Berk Tınaz

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Research Interests

- **Multimodal Foundation Models**: post-training, evaluation, and improving reasoning
- **Generative AI**: diffusion and flow models for controlled generation, personalization, and inverse problems
- **Mechanistic Interpretability**: analyzing internals of diffusion, language, and unified multi-modal models

Education

- **University of Southern California (USC)** — Los Angeles, CA
  Ph.D. Candidate in Electrical and Computer Engineering; GPA: 4.00/4.00 — *Aug 2020 – Apr 2026*
  Master of Science in Electrical and Computer Engineering; GPA: 4.00/4.00 — *Aug 2020 – Dec 2022*
  Advisor: Prof. Mahdi Soltanolkotabi

- **Simons Institute for the Theory of Computing** — Berkeley, CA
  Visiting Graduate Student, "Modern Paradigms in Generalization" program — *Sep 2024 – Dec 2024*

- **Bilkent University** — Ankara, TR
  Bachelor of Science in Electrical and Electronics Engineering; GPA: 3.95/4.00 — *Sep 2016 – June 2020*
  Graduation Rank: 5/153

Research Experience

- **Amazon (Machine Learning Accelerator, Selling Partner Services)** — San Diego, CA
  Applied Scientist II. — *Apr 2026 - Current*
  - **Agentic AI**: Working on long term procedural memory implementation and evaluation for agents.

- **AI Foundations for Sciences Center (AIF4S) at USC** — Los Angeles, CA
  Research Assistant. Advisor: Prof. Mahdi Soltanolkotabi — *Jan 2022 - Apr 2026*
  - **Mechanistic Interpretability**: Explored emergence and time-evolution of concepts in diffusion models via sparse autoencoders (SAEs). Demonstrated steer-ability of these concepts to guide the image generation.
  - **Large Language Models**: Worked on improving LLMs via self-feedback and self-revision loops (i.e. without external verifier). Explored how self-generated negative trajectories can be utilized to improve reasoning capabilities of foundation models.
  - **Generative AI**: Worked on sample-adaptive latent diffusion posterior sampling for solving inverse problems, incorporating forward model information into training of diffusion models to ensure data-consistency, accelerating MRI reconstruction via transformer-convolution hybrid architecture.
  - **Machine Learning Theory**: Analyzed gradient descent dynamics of learning linear target functions with shallow ReLU networks.

- **Amazon (Machine Learning Accelerator, Selling Partner Services)** — Seattle, WA
  Applied Scientist Intern. Mentors: Na Zhang and Qiuying Lin — *May 2025 - Aug 2025*
  - Demonstrated compositional generalization capabilities of transformer models when trained on a synthetic "language" to perform arithmetic operations on sequence data.
  - Developed a novel approach for extracting use-case adaptive seller behavior embeddings from LLM hidden states. Evaluated the performance of LLM embeddings on various domain-specific downstream tasks.

- **Amazon (Machine Learning Accelerator, Selling Partner Services)** — San Diego, CA
  Applied Scientist Intern. Mentors: Kevin Chen and Hua Li — *May 2024 - Aug 2024*
  - Worked on knowledge injection into LLMs through continual pre-training with DoRA adapters and retrieval augmented generation (RAG). Performed multiple-choice question and human evaluations of the adapted models.

- **Signal Analysis and Interpretation Lab (SAIL) at USC** — Los Angeles, CA
  Research Assistant. Advisor: Prof. Shrikanth Narayanan — *Sep 2020 - Dec 2021*
  - Modeling and detection of personal attributes: Improved detection and classification performance of RetinaNet on OpenImages by augmenting the data with Mask-RCNN bounding box predictions.

- **National Magnetic Resonance Research Center (UMRAM)** Ankara, TR
  Undergraduate Researcher. Advisor: Prof. Tolga Çukur *Oct 2018 - Apr 2020*
  - Semi-supervised learning of accelerated multi-contrast MRI synthesis, undersampled across both contrast sets and k-space coefficients by leveraging randomized sampling masks across training subjects. Achieved competitive performance compared to fully-sampled training.
- **Imperial College London** London, UK
  Research Intern at iBUG. Advisor: Prof. Maja Pantic and Dr. Stavros Petridis *July 2018 - Sept 2018*
  - Contributed to the development of a novel audio-visual dataset, and detection of blinks and mouth openings in videos. Integrated a face detection algorithm to an existing face alignment tool which increased the performance over 45° poses.

