Donghyun Ko

Profile

Ph.D student in Industrial and System Engineering at NC State University focusing on risk-aware generative AI models for decision making under uncertainty in complex engineering systems. My research integrates mathematical optimization with generative AI, ML, and DL with applications in industrial, manufacturing, and defense systems.

Contact details

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Areas of interest

- Data Science
- Generative AI
- ML/DL/RL
- RUL/TTF Prediction
- Anomalies detection
- Additive Manufacturing

Technical skills

- **Optimization & Analytics:** Convex Optimization; Linear, Integer, Nonlinear and Stochastic Programming; Statistical Process Control
- **Programming:** Python, R, SQL

Languages

Korean (native)
English (professional)

Education

North Carolina State University, Raleigh, NC **08/2023–Present**
- Ph.D. in Industrial & Systems Engineering (GPA: 3.91 / 4.0)
- Research focus: Data-driven and risk-aware AI modeling for industrial predictive analytics and manufacturing system optimization
- Key coursework: Machine & Deep learning, Generative AI, mathematical modeling, optimization, stochastic and Bayesian modeling
  ** Detailed coursework available in Appendix*

Texas A&M University, College Station, TX **08/2019–05/2021**
- M.S. in Industrial & Systems Engineering (GPA: 3.9 / 4.0)
- Thesis: Nonlinear system optimization with response surface methodology
- Key coursework: Optimization, Stochastic processes, Design of experiment, Statistical computing, Machine & Deep learning
  ** Detailed coursework available in Appendix*

Korea Military Academy, Seoul, South Korea **03/2008–02/2012**
- B.A. in Economics (GPA: 3.96 / 4.3)
- Emphasis on quantitative analysis, mathematical & engineering fundamentals, and defense systems
  ** Detailed coursework available in Appendix*

Research Experience

Operations Research & Analytics Officer **05/2021–06/2023**
Center for Army Analysis & Simulation, Army HQ, South Korea
- Built time-series analytical models to forecast future demand of personnel resources and training facilities
- Applied integer programming to mathematically estimate future enlisted personnel and optimize the capacity of Recruit training centers
- Identified workflow bottlenecks in recruit training and redesigned layouts and schedules, reducing relevant budget by 15%

Battle Command Training Program, Army HQ, South Korea
- Built a prototype of AI-based decision-making system using ML/DL
- Simulation-based decision support systems saving manual planning effort
- Reallocated 105 mm self-propelled artillery assets in the DMZ to optimize cost-effectiveness and operational effect
- Developed and maintained algorithms for military war-gaming simulations

Internship & Training

Teaching & Research Assistant, NC State University
- TA, ISE 535 – Python for Industrial & Systems Engineering (Fall 2023)
- TA, ISE 135 – Computer-Based Modeling for Engineers (Spring & Fall 2024)
- TA, ISE 311 – Engineering Economic Analysis (Spring 2025)
- TA, ISE 443 – Quality Design & Control (Fall 2025)
- RA under Prof. Jake Peloquin, focusing on building risk-aware AI models and optimization for additive manufacturing process (Jan 2026–Present)

Interpreter, 22nd ROK Armed Forces Event Planning Group, South Korea **09/2022–10/2022**
- Provided simultaneous interpretation for senior military officials, including the U.S. 7th Air Force Commander, U.S. 2nd Infantry Division Commander, and the Swedish Ambassador.

Army Operations Course, Canadian Armed Forces, Kingston, Canada **06/2017–12/2017**

- Completed brigade–division level staff officer course with certification in operational planning and joint military operations.

Defense Language Institute, Republic of Korea **09/2014–02/2015**

- Completed intensive English language training program for international military and defence operations.

Certifications

Big Data Analyst Engineer **Korea Data Agency (K-DATA)**

- National government-certified credential validating end-to-end data analytics, statistics, and machine learning proficiency

Advanced Data Analytics Professional (ADP) **K-DATA**

- Highest-level data analytics certification in Korea, distinguished by a very low pass rate (typically <5%) and rigorous evaluation of advanced statistical modelling, optimization, and ML/DL expertise

Advanced Data Analytics Semi-Professional (ADsP) **K-DATA**

- Professional certification confirming strong foundations in data analysis and statistical inference

NVIDIA Certificate of Competency — Deep Learning **NVIDIA**

- Industry-recognized certification demonstrating practical proficiency in deep learning fundamentals and GPU-accelerated AI workflows

