

# Murat Onur Yildirim

Doctoral Researcher / ML Scientist

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## Summary

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ML researcher specializing in making foundation models more practical to adapt, update, and serve on a scale throughout the machine learning lifecycle. 5+ years of experience spanning continual learning, parameter-efficient fine-tuning, and model compression, with methods published at TMLR, MLJ, and CoLLAs, deployed in a €20M EU edge-AI project, and delivering measured reductions of up to 570× in adaptation storage and 20× in update compute. International patent holder; end-to-end ownership from problem formulation to open-source, production-ready systems.

## Experience

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### Doctoral Researcher

2021 – Present

*AMOR/e Lab, TU Eindhoven, The Netherlands*

- Pioneered continual learning research within the group, advancing the lab's lifelong AI research agenda.
- Led two tasks within the €20M EU Horizon project SYNERGIES on edge AI for on-device annotation in CCAM systems, developing a tensor decomposition framework for efficient model compression and deployment under resource constraints.
- Developed state-of-the-art methods and benchmarks for continual pre-training and post-training of foundation models under distribution shifts, mitigating catastrophic forgetting in long-running training regimes while improving compute efficiency and reducing model size.
- Published 7 papers at premier AI journals and conferences (including TMLR, MLJ, CoLLAs, CPAL), with 3 oral presentations at top-tier continual learning venues.
- Supervised 5 MSc students from problem formulation to publication-ready implementations, contributing to continual learning and efficient adaptation projects.

### Research Assistant

2018 – 2021

*Suleyman Demirel University, Turkey*

- Published 3 peer-reviewed machine learning SCI-indexed journal articles for chemical science applications.
- Developed a deep learning-based railway monitoring system using computer vision and audio signals for automated anomaly detection and infrastructure inspection, leading to an international patent.
- Assisted in teaching 3 courses: Database Systems, Project Management, and Operations Management, with a total teaching load of 500+ hours.
- Coordinated departmental Erasmus exchange activities, managing students and academic mobility processes.

### Production and Operation Engineer

2017 – 2018

*4K Plastics, Turkey*

- Secured new business opportunities through customer acquisition and negotiations, contributing £120K in recurring monthly revenue.
- Designed and deployed an in-line quality-control system that reduced raw-material consumption by 15%, improved product consistency, and virtually eliminated customer claims and returns.
- Led 5S process optimization initiatives, redesigning plant layout and material flow to deliver 2× improvement in pallet loading efficiency and streamline dispatch operations.

## Technical Skills

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- **Expertise:** Continual Learning, Foundation Models, Parameter-Efficient Fine-Tuning, Model Compression
- **Programming:** Python, C/C++, SQL, Bash
- **ML Frameworks:** PyTorch, TensorFlow, JAX, Hugging Face, NumPy, SciPy, Pandas, OpenCV
- **MLOps & Infrastructure:** Docker, Ray, Weights & Biases, Git, Linux

## Portfolio

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### Parameter-Efficient Continual Adaptation of Foundation Models - [published in TMLR]

- Designed a sparse PEFT module (adapter + calibrator) acting only on the final [CLS] token of frozen Vision Transformers, adapting to each new task by training 147K parameters.
- Achieved state-of-the-art on all 6 benchmarks with  $8\times$  fewer trainable parameters and  $2.5\times$  faster runtime, with the largest gains under distribution shift and on out-of-distribution data.
- **Cut adaptation cost per model:** 60% less wall-clock, 2 GPU-hours saved per run, and checkpoints of 0.6 MB vs. 340 MB for a full model copy; at fleet scale (hundreds of per-customer variants), this projects to €500K+/yr in training and serving savings.

### Continual Post-Training of Streaming Updates for Foundation Models

- Built a dual-granularity adaptation system (global adapter and per-sample hypernetwork with EMA merging) that reduces continual learning to closed-form ridge regression using  $<1\%$  of backbone parameters.
- Achieved state-of-the-art on all 4 benchmarks with  $4\times$  lower update runtime and a fixed parameter budget, with the largest gains on out-of-distribution data.
- Introduced the offline-to-online evaluation protocol which closely mirrors production machine learning practice (multi-pass initial adaptation  $\rightarrow$  strictly single-pass streaming updates).
- **Cut update cost per model:** 75% less wall-clock per update than the efficient baselines, and  $30\times$  less than periodic full re-adaptation; at fleet scale (hundreds of deployed models and variants), this projects to €350K+/yr in training and serving savings by keeping a fixed footprint.

### Real-Time Learning System for Non-Stationary Data Streams - [published in CoLLAs]

- Built a brain-inspired online learning system that adapts a single fixed network to non-stationary streams via automatic drift detection and sparse concept cell allocation with no network expansion.
- Achieved state-of-the-art on all 10 benchmarks with zero added parameters and on-par runtime, reaching up to  $2.5\times$  the accuracy of the top baseline and near-zero forgetting.
- **Cut update cost per model:**  $20\times$  less compute than offline retraining with zero replay storage and model growth; at fleet scale (hundreds of deployed models on evolving data), this projects to €200K+/yr in training and storage savings by replacing periodic retraining with single-pass updates on a fixed footprint.

## Publications

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Top-tier venues including TMLR, MLJ, CoLLAs, CPAL. (*H-index: 6, Citations: 140+*)

- Unlocking [CLS] Features for Continual Post-Training (TMLR, 2026)
- Pruned Adaptation Modules: A Simple yet Strong Baseline for Continual Foundation Models (CPAL, 2026)
- Coresets are more than replay: a data-centric view of continual learning (NCAA, 2026)
- Automated Machine Learning for Unsupervised Tabular Tasks (MLJ, 2026)
- Self-Regulated Neurogenesis for Online Data-Incremental Learning (CoLLAs, 2025, **Oral**)
- Continual learning with sparse training: Exploring algorithms for effective model updates (CPAL, 2024, **Oral**)
- AdaCL: Adaptive Continual Learning (Continual Uncoference, 2023, **Oral**)

## Education

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### PhD in Deep Learning

2021– Present

TU Eindhoven, The Netherlands

Thesis - *Continual Adaptation Throughout the Model Lifecycle: From Pre-training to Post-training*

### MSc in Machine Learning

2018 – 2020

Suleyman Demirel University, Turkey

Thesis - *Machine Learning for Heart Disease Diagnosis: Feature Selection and Hyperparameter Optimization*

### BSc in Industrial Engineering

2013 – 2018

Antalya University of Science, Turkey

Thesis - *Process Failure Analysis of a Production Line with Data Mining and Simulation.*