection in Nuclear Reactors, *Journal of the Korean Institute of Industrial Engineers*, 47(2), pp 130-143.
3. YongKyung Oh, Namu Kim, and Sungil Kim** (2021), Transfer Learning based approach for mixture gas classification, *Journal of the Korean Institute of Industrial Engineers*, 47(2), pp 144-159.
4. Sungil Kim, Rong Duan, Guang-Qin Ma, and Heeyoung Kim* (2020), Multiresolution spatial generalized linear mixed model for integrating multi-fidelity spatial count data without common identifiers between data sources, *Spatial Statistics*, 39, 100467.
5. Jaemin Park and Sungil Kim** (2020), Maritime anomaly detection based on VAE-CUSUM monitoring system, *Journal of the Korean Institute of Industrial Engineers*, 46(4), pp 432-442.
6. Sungil Kim* (2019), Revealing household characteristics using connected home products, *Information Sciences*, 486, pp 52-61.
7. Sungil Kim, Heeyoung Kim*, and Jye-Chyi Lu (2019), A Practical Approach to Measuring the Impacts of Stockouts on Demand, *Journal of Business and Industrial Marketing*, 34(4), pp 891-901.
8. Heeyoung Kim, Rong Duan*, Sungil Kim, Jaehwan Lee, and Guang-Qin Ma (2019), Spatial cluster detection in mobility networks: a copula approach, *Journal of the Royal Statistical Society: Series C*, 68(1), pp 99-120.
9. Heeyoung Kim, Justin T. Vastola, Sungil Kim, Jye-Chyi Lu*, and Martha A. Grover (2017), Incorporation of engineering knowledge into the modeling process: a local approach, *International Journal of Production Research*, 55(20), pp 5865-5880.
10. Heeyoung Kim, Sungil Kim, Jian Deng, Jye-Chyi Lu*, K. Wang, C. Zhang, Martha A. Grover, and B. Wang (2017), An integrated holistic model of a complex process, *International Journal of Advanced Manufacturing Technology*, 89(1), pp 1137-1147.
11. Sungil Kim, Heeyoung Kim*, and Yongro Park (2017), Early detection of vessel delays using combined historical and real-time information, *Journal of the Operational Research Society*, 68(2), pp 182-191.

12. Heeyoung Kim, Justin T. Vastola, Sungil Kim*, Jye-Chyi Lu, and Martha A. Grover (2017), Batch sequential minimum energy design with design region adaptation, *Journal of Quality Technology*, 49(1), pp 11-26.
13. Sungil Kim, Heeyoung Kim*, and Younghwan Namkoong (2016), Ordinal classification of imbalanced data with application in emergency and disaster information services, *IEEE Intelligent Systems*, 31(5), pp 50-56.
14. Sungil Kim and Heeyoung Kim* (2016), A new metric of absolute percentage error for intermittent demand forecasts, *International Journal of Forecasting*, 32(3), pp 669-679.
15. Sungil Kim, Heeyoung Kim*, Richard W. Lu, Jye-Chyi Lu, Michael J. Casciato, and Martha A. Grover (2015), Adaptive combined space-filling and D-optimal designs, *International Journal of Production Research*, 53(17), pp 5354-5368.
16. Sungil Kim, Heeyoung Kim*, Jye-Chyi Lu, Michael J. Casciato, Martha A. Grover, Dennis W. Hess, Richard W. Lu, and Xin Wang (2015), Layers of experiments with adaptive combined design, *Naval Research Logistics*, 62(2), pp 127-142.
17. Michael J. Casciato*, Sungil Kim, Jye-Chyi Lu, Dennis W. Hess, Martha A. Grover (2012), Optimization of a carbon dioxide-assisted nanoparticle deposition process using sequential experimental design with adaptive design space, *Industrial & Engineering Chemistry Research*, 51(11), pp 4363-4370.
18. Seung-Kweon Hong*, Sungil Kim (2005), A time prediction model of cursor movement with path constraints, *Journal of the Korean Institute of Industrial Engineers*, 31(4), pp 334-340.

