

Junyong Bae, Ph.D.

c8523512@naver.com

50, UNIST-gil, Ulsan 44919, Republic of Korea

1996. 05. 13

Tel.: +82-10-4007-8090 / <https://github.com/JunyongBae>

EDUCATION

Ph. D. in Nuclear Engineering (Feb. 2025)

- Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea
- Dissertation: Deep Learning-based Optimized Simulation and Consequence Estimation with Neural Network Uncertainty for Dynamic Risk Assessment of Nuclear Power Plants
- Advisor: Prof. Seung Jun Lee

B.S. in Nuclear Science and Engineering (Feb. 2019)

- Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea
- Minor in Electrical Engineering
- Graduated with Cum Laude

WORK EXPERIENCES

Research Activities

- Development of the **autonomous operation** framework with future plant status predictions (2022-present)
- Development of the **cyber-attack detection** system monitoring NPP process parameters with deep-learning models (2022-present)
- Development of the **deep learning-based platform for dynamic probabilistic risk assessment (DPRA)** of NPPs
- Application of a **deep reinforcement learning (DRL) for autonomous NPP** start-up operation (2020 - 2022)
- Implementation of A.I techniques for **NPP major parameter prediction** and NPP operation validation system based on the prediction (2019 - 2020)
- Development of the reactor protection system test facility integrating **safety class software and hardware (i.e., PLC)** (2019)

Educational Activities

- **Teaching Assistant** | Nuclear Safety and Safety Culture (2022 - 2024)
- **Teaching Assistant** | NPP Accident Diagnosis using AI Techniques (2022), Introduction to Nuclear Reactor Operation (2021), and Nuclear Power Plant Instrumentation and Control Systems (2019, 2020)
- **Undergraduate Teaching Assistant** | General Physics II (2017, 2018)
- **Project Staff** | Nuclear Safety Preliminary Training Enhancement Program funded by Korea Foundation of Nuclear Safety (KoFONS) (2022-2025)

Professional Activities

- **Advisory Board Member** | SMR Virtual Reactor Project (2025-)

HONORS & AWARDS

- Grand Prize in the Best Oral Presentation Awards at ASRAM 2025 conference (2025)
- Outstanding Doctoral Dissertation Award (2025)
- Best Paper Award at 2024 KNS Fall Conference (2025)
- Best Student Paper Award at ISOFIG 2024 conference (2024)
- Best Paper Award at 2023 KNS Fall Conference (2024)
- KNS Doosan Enerbility Scholarship (2023)
- KNS Park Chang-kyu PSA Student Paper Award (2022)
- Excellence Award at the Nuclear-AI Convergence Case Study Presentation (2021)
- Best Paper Award at 2018 KNS Student Conference (2018)
- National Scholarship for Science and Engineering (2017–2018)

SCI PAPERS

1. **Junyong Bae**, Kyeong Seo Kim, Seung Jun Lee "Two-Stage Deep Learning Model for Nuclear Power Plant Parameter Trend Prediction with Epistemic Uncertainty Quantification", *Applied Soft Computing* (**Under review**)
2. Wooseok Jo, **Junyong Bae**, Dong-San Kim, Seung Jun Lee "Automatic Accident Sequence Generation using Optimized Simulations for Dynamic Probabilistic Safety Assessment", *Reliability Engineering & System Safety*
<https://doi.org/10.1016/j.ress.2025.111643>
3. Ji Hyeon Shin, **Junyong Bae**, Seung Jun Lee "An approach to validating abnormal event diagnoses with Explainable AI", *Progress in Nuclear Energy*, Vol. 189, November 2025 <https://doi.org/10.1016/j.pnucene.2025.105939>
4. **Junyong Bae**, Seung Jun Lee, "Current Progress in the Application of Artificial Intelligence for Nuclear Power Plant Operation", *Korean Journal of Chemical Engineering*, Vol. 41, August 2024 <https://doi.org/10.1007/s11814-024-00246-7>
5. **Junyong Bae**, Jae Min Kim, Seung Jun Lee, "Deep Reinforcement Learning for a Multi-Objective Operation in a Nuclear Power Plant", *Nuclear Engineering and Technology*, Vol. 55, June 2023 <https://doi.org/10.1016/j.net.06.009>
6. Jae Min Kim, **Junyong Bae**, Seung Jun Lee, "Strategy to coordinate actions through a plant parameter prediction model during startup operation of a nuclear power plant", *Nuclear Engineering and Technology*, Vol. 55, March 2023
<https://doi.org/10.1016/j.net.2022.11.012>
7. Ji Hyeon Shin, **Junyong Bae**, Jae Min Kim, Seung Jun Lee, "An Interpretable Convolutional Neural Network for Nuclear Power Plant Abnormal Events", *Applied Soft Computing*, Vol. 132, January 2023 <https://doi.org/10.1016/j.asoc.2022.109792>
8. Jeeyea Ahn, **Junyong Bae**, Byung Joo Min, Seung Jun Lee, "Operation Validation System to Prevent Human Errors in Nuclear Power Plants", *Nuclear Engineering and Design*, Vol. 397, October 2022 <https://doi.org/10.1016/j.nucengdes.2022.111949>
9. **Junyong Bae**, Jong Woo Park, Seung Jun Lee, "Limit Surface/States Searching Algorithm with a Deep Neural Network and Monte Carlo Dropout for Nuclear Power Plant Safety Assessment", *Applied Soft Computing*, Vol. 124, July 2022
<https://doi.org/10.1016/j.asoc.2022.109007>
10. **Junyong Bae**, Geunhee Kim, Seung Jun Lee, "Real-Time Prediction of Nuclear Power Plant Parameter Trends following Operator Actions", *Expert Systems with Applications*, Vol. 186, December 2021 <https://doi.org/10.1016/j.eswa.2021.115848>