Selected Publications

[1] **B. Tinaz**, C. Xie, and M. Soltanolkotabi, "When both layers learn: Training dynamics of representing linear models via relu networks," in *39th Annual Conference on Learning Theory (COLT)*, 2026.

[2] P. Arguello, **B. Tinaz**, M. S. Sepehri, and M. Soltanolkotabi, "Mosaicmri: : A diverse dataset and benchmark for raw musculoskeletal mri," in *submitted to the 40th Conference on Neural Information Processing Systems (NeurIPS)*, 2026.

[3] M. S. Sepehri, A. Mehradfar, **B. Tinaz**, S. Avestimehr, and M. Soltanolkotabi, "Athena: Adaptive test-time steering for improving count fidelity in diffusion models," in *submitted to the 40th Conference on Neural Information Processing Systems (NeurIPS)*, 2026.

[4] **B. Tinaz**, C. Xie, and M. Soltanolkotabi, "On the dynamics of learning linear functions with neural networks," in *to be submitted to the Transactions on Machine Learning Research (TMLR)*, 2026.

[5] **B. Tinaz**, Z. Fabian, and M. Soltanolkotabi, "Emergence and evolution of interpretable concepts in diffusion models," in *39th Conference on Neural Information Processing Systems (NeurIPS) [Spotlight]*, 2025.

[6] M. S. Sepehri, **B. Tinaz**, Z. Fabian, and M. Soltanolkotabi, "Hyperphantasia: A benchmark for evaluating the mental visualization capabilities of multimodal llms," in *39th Conference on Neural Information Processing Systems (NeurIPS)*, 2025.

[7] **B. Tinaz**, Z. Fabian, and M. Soltanolkotabi, "Emergence and evolution of interpretable concepts in diffusion models through the lens of sparse autoencoders," in *IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR) Workshops on VisCon and GMCV*, 2025.

[8] H. Gan, **B. Tinaz**, M. S. Sepehri, Z. Fabian, and M. Soltanolkotabi, "Conceptmix++: Leveling the playing field in text-to-image benchmarking via iterative prompt optimization," in *IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR) Workshop on GMCV*, 2025.

[9] Z. Fabian*, **B. Tinaz***, and M. Soltanolkotabi, "Adapt and diffuse: Sample-adaptive reconstruction via latent diffusion models," in *Forty-first International Conference on Machine Learning (ICML) [Spotlight]*, 2024. [Online]. Available: https://openreview.net/forum?id=V3OpGwo68Z.

[10] Z. Fabian, **B. Tinaz**, and M. Soltanolkotabi, "Diracdiffusion: Denoising and incremental reconstruction with assured data-consistency," in *Forty-first International Conference on Machine Learning (ICML)*, 2024. [Online]. Available: https://openreview.net/forum?id=ibwxzYCep9.

[11] Z. Fabian, **B. Tinaz**, and M. Soltanolkotabi, "Humus-net: Hybrid unrolled multi-scale network architecture for accelerated mri reconstruction," in *36th Conference on Neural Information Processing Systems (NeurIPS)*, 2022. [Online]. Available: https://arxiv.org/abs/2203.08213.

[12] M. Yurt, S. Dar, **B. Tinaz**, M. Ozbey, Y. Korkmaz, and T. Cukur, "A semi-supervised learning framework for jointly accelerated multi-contrast mri synthesis without fully-sampled ground-truths," in *29th annual meeting of International Society for Magnetic Resonance Imaging (ISMRM)*, Virtual Conference, May 2021.

[13] M. Yurt, **B. Tinaz**, M. Ozbey, S. U. H. Dar, and T. Çukur, "Semi-supervised learning of multi-contrast MR image synthesis without fully-sampled ground-truth acquisitions," in *Medical Imaging Meets NeurIPS*, Virtual Conference, Dec. 2020.