REFEREED CONFERENCES (Published or In Press)

1. YongKyung Oh and Sungil Kim** (2021), Multichannel convolution neural network for gas mixture classification, *The 4th Conference of Korean Artificial Intelligence Association, Online.*
2. Juhui Lee and Sungil Kim** (2019), Ordinal-imbalanced data classification through noise reduction by singular value decomposing truncation, *In Proceedings of the IISE Annual Conference,(AC19), IISE, Orlando [**2019 IISE Best Paper Award, Quality Control & Reliability Engineering Division**].*
3. Michael J. Casciato, Sungil Kim, Jye-Chyi Lu, Dennis W. Hess, Martha A. Grover (2012), Optimization of carbon dioxide-assisted nanoparticle deposition process with uncertain design space, *Proceedings of the 11th International Symposium on Process Systems Engineering*, pp 1191-1195.

OTHER PUBLICATIONS AND CREATIVE PRODUCTS

1. YongKyung Oh and Sungil Kim** (2018), Research trends for solving the odor problem, *Industrial Engineering Magazine*, 25(3), 45-51.

INDIVIDUAL STUDENT GUIDANCE

1. Juhui Lee, MS. Started in Fall 2018; passed defense on June 18, 2020; thesis title: "Data Quality Improvements for Multiclass Classification;" graduated in August 2020; first position: Senior Researcher at THYROSCOPE Inc.

2. Jaemin Park, MS. Started in Spring 2018; passed defense on December 16, 2020; thesis title: "Unsupervised Anomaly Detection to Monitor Delays of Vessel Voyages based on Variational Autoencoder and Control Chart;" graduated in February 2021; first position: CEO at THYROSCOPE Inc.
3. JuYoung Lee, MS. Started in Fall 2019; passed defense on June 17, 2021; thesis title: "Modelling Traffic Incidents Impacts and Prediction of Incident driven Congestion Propagation in a Large Scale Road Network;" graduated in August 2021; first position:

PATENTS

1. Kim, Sungil (primary inventor), Method and Apparatus for Determining Delay Possibility of Shipment. (10-2250354, granted May 4, 2021), (PCT/KR2020/015854, applied November 12, 2020).
2. Kim, Sungil (primary inventor), Apparatus and method for sensor based realtime odor classification. (10-2106561, granted April 24, 2020), (China 201910234530.5, applied March 26, 2019).
3. Kim, Sungil (primary inventor), Bayesian Bootstrap based anomaly detection of vessels. (KR 10-2020-0178651, applied December 18, 2020).
4. Kim, Sungil (primary inventor), Sensor Drift Compensation Method and Device. (KR 10-2020-0101037, applied August 14, 2020).
5. Kim, Sungil (primary inventor), Method for risk scoring in logistics system. (KR 10-2015-0150296, applied October 28, 2015).
6. Kim, Sungil (primary inventor), System and method for grid-based geofencing service, (KR 10-2015-0090396, applied June 25, 2015).
7. Kim, Sungil (co-inventor), System and method for detecting and predicting anomalies based on analysis of text data, (KR 10-2014-0142784, applied October 21, 2014).
8. Kim, Sungil (co-inventor), System and method for detecting and predicting anomalies based on analysis of time-series data. (USA 09952921, granted April 24, 2018), (KR 10-2014-0136765, applied October 10, 2014).
9. Kim, Sungil (primary inventor), Apparatus and method for calculating standard route of moving body. (10-1766640, granted August 3, 2017), (KR 10-2014-0127859, applied September 24, 2014).
10. Kim, Sungil (primary inventor), Apparatus and method for early detection of abnormality. (KR 10-2014-0112321, applied August 27, 2014).