11. **Junyong Bae**, Jeeyea Ahn, Seung Jun Lee, "Comparison of Multi-layer Perceptron and Long Short-Term Memory for Plant Parameter Trend Prediction", *Nuclear Technology*, Vol. 206, July 2020 <https://doi.org/10.1080/00295450.2019.1693215>

CONFERENCES

1. Wooseok Jo, **Junyong Bae**, Seung Jun Lee, "Dynamic risk assessment through automatic accident sequences generation using optimized simulation of nuclear power plants", AHFE International Conference Hawaii Edition, Honolulu, U.S. (2024. 12)
2. Kyeong Seo Kim, Wooseok Jo, **Junyong Bae**, Seung Jun Lee, "Optimized and Accelerated Simulation using Intermediate state Storage (OASIS) for Dynamic Probabilistic Safety Assessment", AHFE International Conference Hawaii Edition, Honolulu, U.S. (2024. 12)
3. Yoojoon Seung, **Junyong Bae**, Seung Jun Lee, "Integrating deep learning and tree-search algorithms for autonomous emergency management in Nuclear Power Plants", AHFE International Conference Hawaii Edition, Honolulu, U.S. (2024. 12)
4. **Junyong Bae**, Wooseok Jo, Kyeong Seo Kim, Seung Jun Lee, "Parameters Trend Prediction using Two-Stage Deep Learning Models to Capture their Predictive Uncertainty under Optimized Simulations", ISOFIC 2024, Jeju, Korea (2024. 12)
5. Wooseok Jo, **Junyong Bae**, Seung Jun Lee "Automatic Generation of Dynamic Event Tree for Accident Progression through Flexible Analysis of Optimized Simulations", ISOFIC 2024, Jeju, Korea (2024. 12)
6. Wooseok Jo, **Junyong Bae**, Seung Jun Lee, "Optimized Simulation-Driven Automatic Generation of Dynamic Accident Sequences for LOCA scenarios", KNS 2024 Fall, Changwon, Korea (2024. 10)
7. **Junyong Bae** and Seung Jun Lee, "Epistemic Uncertainty in Deep Learning Models and Its Application to Simulation Optimization and Consequence Parameter Trend Predictions for Dynamic Risk Assessment", KNS 2024 Fall, Changwon, Korea (2024. 10)
8. Kyeong Seo Kim, **Junyong Bae**, Wooseok Jo, Seung Jun Lee, "A Framework of Streamlined Simulation of Thermal-hydraulic Code for Dynamic Probabilistic Safety Assessment", KNS 2024 Fall, Changwon, Korea (2024. 10)
9. **Junyong Bae**, Ji Hyeon Shin, Seung Jun Lee, "Deep Autoencoding Gaussian Mixture Model for Detection of Manipulation Attacks on NPP Process Data", PSAM17&ASRAM2024, Sendai, Japan (2024. 10)
10. Wooseok Jo, **Junyong Bae**, Seung Jun Lee, "Automatic Accident Sequences Generation for Dynamic PSA", PSAM17&ASRAM2024, Sendai, Japan (2024. 10)
11. Donghee Jung, **Junyong Bae**, Seung Jun Lee, "Deep Learning Model for Predicting Future Trends of NPP Parameters with Accident Trend Predictor and Operator Action Impact Evaluator", PSAM17&ASRAM2024, Sendai, Japan (2024. 10)
12. Donghee Jung, **Junyong Bae**, Seung Jun Lee, "Two-stage prediction model of nuclear power plant parameter trends for preventing significantly erroneous predictions", KNS 2024 Spring, Jeju, Korea (2024. 05)
13. Yuneong Heo, **Junyong Bae**, Seung Jun Lee, "A framework of dynamic importance measure", ASRAM 2023, Kowloon Tong, Hong Kong (2023. 10)

