Inkee Jung

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SUMMARY

PhD in Mathematics with research expertise in geometry, topology, and hands-on experience in machine learning, AI applications, and designing end-to-end experiment pipelines. Proven ability to translate complex mathematical ideas into practical models, with proficiency in Python and TensorFlow. Seeking a research-driven role in AI, data science, or machine learning where mathematical depth and model interpretability are valued.

EDUCATION

Boston University, *PhD of Mathematics* **2020 - 2026**

- Geometric application to Data structure and machine learning, Topological Data Analysis, Fuzzy logic.
- Lectured in and led discussions for over 400 students across 9 semesters. Subjects taught include Calculus I, II, Multivariable Calculus, Complex analysis, Mathematical Statistics, Probability and Linear Algebra as Teaching Assistant & Lecturer

Yonsei University, *Bachelor of Science in Mathematics* **2020**

Selected Projects & Publications

Law of Learning Dynamics and Core of Learners – *Boston University, arXiv:2602.05026* **2026**

- Proposed entropy-routed ensemble (IMM) that improves CIFAR-10 robustness vs. a baseline ensemble and yields higher reliability (measured by total entropy 1.9782 to 0.2054 under strong adversarial attacks).
- Decomposed inputs into entropy-based core / out-of-core (safe/unsafe) regions and routed uncertain samples to specialists via a gating aggregator.
- Implemented the full pipelines: trained 8 base Keras models; generated APGD and AutoAttack adversarial samples (PyTorch/TF); selected domain-wise entropy thresholds on validation; fintuned specialists and evaluated IMM per domain.

Persistent Laplacian Diagrams – arXiv:2512.05463 **Spring 2025 – Present**

- Developed structure-aware representations (Persistent Laplacian features) to analyze geometry/topology of evolving data
- Defined signatures of Persistent Laplacian and developed analysis for the stability of Persistent Laplacian Diagram & Images
- Applying our method and design experiments on biomolecule, molecular dataset and GNN structure.

A Logifold Structure for Measure Space **2025**

- Developed Logifold theory, `atlas' geometric structure on topological measure space where each chart is a graph of (fuzzy) logical function and proved the universality theorem supporting broad representational coverage.
- Designed and implemented Logifold algorithms for domain/target-wise aggregation, and chart migration/specialization, enabling uncertainty-aware routing of predictions across charts.
- Validated on CIFAR-10 with an implemented Logifold structure, achieving ~24% improvement vs. the average ensemble
- Related publications:
  i) Jung, I., & Lau, S.-C. (2024). Logifold: A Geometrical Foundation of Ensemble Machine Learning. 2024 4th International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), 1–6
  ii) Jung, I., & Lau, S.-C. (2025). A Logifold Structure for Measure Space. Axioms, 14(8), 599.

Team Predicting Aviation Accident Severity - *The Erdős Institute* **Summer 2025**

- Developed ensemble models. Achieved F1 score of 0.459 (Extra Trees) in aircraft damage classification vs. 0.316 baseline (Majority) and delivered interpretable insights into accident severity.
- Led data extraction and cleaning by converting *.mdb* files to *.csv*, integrating event, aircraft, and sub-aircraft tables into a unified dataset; engineered, imputed, and prepared features for classification and regression.

SKILLS & CERTIFICATIONS

- Programming Languages, Skils & Platforms: Python, Tensorflow, Keras, PyTorch, Git
- Mathematical skills: Statistics and Probability, Optimization, Geometry and Topology, Topological Data Analysis
- Soft Skills: Experiment design, Collaboration, Analytical thinking, Research development, Problem-Solving
- ML Skills: Adversarial Robustness, Ensemble machine learning, Deep Learning, Uncertainty Quantification, Calibration
- Certifications: The Erdős Institute Data Science Boot Camp, Korean Certified Investment Manager

Leadership Experience

Directed Reading Program - *Boston University* **Spring 2023, Fall 2025**

- Mentored 2 undergraduate students through a 10-week research project, directing them into feasible research questions (riffle shuffles & Markov chains; Maxwell's equations via differential forms & Hodge Theory).
- Translated advanced probability and differential geometry into accessible, application-driven projects and weekly milestones to build conceptual and computational intuitions.