GRANTS & CONTRACTS

1. Development of AI-based vessel ETA (Estimated Time of Arrival) prediction methodology for intelligent smart ports
    - Role: Principal Investigator
    - Source: National Research Foundation of Korea (NRF)
    - Duration: June 1, 2021-February 29, 2024

- Amount: ₩131,343,000

2. Development of AI technology for identifying traffic congestion patterns
    - Role: Participant
    - Source: NAVER
    - Duration: November 1, 2020-October 31, 2022
    - Amount: ₩300,000,000
3. AI dataset construction for manufacturing facilities
    - Role: Participant
    - Source: the Korea Technology and information Promotion Agency for SMEs (TIPA)
    - Duration: Sep 18, 2020-November 30, 2020
    - Amount: ₩283,739,091
4. Manufacturing data analysis and AI model development
    - Role: Participant
    - Source: interX
    - Duration: June 10, 2020-November 30, 2020
    - Amount: ₩122,727,273
5. Incorporation of domain knowledge into the modeling process for quality Improvement in smart manufacturing
    - Role: Principal Investigator
    - Source: National Research Foundation of Korea (NRF)
    - Duration: March 1, 2017-February 28, 2022
    - Amount: ₩250,000,000
6. Structural analysis on the processes of technological innovation in the fourth industrial revolution: focusing on open innovation and concurrent transformation of regional innovation system
    - Role: Participant
    - Source: National Research Foundation of Korea (NRF)
    - Duration: July 1, 2018-June 30, 2021
    - Amount: ₩228,762,000
7. Development of AI Based Reactor Core Diagnostics System
    - Role: Participant
    - Source: Korea Hydro & Nuclear Power Co.,Ltd.
    - Duration: June 1, 2019-May 31, 2021
    - Amount: ₩446,557,680
8. Development of stowage optimization engine solver using reinforcement learning

- Role: Principal Investigator
- Source: Cyberlogitec
- Duration: November 1, 2018-August 31, 2020
- Amount: ₩90,000,000

9. Development of Algorithms for Mixture Gases Classification
    - Role: Principal Investigator
    - Source: Ulsan Industry-University Convergence Campus
    - Duration: March 16, 2020-July 31, 2020
    - Amount: ₩40,000,000
10. Smart Port Logistics Support Center
    - Role: Principal Investigator
    - Source: Ulsan Port Authority
    - Duration: January 1, 2019-December 31, 2019
    - Amount: ₩1,395,460,000
11. A Constraint satisfaction problem with attribute data: an application to connected home products
    - Role: Principal Investigator
    - Source: UNIST
    - Duration: September 1, 2016-August 31, 2019
    - Amount: ₩20,000,000
12. Data mining project lab
    - Role: Participant
    - Source: UNIST-Taesung Environmental Research Institute
    - Duration: October 1, 2018-December 31, 2018
    - Amount: ₩15,000,000
13. Development of data analytics methods for mixture gases classification
    - Role: Principal Investigator
    - Source: UNIST-Taesung Environmental Research Institute
    - Duration: August 1, 2018-December 31, 2018
    - Amount: ₩10,000,000
14. Blockchain-based system engineering
    - Role: Participant
    - Source: UNIST
    - Duration: March 1, 2018-December 31, 2018
    - Amount: ₩45,000,000

15. Development of data analytics methods to identify the sources of odor
    - Role: Principal Investigator
    - Source: Ulsan Industry-University Convergence Campus
    - Duration: October 1, 2017-March 31, 2018
    - Amount: ₩38,500,000
16. Development and application of methods and an intelligent platform system for industry 4.0
    - Role: Participant
    - Source: UNIST
    - Duration: February 1, 2017-December 31, 2017
    - Amount: ₩40,000,000

TEACHING EXPERIENCE

Ulsan National Institute of Science and Technology, Ulsan, Korea
Department of Industrial Engineering
Instructor

- IE 471: Special Topic (Project Lab) — Fall, 2021
- IE 509/AI 533: Advanced Quality Control — Fall, 2021
- IE 362/MGE 362: Statistical Quality Management — Spring, 2017-2021
- MGT 101: Entrepreneurship & Big Data — Fall, 2020
- IE 502/MGE 502: Statistical Programming — Fall, 2018-2020
- TIM 713: Industrial Innovation Seminar — Fall, 2018
- MGE 509: Advanced Quality Control — Fall, 2017-2019
- MGE 301: Operations Research I — Fall, 2016-2017
- MGT 209: Operations Management — Fall, 2016