14. Yunyeong Heo, **Junyong Bae**, Wooseok Jo, Seung Jun Lee, "Success Criteria Analysis using Deep Neural Network and Monte Carlo Dropout for Dynamic Probabilistic Safety Assessment", PSAM topical meeting, online (2023. 10)
15. **Junyong Bae**, Yunyeong Heo, Wooseok Jo, and Seung Jun Lee, "Postprocessing of Multi-dimensional Limit Surfaces Searched by a Deep Learning-based Algorithm", KNS 2023 Fall, Gyeongju, Korea (2023. 10)
16. Yunyeong Heo, **Junyong Bae**, Seung Jun Lee, "A Framework of Quantification for Dynamic Probabilistic Safety Assessment", KNS 2023 Fall, Gyeongju, Korea (2023. 10)
17. **Junyong Bae**, Donghee Jung, and Seung Jun Lee, "NPP Emergency Response Planning utilizing Tree Search Algorithm and Deep Learning Models", ESREL 2023, Southampton, United Kingdom (2023. 09) (Presentation only)
18. **Junyong Bae** and Seung Jun Lee, "Sensitivity Study about Hyperparameters of a Guided Simulation Algorithm with Deep Learning", ASRAM 2022, Daejeon, Korea (2022. 11)
19. **Junyong Bae** and Seung Jun Lee, "Application of Deep Reinforcement Learning for Multi-objective and Continuous Control of Reactor Coolant", KNS 2022 Fall, Changwon, Korea (2022. 10)
20. Jae Min Kim, **Junyong Bae**, Seung Jun Lee, "Comparison of Quantification Methods for Reflecting Limiting Conditions for Operation during Startup Operation of Nuclear Power Plants", ESREL 2022, Dublin, Ireland (2022. 08)
21. **Junyong Bae**, Jong Woo Park, Seung Jun Lee, "Deep learning for Guided Simulation of Scenarios for Dynamic Probabilistic Risk Assessment", PSAM 16, Honolulu, U.S. (2022. 06)
22. **Junyong Bae**, Jong Woo Park, Seung Jun Lee, "Uncertainty-aware Limit Surface Search Algorithm using Deep Neural Network", 2021 ANS winter, Washington DC, U.S. (2021. 12)
23. **Junyong Bae**, Jong Woo Park, and Seung Jun Lee, "Limit Surface Search Algorithm with Artificial Neural Network and Monte Carlo Dropout Uncertainty Quantification", PSA 2021, Online. (2021. 11)
24. **Junyong Bae**, Jong Woo Park, Seung Jun Lee, "Adaptive Sampling for Limit Surface Search using Deep Neural Network and Monte Carlo Dropout", KNS 2021 Fall, Changwon, Korea (2021. 10)
25. Jae Min Kim, **Junyong Bae**, Seung Jun Lee, "Development of Evaluation Method for Startup Operation of Nuclear Power Plants", KNS 2021 Fall, Online, Korea (2021. 10)
26. Jae Min Kim, **Junyong Bae**, Seung Jun Lee, "Comparison of Detection Time for Abnormality Diagnosis Model Using Two-stage Gated Recurrent Units", ICAPP 2021, Online (2021. 6)
27. **Junyong Bae**, Jae Min Kim, and Seung Jun Lee, "An Autonomous Pressure Controller based on Approximation of Action Value Function", 2020 KNS Fall, Online, Korea (2020. 12)
28. **Junyong Bae** and Seung Jun Lee, "Nuclear Power Plant Parameter Prediction

Strategy for Human Error Detection", 2019 ANS Winter Meeting, Washington D.C., USA (2019. 11)

29. **Junyong Bae** and Seung Jun Lee, "Framework for Operator Manipulation Validation System using Plant Parameter Prediction", 2019 KNS Fall, Go-yang, Korea (2019. 10)
30. **Junyong Bae** and Seung Jun Lee, "Application of Artificial Neural Network for Plant Parameter Forecasting", 2019 ANS Student Conference, Richmond, USA (2019. 4)
31. Jeeyea Ahn, **Junyong Bae** and Seung Jun Lee, "A Human Error Detection System in Nuclear Power Plant Operations", 2019 NPIC&HMIT, Orlando, USA (2019. 2)
32. **Junyong Bae** and Seung Jun Lee, "Operation Validation System through Time Series Forecasting by Artificial Neural Network", 2018 KNS Student Conference, Yeosu, Korea (2018. 10)

TRAINING

1. APR 1400 Simulator operating training by Korea Institute of Nuclear Safety (Daejeon, South Korea, 2022.08)
2. RELAP5, TRACE, RELAP/SCDAPSIM, MARS-KS training course (Barcelona, Spain, 2018. 06)