Ege Çırakman

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Academics

Istanbul Technical University (ITU), Istanbul, Turkey *B.Sc., Control & Automation Engineering (Exp. June 2026)*
GPA: **3.71/4.00** | Department Rank: **1/101** (end of 2024)

TED Ankara College Foundation Private High School, Ankara, Turkey

Publications & Manuscripts

IMAGE 2025 (oral). E. Çırakman*, H. T. Erdinc*, F. J. Herrmann, *Efficient and scalable posterior surrogate for seismic inversion via wavelet score-based generative models.* Project page, paper (PDF).

- Proposed a conditional WSGM within an SBI pipeline; replaced DDPM-style sampling with EDM (Karras) scheduling; added wavelet factorization with per-scale normalization.
- Achieved ∼73% faster sampling and ∼50% lower GPU memory at matched fidelity.

ICML 2025. B. Kurtkaya, E. Çırakman, *et al. Dynamical phases of short-term memory mechanisms in RNNs.*
arXiv:2502.17433, ICML 2025 entry.

- Reveals two STM mechanisms (slow-point manifolds vs. limit cycles) producing stable neural sequences without periodic drive.
- Derives power-law scaling of the critical learning rate with delay; maps phase diagrams over learning rate, delay, and task design.

Physical Review X (accepted). F. Dinc*, E. Çırakman*,M. J. Schnitzer, H. Tanaka. *A ghost mechanism: An analytical model of abrupt learning.* arXiv:2501.02378.

- Identifies a ghost-induced transient bottleneck near a saddle-node remnant driving abrupt learning and timed working-memory delays.
- Derives the exact critical learning-rate law $\alpha^* \propto T^{-5}$ and a no-learning zone with oscillatory minima; trends validated across low- and full-rank RNNs.

ICIP 2024. C. Korkmaz, E. Çırakman, A. M. Tekalp, Z. Doğan. *Trustworthy SR: Resolving ambiguity in image super-resolution via diffusion models and human feedback.* arXiv:2402.07597, ICIP entry.

- Human-in-the-loop selection and ensembling for diffusion SR to form ambiguity-aware, trustworthy reconstructions.
- Shows PSNR/SSIM/LPIPS/DISTS can misalign with human trust under SR ambiguity; advocates preference-informed evaluation.

IEEE Big Data 2022. P. Ünal, E. Çırakman, *et al. A Big Data Application in Manufacturing Industry—Computer Vision to Detect Defects on Bearings.*
DOI: 10.1109/BigData55660.2022.10020608.

- Built and deployed *TC-VISION*: a real-time CNN-based optical inspection system with a hardware + big-data pipeline for rolling-bearing quality control.

Preprints / in preparation:

Heavy-Tailed Diffusion for Minority-Mode Coverage: heavier-tailed noise schedules for rare-structure coverage and class imbalance; initial results on well-log generation and rare geological features.

Curvelet-Adapted Diffusion & Curvelet Neural Operator: exploiting curvelet sparsity and directional anisotropy, 1D→2D guidance, and a pathway to 2D/3D inversion.

International Research Experience & Internship

Georgia Institute of Technology, Seismic Laboratory for Imaging and Modeling (SLIM) *Research Intern / Dec 2024–Present*

- Built a cascaded, multi-scale posterior surrogate in the wavelet domain; ported DDPM-style pipelines to EDM (Karras) scheduling for stability and speed.
- Generalized WSGM to the conditional setting by factorizing $p(\mathbf{x} \mid \mathbf{y})$ across scales; derived scale-wise objectives and reverse-SDE samplers with better-conditioned scores.
- Designed tail-robust diffusion schedules to capture minority/outlier modes; analyzed schedule–attention coupling for 1D well-log synthesis with 1D→2D guidance.
- Prototyped wavelet/curvelet-adapted diffusion and a Curvelet Neural Operator for geologically consistent samples.

Stanford University, CNC Program (Prof. M. J. Schnitzer; Dr. F. Dinc) *Research Intern / Jan 2024–Dec 2024*

- Formulated FORCE learning in a dynamical-systems framework; derived stability/chaos and memory–parameter scaling for RNNs; validated on timed working-memory tasks.
- Co-developed the ghost-mechanism theory; mapped slow-point vs. limit-cycle phases with large-scale diagnostics; identified critical learning-rate scaling and no-learning zones.
- Built reproducible pipelines showing that increasing trainable rank and reducing output confidence mitigate instabilities across low/full-rank RNNs.

National Research Experience & Internship

Koç University, KUIS AI Center (Prof. A. M. Tekalp) *Research Intern / 2021–Jan 2024*

- Customized SwinIR for single-image SR (attention/windowing, training/inference recipes, ablations) to strengthen a ViT baseline and benchmark capacity vs. fidelity.
- Implemented diffusion SR with human-in-the-loop selection and ensemble decoding; designed protocols using universal IQA alongside PSNR/SSIM/LPIPS/DISTS.

TEKNOPAR, Ankara *Researcher / 2022–2023*

- Built a real-time, patch-wise SVDD pipeline for anomaly detection on manufacturing.
- Implemented digital twins by integrating sensor telemetry with data-driven models for production monitoring.

Awards & Achievements

- McClelland Scholarship, Stanford University (2024).
- Top 0.7% in Turkey's national university entrance exam (YKS).
- SAUVC World Champion (2022) and RAMI Runner-up (2023), ITU AUV Team (vision + ROS).
- Teknofest AI Finalist (transportation with AI).

Projects

Cryptocurrency price forecasting with BERT+LSTM — Combined contextual embeddings with sequence models for short/long-horizon forecasts under high volatility.
ITU AUV Team — Built the vision pipeline and ROS integration for autonomous navigation.

Skills

Programming languages : Python(PyTorch,TensorFlow, OpenCV), C/C++, MATLAB
Other Software :AutoCAD,CUDA, Docker, Linux, ROS, Simulink, Devito, JUDI

Relevant Courses

Graduate/advanced: *Intro to Optimal Control*; *Discrete-Time Control & Formal Methods*; *Theoretical Machine Learning for EE*; *Control of Nonlinear Dynamic Systems.*