Rinor Cakaj

PhD Candidate · Deep Learning

✉ cakajrinor@gmail.com | 🎂 January 28st, 1998 | 🏠 www.rinorcakaj.com | 🔲 rinorcakaj | 🔲 rinorcakaj

Summary

PhD Candidate in Deep Learning with a focus on improving Convolutional Neural Networks (CNNs) performance and a deep understanding of advanced architectures, including Transformers like Vision Transformers (ViT) and Large Language Models (LLMs). I bring over 4 years of Python experience and more than 3 years in PyTorch, with a solid foundation in TensorFlow. With five published papers and five patent submissions, I am excited to contribute my expertise to impactful AI projects in innovative tech environments.

Education

University of Stuttgart   *Stuttgart, Germany*

PhD Candidate in Deep Learning | Institute of Signal Processing and System Theory   *Sep. 2021 - Present*

- Focused on improving CNN performance for computer vision, developing techniques such as Weight Compander (WC), Spectral Batch Normalization (SBN), Spectral Wavelet Dropout (SWD), and Squeeze-and-Remember (SR) Block to improve generalization and accuracy.
- Developed the Mixture-of-Depths (MoD) technique for CNNs, optimizing computational efficiency by selectively processing relevant channels in feature maps (accepted at ACCV 2024). Key performance highlights:
  - Image Recognition (ImageNet): ResNet75-MoD matches ResNet50's accuracy with a 25% speed-up on CPU and 15% on GPU; ResNet86-MoD improves accuracy by 0.45%, with a 6% speed-up on CPU and 5% on GPU.
  - Semantic Segmentation (Cityscapes): FCN with ResNet86-MoD increases mIoU by 0.95% with similar computational costs.
  - Object Detection (Pascal VOC): Faster-RCNN with ResNet86-MoD raises mAP by 0.37% and AP50 by 0.4%, achieving a 10% CPU speed-up.
- Working with the Robert Bosch GmbH, under the supervision of Prof. Dr.-Eng. Bin Yang.

Technical University (TU) of Darmstadt   *Darmstadt, Germany*

M.Sc. Mathematics interdisciplinary Informatics   *Oct. 2019 - Aug. 2021*

- Advanced courses in mathematical optimization (Discrete Optimization, Nonlinear Optimization) and computer science (Statistical Machine Learning, Data Mining and Machine Learning, Artificial Intelligence).
- Minor in economics (Creating a Web Startup, Digital Transformations and Software & Digital Business).
- Master thesis: Exact Rule Learning via Boolean Compressed Sensing (1,3).
- GPA (German): 1,25

Technical University (TU) of Darmstadt   *Darmstadt, Germany*

B.Sc. Mathematics with Economics bilingual   *Oct. 2016 - Sep. 2019*

- Fundamentals in a broad range of mathematical areas (Analysis, Linear Algebra, Optimization, Stochastics, Numerical Analysis).
- Minor in economics (Micro- and Macroeconomics, Bookkeeping and Cost Accounting, Principles of Business Administration).
- Minor in computer science (Functional and Object-oriented Programming Concepts and Algorithms and Data Structures).
- Topic of bachelor thesis: Portfolio Optimization (1,3).
- GPA (German): 2,20

Work Experience

Quality Match GmbH   *Heidelberg, Germany*

Solution Architect   *Mar. 2025 – Present*

- Using AI-driven techniques to automatically evaluate and improve data quality for companies.

Fletza   *Stuttgart, Germany*

Co-Founder & Full Stack Developer   *Jan. 2025 – Present*

- An AI-driven platform that transforms lecture materials (PDF, Word, PPTX) into flashcards, quizzes, and exam questions.
- The platform uses the SM-2 algorithm (similar to Anki) for effective learning and offers exam simulations with automatic feedback.
- Learn more at `www.fletza.com`.

Robert Bosch GmbH   *Stuttgart, Germany*

PhD Candidate in Deep Learning | Division Cross-Computing Solutions (XC) in the field for
                                                                                              Sep. 2021 - Feb. 2025
Advanced Driver Assistance Systems (ADAS)

- Gained a deep understanding of advanced deep learning architectures, including Convolutional Neural Networks (CNNs), Transformers (such as Vision Transformers (ViT) and Large Language Models (LLMs)), as well as Recurrent Neural Networks (RNNs) like LSTMs.
- Authored five patents related to the novel methods developed during my PhD, with one already published and four currently under review.
- Onboarded and provided technical guidance to two PhD students in their initial phases.
- Collaborated with the University of Stuttgart under the supervision of Dr. rer. nat. Jens Mehnert.

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Ministry of Foreign Affairs and Diaspora, Republic of Kosovo *Pristina, Kosovo*

Diaspora Professional Engagement | Economic Division *15 Oct. 2024 - 31 Oct. 2024*

- Analyzed Kosovo's export and import data by product from 2010 to 2023, using Python for data processing.
- Developed recommendations to support Kosovo's economic policy, with insights drawn from tools like the BCG Matrix.

Segura & Jesberger GmbH *Frankfurt am Main, Germany*

Working Student | Family Office *Feb. 2018 - Aug. 2021*

- Digitized an annual capital market survey by coding a website using HTML, CSS, PHP, MySQL, and JavaScript, saving one month of work for a working student each year.
- Developed Python-based software for automatic portfolio verification, using OCR to extract tables from printed pages and compare them with Excel data, saving 16 hours of work each month.
- Developed automated data processing applications in Excel using VBA.

KPMG AG *Frankfurt am Main, Germany*

Working Student | CIO Consulting - Digital Strategy *Nov. 2017 - Jan. 2018*

- Researched technological trends to support digital strategy development, focusing on data-driven decision-making.
- Contributed to creating data and analytics training programs to enhance employee skills.

