VU-ANH LE

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PROFESSIONAL INTERESTS & SKILLS

Professional Interests: Algorithms. Quantum Information Science
Programming Languages and Software: Python, C++, Java, MATLAB, Haskell, Lisp, Coq, Isabelle, Lean, Git

EDUCATION

Beloit College Beloit, Wisconsin
Bachelor of Science, Mathematics, GPA: 3.74/4.00 *Aug 2021 - May 2025*
Relevant Coursework: Mathematical Statistics, Differential Equations, Complex Analysis, Topology, Algorithm Design and Analysis, Data Mining

ARTICLES AND PREPRINTS

1. Le, Vu Anh and Dik, Mehmet, "Topology-Preserving Scaling in Data Augmentation," in *arXiv, Nov 2024*
2. Le, Vu Anh and Dik, Mehmet, "The Stability of Persistence Diagrams Under Non-Uniform Scaling," in *arXiv, Nov 2024*
3. Le, Vu Anh, and Dik, Mehmet, "How Analysis Can Teach Us the Optimal Way to Design Neural Operators," in *Proceedings of International Mathematical Sciences, Nov 2024*
4. Le, Vu Anh, and Dik, Mehmet, "A Mathematical Analysis of Neural Operator Behaviors," in *arXiv, Oct 2024*. (Accepted as a chapter to the book issue *Advances in Quantum Calculus and Functional Analysis*, CRC Press, Taylor & Francis Group)

RESEARCH EXPERIENCE

Google Research Remote
Student Researcher, B.S. *Aug 2024 - Present*

- **Research Advisors: Jake Garrison (Google Research)** and **Prof. Mehmet Dik (Beloit College)**.
- Developed a mathematical framework to analyze the behaviors of neural operators, focusing on these aspects:
  - **Stability:** Established bounds for neural operators using **Lipschitz continuity conditions**.
  - **Convergence:** Proved exponential convergence via the **Banach Fixed Point Theorem**.
  - **Clustering Behavior:** Analyzed long-term solution dynamics through **gradient flow interpretation**.
  - **Universality:** Extended the **Universal Approximation Theorem** and **Stone-Weierstrass Theorem** to demonstrate the approximation capabilities of neural operators.
- Provided **theoretical guarantees** on **stability, exponential convergence, and generalization**. Detailed results published in the following papers **1** and **2**.
- Applied the proposed framework in designing a case study model for solving complex partial differential equations. Compared with the state-of-the-art works e.g. DeepONet, it requires **15% fewer epochs**.

Massachusetts Institute of Technology Cambridge, Massachusetts
Intern, MIT Summer Research Program - General *June 2024 - Aug 2024*

- **Research Advisor: Prof. Haruko Murakami Wainwright.**
- Integrated two machine learning models, namely **Random Forest and Bidirectional LSTM,** into the Python-based computational chemistry library PyLEnM to monitor the behavior of toxic analytes.
- Achieved **97.7% accuracy** in predicting the time taken for analyte concentration to drop to safety levels. Outperformed baseline models e.g. linear regression and univariate LSTMs with accuracies between 70–85%.