Georgia Institute of Technology, Atlanta, Georgia, USA
H. Milton Stewart School of Industrial and Systems Engineering
Teaching Assistant

- ISyE 4031: Regression and Forecasting — Spring, 2011
- ISyE 3770: Probability and Statistics — Fall, 2010
- ISyE 2027: Probability with Applications — Spring, 2010
- ISyE 4803: Advanced Supply Chain Logistics — Fall, 2007
- ISyE 6739: Statistical Methods — Summer, 2007

PRESENTATIONS

1. Multi-channel convolution neural network for gas mixture classification, IISE Annual Conference & Expo 2021, May 2021.
2. Logistics anomaly detection with maritime big data: a bootstrap approach, IISE Annual Conference & Expo 2021, May 2021.
3. Commercial area analysis using big data on GIS: case of YongIn-si, KIIE, May 2021.
4. Sensor drift compensation for mixed gas classification under batch experiments, KIIE, May 2021.
5. Sensor drift compensation for mixed gas classification under batch experiments, INFORMS Annual Meeting, November 2020.
6. Maximum feasibility estimation, The 2020 INFORMS Workshop on Data Science, November 2020.
7. Transfer-learning based approach for mixture gas classification, KIIE, November 2020.
8. Congestion propagation modeling with graph neural network (GNN), KIIE, November 2020.
9. Simulation-based anomaly detection in nuclear reactors, KIIE, November 2020.
10. Logistics anomaly detection with maritime big data: a bootstrap approach, IISE Annual Conference & Expo 2020, November 2020.
11. Exploiting logistics anomaly detection using maritime big data, KIIE, November 2019.
12. Maximum feasibility estimation, INFORMS Annual Meeting, October 2019.
13. Revealing household characteristics using connected home products, The Fifth International Conference on the Interface between Statistics and Engineering, June 2019.
14. Ordinal-imbalanced data classification by singular value decomposing truncation, IISE Annual Conference & Expo 2019, May 2019.
15. Exploiting logistics anomaly detection using maritime bigdata, IISE Annual Conference & Expo 2019, May 2019.
16. Ordinal-imbalanced data classification through noise reduction by singular value decomposing truncation, KIIE, April 2019.
17. Data analytics in logistics systems: monitoring, classification, and assessment, Yonsei University, May 2018.
18. Sensor drift compensation using temperature and humidity for mixture gases classification, KIIE, April 2018.
19. Big data analytics in logistics, 4th UNIST Big Data Symposium, November 2017.
20. Early detection of vessel delays using combined historical and real-time information, INFORMS Annual Meeting, October 2017.
21. Layers of experiments with adaptive combined design, INFORMS Annual Meeting, November 2014.
22. Prediction & inference using hierarchical spatio-temporal varying coefficient model: applied to detailed sales forecasting for retail providers, Georgia Tech Research and Innovation Conference, February 2010.

23. Detailed sales forecasting & promotion analysis for retail providers, Joint Statistical Meetings, August 2009.

SERVICE

Campus Contributions

- Chair, The Industrial Cooperation Committee, Artificial Intelligence Graduate School, 2021
- Chair, The Faculty Recruitment Committee, Department of Industrial Engineering, 2021
- Chair, The Department Education Committee, Department of Industrial Engineering, 2020-2021
- Member, The University Admission Interview Committee, 2020
- Member, Election Commission for Faculty Representatives of the UNIST Council, 2020
- Member, The Fourth Industrial Revolution Working Committee, 2018-2022
- Member, UNIST Visibility Committee, 2018-2020
- Member, Space Planning and Allocation Committee for Industry-University Convergence Campus, 2018-2019
- Member, The Faculty Recruitment Committee, School of Management Engineering, 2017-2020
- Member, The Undergraduate Admissions Committee, 2017
- Member, Committee for the Preparation of the Movement to Complex Campus, School of Management Engineering, 2017