Publications

Conference Proceedings

[1] **CNN Mixture-of-Depths**
Rinor Cakaj, Jens Mehnert, Bin Yang
2024 Asian Conference on Computer Vision (ACCV), Hanoi, Vietnam

[2] **Spectral Wavelet Dropout: Regularization in the Wavelet Domain**
Rinor Cakaj, Jens Mehnert, Bin Yang
2024 International Conference on Machine Learning and Applications (ICMLA), Miami, Florida, USA

[3] **Squeeze-and-Remember Block**
Rinor Cakaj, Jens Mehnert, Bin Yang
2024 International Conference on Machine Learning and Applications (ICMLA), Miami, Florida, USA

[4] **Spectral Batch Normalization: Normalization in the Frequency Domain**
Rinor Cakaj, Jens Mehnert, Bin Yang
2023 International Joint Conference on Neural Networks (IJCNN), Goldcoast, Australia

[5] **Weight Compander: A Simple Weight Reparameterization for Regularization**
Rinor Cakaj, Jens Mehnert, Bin Yang
2023 International Joint Conference on Neural Networks (IJCNN), Goldcoast, Australia

Patents

Published Patents

[1] **Method for Regularizing a Neural Network**
Rinor Cakaj, Jens Mehnert, Bin Yang
No.: EP4343619, Date: 27 Mar. 2024, Assignee: Robert Bosch GmbH

Projects & Competitions

Bosch Hackathon - Capture the Flag (CTF) *HTB Platform*

Participant *7 Oct. 2024 - 10 Oct. 2024*

- Collaborating with a colleague on CTF challenges in web, forensics, reversing, OSINT, hardware, and crypto.
- Solved tasks such as SQL injection, template injection, XSS, and buffer overflow.
- Gained hands-on experience with Python, JavaScript (client- and server-side), Linux command line, and a basic understanding of the OWASP Top 10 vulnerabilities.

Stock Index Trend Prediction Tool

Personal Project   *Mar. 2023 - Present*

- Developed an end-to-end deep learning pipeline for stock index trend prediction, including automated web scraping with data integrity checks, data processing with rolling statistics and augmentation.
- Built a deep learning model using multi-scale convolutions for pattern recognition and BiLSTM layers for temporal dependencies.
- Worked independently, using a variety of tools and libraries:
  - Development Environment: JupyterLab, VS Code, Anaconda
  - Data Processing & Visualization: Pandas, NumPy, Plotly, Matplotlib, Scipy
  - Automation & Testing: Selenium, Pytest, Optuna
  - Model Tracking & Deployment: Weights & Biases, TensorBoard, Docker, Git
  - Documentation: Sphinx

Skills

Category	Skill	Level	Skill	Level
Programming	Python	●●●●●	C++	●●●○○
Deep Learning	PyTorch	●●●●●	Tensorflow	●●●●○
	Anaconda	●●●●○	TensorBoard	●●●●○
	CUDA	●●○○○		
Development & Documentation	Git	●●●●●	Docker	●●●○○
	VS Code	●●●●○	Sphinx	●●●○○
	Pytest	●●●○○		
Data Science	Pandas	●●●●○	NumPy	●●●●○
	Matplotlib	●●●●○	SQL	●●●○○
Languages	German	●●●●●	English	●●●●●
	French	●●○○○	Albanian	●●●●●

Courses

Leadership in Motion: Strategies for PhDs   *Stuttgart, Germany*

Dr. Franka Schröder   *9 Oct. 2023*

- Covered Google's Project Aristotle on effective team building.
- Participated in Delegation Poker to clarify decision-making roles.
- Practiced the Pendleton Feedback model for constructive feedback.

Science & Stories   *Stuttgart, Germany*

Rainer Holl   *21 Jul. 2023*

- Focused on storytelling techniques and structuring presentations effectively.
- Learned how to engage and interact with the audience.
- Participated in stage training, with a focus on body language and presence.

The Principles of Effective Leadership   *Stuttgart, Germany*

Frank Müller   *17 Oct. 2022 - 18 Oct. 2022*

- Explored team dynamics and challenges, and learned to motivate individuals based on their behavior.
- Addressed obstacles and conflicts during team processes.
- Reflect leadership style and enhanced it through feedback.

Scientific Writing: The PhD Thesis   *Stuttgart, Germany*

Dr. Katrin Bischl   *4 May 2022 - 5 May 2022*

- Covered PhD thesis structure and organization in scientific writing.

From PhD to Innovator   *Stuttgart, Germany*

Young Entrepreneurs in Science Innovation Coaches (Falling Walls Foundation)   *21 Apr. 2022 - 22 Apr. 2022*

- Engaged in ideation by identifying problems, formulating questions, developing solutions, and evaluating ideas.
- Practiced Design Thinking and Rapid Prototyping to test critical functions.

Fundamentals of Leadership   *Stuttgart, Germany*

Huntercoach   *15 Dec. 2021*

- Explored leadership mindset and its impact on team dynamics.
- Focused on receiver-oriented communication techniques.
- Covered the basics of situational leadership.
- Studied leadership principles based on the maturity model.

Volunteering

Erster Sindlinger Schwimm-Club 1901 e.V. *Frankfurt am Main, Germany*
Member of the Executive Board, Treasurer and Trainer *Jun. 2018 - Jun. 2022*

- Introduced and administered Office 365 to enhance collaboration between trainers and the board.
- Ordered and implemented electronic membership cards (RFID) with an access control system on a Raspberry Pi 4 using Python.
- Rewrote statutes and regulations for business, contributions, data protection, training, and honorary policies.
- Redesigned the website.
- Handled cash office responsibilities, including tax returns, bookkeeping, grant applications, collection of membership fees, compensation payments for exercise leaders, and donation processing.
- Taught children how to swim.