Honors and Awards

- **USC Viterbi Graduate Student Awards**: Received the "Best Research Assistant" award and was a finalist (top 3) for the William F. Ballhaus, Jr. Prize for Excellence in Graduate Engineering Research (Best Dissertation), 2026
- **Best Paper Honorable Mention (CVPR)**: Runner up for the best paper award at the 2nd Workshop on Visual Concepts (VisCon), 2025
- **Top Reviewer**: Recognized as a top reviewer for NeurIPS 2024 and ICML 2025 conferences.
- **Machine Learning Summer Schools**: Attended to CIFAR DLRL (2021), MLSS (2021), and Princeton ML Theory (2022) summer schools.
- **USC ECE Ph.D. Screening Exam**: Ranked 1^{st} among test takers, 2021
- **Bilkent University Graduate Research Conference (GRC)**: Best paper award for the publication "Semi-supervised learning of mutually accelerated multi-contrast MRI synthesis without fully-sampled ground-truth", 2021
- **USC Viterbi School of Engineering/Graduate School Fellowship**: Full tuition waiver & stipend during the first year of Ph.D. program, 2020
- **Bilkent University Comprehensive Scholarship and High Honor Student**: Full tuition waiver & stipend during the B.Sc. program. High honor student for 8 consecutive semesters, 2016-2020
- **IEEExtreme 11.0 Programming Competition**: Ranked 3^{rd} in Turkey as a team of three, 2017
- **Nationwide University Entrance Exam (LYS)**: Ranked 139^{th} among 2 million students in Turkey, 2016

Academic Service

- **Reviewer**: COLT '23, NeurIPS ('24, '25, '26), ICML ('24, '25, '26), AAAI '25, ICLR ('25, '26), ICCV '25, TMLR

Skills

- **Language**: English (fluent, TOEFL iBT: 109/120), Turkish (native)
- **Programming**: Python, MATLAB, LaTeX, C/C++, R
- **Libraries**: `PyTorch`, `transformers`, `numpy`, `pandas`, `matplotlib`, `scikit-learn`

Teaching Experience

- **University of Southern California (USC)** Los Angeles, CA
  Teaching Assistant
  - EE562 Random Processes in Engineering (Spring 2022): holding office hours and discussion sessions, preparing and grading homeworks and exams.
  - EE546 Mathematics of High-Dimensional Data (Fall 2023, Fall 2025): holding office hours, preparing homeworks.

Relevant Coursework

- EE503: Probability for Electrical and Computer Engineers (Fall 2020) → Grade: A
- EE510: Linear Algebra for Engineering (Fall 2020) → Grade: A
- EE562: Random Processes in Engineering (Spring 2021) → Grade: A
- EE517: Statistics and Data Analysis for Engineers (Spring 2021) → Grade: A
- CSCI699: Special Topics - Theory of Machine Learning (Fall 2021) → Grade: A
- CSCI699: Special Topics - Dynamics of Representation Learning (Spring 2022) → Grade: A
- EE546: Mathematics of High-Dimensional Data (Fall 2022) → Grade: A
- EE588: Optimization for the Information and Data Sciences (Fall 2022) → Grade: A
- CSCI699: Special Topics - Mathematical Foundations of Intelligent Autonomy (Fall 2023) → Grade: A
- DSO699: Modern Statistical Inference (Fall 2023) → Grade: A

Extracurricular Activities and Hobbies

- **USC Center for Undergraduate Research in Viterbi Engineering (CURVE) Program (2024-2025)**:
  - Mentoring CS undergraduates Woody Gan and Sarah Fan on improving concept mixing capabilities of diffusion models via TextGrad based prompt optimization.
- **USC exploreCSR Workshop Series on Computational Media Intelligence (2021)**:
  - Mentoring undergraduates through workshop series in computational media intelligence sponsored by Google Research.
- **Bilkent IEEE Student Branch Active Member (2016-2020)**:
  - "Road to University" Volunteer (2016-2017): Introducing engineering and campus life to high school students from all around Turkey.
  - Graphics Design Team: Made several posters for the events organized by the student branch of IEEE.
- **Hobbies**: Playing the piano and drums, Amateur Photography, Travelling, Hiking/Camping, Reading, Trekking