Professional Membership

- The Institute of Industrial & Systems Engineers, 2019-present
- The Korean Institute of Industrial Engineers, 2014-present
- The Institute for Operations Research and the Management Sciences, 2006-present

Public and Community Service

- Member, Logistics Policy Committee, Ulsan Metropolitan City Hall, 2019-2021

Professional Activities

- Session chair of the KIIE Annual Conference, Probability/Statistics/Quality, Jeju, June, 2021.
- Reviewer, IISE Transactions, 2021
- Session chair of the Fifth International Conference on the Interface between Statistics and Engineering (ICISE), Statistics and Analytics, Seoul, June, 2019.
- Session chair of the KIIE Annual Conference, Industrial AI, Gwangju, April, 2019.

PROFESSIONAL EXPERIENCE

Samsung SDS, Seoul, Korea
Data Analytics Lab, Algorithm Research Team, R&D Center
Senior Engineer/Data Scientist January 2014-June 2016

- Developed risk assessment and scoring algorithm using text mining for SDS Smart Logistics portal solution, Cello Square.
- Developed a data-driven method for early detection of vessel delays combining with real-time vessel tracking information. The proposed approach is validated by applying to real data-sets extracted from the logistics platform of Samsung SDS, Cello.
- Analyzed global IT trends and disruptive technologies in the fields of big data analytics, Internet of Things (IoT), and video analytics.
- Collaborated with SDS R&D center in San Jose to research new technologies in data analytics for SDS mid/long term business in global markets.

Terra Technology, Norwalk, Connecticut, USA
Supply Chain Management Consultant September 2011-December 2013

- Applied data mining techniques (e.g., pattern recognition, regression analysis, clustering) to real business problems.
- Collected/identified big data from existing internal databases and external/public data sources.
- Cooperated with the client's DBA team and tested the performance of forecasts.
- Developed technical solutions, including writing and testing SQL procedures and/or UNIX/Windows shell scripts to meet customer integration requirements.
- Participated in demand planning projects for Procter & Gamble, Unilever, Kraft Foods Inc., ConAgra Foods, Kellogg's etc.
- Analyzed data to identify demand volatility and changing consumer preferences.
- Created data validation templates using Qlikview reports by adding new functionalities: multiple selection, high dimensional search.

Predictix, Atlanta, Georgia, USA
Data Scientist Intern May-December 2009 & May-August 2008

- Participated in pre-sales projects for Target Corporation.
- Developed a synthetic sales data generator for studying promotion effects.
- Analyzed retail sales transaction data for the promotion planning.
- Developed spatial-temporal data mining techniques for retail sales transaction data from Shopko.
- Collected/identified big data from existing internal databases and external/public data sources.

Georgia Institute of Technology, Atlanta, Georgia, USA
H. Milton Stewart School of Industrial and Systems Engineering
Research Assistant May 2006-August 2011

- Developed statistical methodologies for a data collection plan with uncertain design space.

- Developed a new approach, *Layers of Experiments*, for the robust optimization of nanoparticle synthesis.
- Explored a new statistical methodology in a multi-level, multi-scale framework in the context of supply chain logistics systems.
- Performed inventory system analysis on stocked items and participated in a warehousing design for Enraf Fluid Technology.

TECHNICAL SKILLS

R, Python, Julia, MATLAB, Hadoop, Spark, Perl, C/C++, Korn Shell, Unix/Linux, Java, SQL, MS Access, PL/SQL, XML, MySQL, LINDO/LINGO, GAMS, Qlikview

AWARDS & HONORS

2021 IISE Best Paper Award, Logistics and Supply Chain Division, *The Institute of Industrial and Systems Engineers*

2019 IISE Best Paper Award, Quality Control & Reliability Engineering Division, *The Institute of Industrial and Systems Engineers*

2015 SDSers of the Quarter, *Samsung SDS*

2010 Honorable mentions, *The Business and Economics Statistics Section at the Joint Statistical Meetings*

2006 Global Logistics Scholar, *The Logistics Institute*

2005 Graduate Research Scholarship, *Korea Research Foundation*