Leadership

Republic of Korea Army **03/2012–07/2019**

Company Commander (2017–2019)

- Led company-level operations and training; ensured combat readiness, troop management, and unit discipline
- Conducted high-security missions including protection of the US–ROK Combined Command facility and presidential security operations

Logistics Officer (S-4) (2016–2017)

- Forecasted combat resource requirements and coordinated replenishment, maintenance, and combat service supports

Operations Planning Officer (S-3) (2015–2016)

- Developed brigade-level infantry operational plans, conducted risk assessments, and established rules of engagement

Operations Planning Officer (S-3) (2014–2015)

- Developed battalion-level infantry operational plans, conducted risk assessments, and established rules of engagement for border security and DMZ operations

Platoon Leader (2013–2014)

- Commanded platoon-level units responsible for border security, readiness, training, and rapid response under established rules of engagement

Publications

[Published] Donghyun Ko, Juneyoung Bang (2022).
"Application of Response Surface Method on Non-linear System Optimization: Maximization of military microdrone's flight time." *Korean Management Science Review*, 39(1), 1–14. https://doi.org/10.7737/kmsr.2022.39.1.001

[Published & Classified] Donghyun Ko (2022).
"Building a model for predicting the success rate of a military operation with

the use of a variety of ML algorithms: Focusing on the phase of counter-attack." Army Future Innovation & Technology (36-981AGG-010534-06): 87–116

[Under-review] Donghyun Ko, Xiaolei Fang (2025).
"A Conditional Diffusion-Based Generative AI Model for Industrial Predictive Analytics." Under review at *Mechanical Systems and Signal Processing*. Preprint (SSRN): https://doi.org/10.2139/ssrn.6169178

[On-going] Donghyun Ko, Jacob Peloquin (2026).
"Risk-Aware Parameter Optimization for Metal Additive Manufacturing via Conditional Diffusion Model with Co-Registered Digital-Twin Data"

Talks & Other activities

[Oral Presentation] Diffusion Models for Robust RUL/TTF Prediction under Complex Degradational Process. AI4SE & SE4AI Research and Application Workshop, 17–18 September 2025, Washington, DC. Included in the official workshop report: AI4SE & SE4AI Final Report (2025).

[Oral Presentation] Application of Response Surface Methodology on Nonlinear system optimization. 1–2 November 2023, Daejeon, Korea, International Army Modeling and Simulation Conference

[Poster Presentation] Additive Manufacturing Process parameter optimization by generative AI. Graduate Student Research Symposium, North Carolina State University, April 15, 2026.

[Oral Presentation] A Conditional Diffusion-based Generative AI Model for Industrial Predictive Analytics. 16–19 May 2026, Arlington, TX, 2026 IISE Annual Conference & Expo

[Oral Presentation] Risk-Aware Parameter Optimization of Additive Manufacturing Process via Conditional Diffusion Model. 16–19 May 2026, Arlington, TX, 2026 IISE Annual Conference & Expo

A member of Institute of Industrial and Systems Engineers (IISE)

Appendix: Detailed Coursework

North Carolina State University **Ph.D.**

- Linear Programming (ISE 505); Statistical Models for System Analytics in ISE (ISE 537); Applied Stochastic Models (ISE 760); High-Dimensional Data Analysis (ISE 789); Manufacturing Processes (ISE 515); Human Factors System Design (ISE 540); Practical Machine Learning for Engineering (ISE 538); Fundamentals of Statistical Inference I–II (ST 501/502); Experimental Statistics for Engineers I–II (ST 515/516); Applied Bayesian Analysis (ST 540); Neural Networks (ECE 542); Algorithmic Methods in Nonlinear Programming (OR 506); Scientific Machine Learning (NE 795).

Texas A&M University **M.S.**

- Linear Programming; Nonlinear Programming; Distribution Theory; Stochastic Processes; Design of Experiments; Advanced Quality Control; Statistical Computing with R and Python; Engineering Data Analysis; Data Mining; Applied Numerical Analysis.

Korea Military Academy **B.A.**

- Introduction to Computers; Computer Networks; Computer Programming; Linear Algebra; Probability & Statistics; Calculus; Information Warfare; Fundamental Physics; Fundamental Chemistry; Introduction to Civil Engineering; Introduction to Mechanical Engineering; Weapon Systems Engineering; Social Science Research Methods (SPSS); Economics (Micro, Macro, Econometrics, International, Public, Industrial Organization); Cost & Benefit Analysis; Wargame Theory; National Defense Economics; etc.