Yaé Ulrich Gaba

Research · Teaching · Consulting

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Summary

Topologist and AI researcher. I develop mathematical methods for machine learning, teach them at the graduate level, and consult with organizations that need rigorous thinking applied to hard problems. Head of R&D at a technology startup, leading applied research with cross-industry experience in banking, energy, insurance, IT, and retail.

Education

PhD in Topology 2013–2017
University of Cape Town (UCT), Cape Town, South Africa
Thesis: Asymmetric topology and fixed point theory in generalized metric spaces

MSc in Pure & Applied Mathematics 2011–2013
African University of Science and Technology (AUST), Abuja, Nigeria

Experience

Head of R&D · AI Research & Innovation Lead 2025–present
AIRINA Labs, Kigali, Rwanda
Applied research bridging methodological innovation and operational deployment. Statistical modeling and ML across banking, energy, insurance, IT, and retail. AI research for the African continent.

Research Affiliate 2020–present
African Centre for Advanced Studies (ACAS), Yaoundé, Cameroon
Research in topology, data science, and machine learning. Mentoring African graduate students.

Research Associate 2021–2024
Quantum Leap Africa (QLA) | AIMS-RIC, Kigali, Rwanda
Topological methods in machine learning and data analysis. WoComToQC workshop organizer.

Postdoctoral Researcher 2017–2019
North-West University, South Africa
Fixed point theory and generalized metric spaces. Published in Topology and its Applications, JMAA, and Quaestiones Mathematicae.

Assistant Professor 2018–2020
IMSP (Institut de Mathématiques et de Sciences Physiques), Dangbo, Bénin
Teaching graduate courses in topology and analysis. Supervising MSc students.

Selected Publications

- C. M. Farrelly and Y. U. Gaba, *The Shape of Data: Geometry-Based Machine Learning and Data Analysis in R*, No Starch Press, 2024.
- D. K. Kadurha, D. J. L. Moutouo, and Y. U. Gaba, "Bellman Operator Convergence Enhancements in Reinforcement Learning Algorithms," arXiv:2505.14564, 2025.
- D. K. Kadurha and Y. U. Gaba, "Topological Foundations of Reinforcement Learning," arXiv:2410.03706, 2024.

- Y. U. Gaba and E. Karapınar, "Interpolative Kannan Contractions in T_0-Quasi-Metric Spaces," *Journal of Mathematics*, 2021.
- Y. U. Gaba, E. Karapınar, A. Petruşel, and S. Radenović, "New Results on Start-Points for Multi-Valued Maps," *Axioms*, 9(4):141, 2020.
- Y. U. Gaba and E. Karapınar, "A New Approach to the Interpolative Contractions," *Axioms*, 8(4):110, 2019.
- Y. U. Gaba, "Startpoints and (α, γ)-Contractions in Quasi-Pseudometric Spaces," *Journal of Mathematics*, 2014.

Skills

- **Mathematics:** Asymmetric Topology, Fixed Point Theory, Generalized Metric Spaces, TDA, Persistent Homology
- **Machine Learning & AI:** Geometric Deep Learning, Deep RL, Graph Neural Networks, Manifold Learning
- **Statistical Modeling:** Regression, Time Series, Bayesian Methods, Model Validation, Risk Modeling
- **Programming:** Python, R, PyTorch, TensorFlow, scikit-learn, GUDHI, Ripser, SQL
- **Tools:** Git, Docker, LaTeX, Linux, Jupyter, MLflow, GitHub Actions
- **Domains:** Banking, Energy, Insurance, IT, Retail, Quantitative Finance

Languages

French (native) · English (fluent)

Community & Service

- Workshop on Computational Topology & Quantum Computing (WoComToQC) — organizer
- Data Science Makers / AI.Technipreneurs — open-source ML teaching and outreach
- Data Science Africa — instructor and participant