

MEHMET KEREM TURKCAN

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SUMMARY

Associate Research Scientist at Columbia University with 8+ years of experience building computer vision, multimodal, and scientific data systems for environments where latency, reliability, and real-world constraints matter. I lead research from data and model design through optimization, deployment, evaluation, and public release, with work spanning urban infrastructure, medical robotics, and connectome-scale neuroscience. My record includes systems deployed across major urban testbeds, publications at CVPR, ICML, ACM UIST, ACM/IEEE SEC, IEEE INFOCOM, and eLife, and open-source projects with 1,200+ combined GitHub stars.

SELECTED CONTRIBUTIONS

- ♦ **Real-world AI systems:** Lead multimodal perception and urban analytics efforts intended to scale across 900+ New York City intersections and the COSMOS PAWR, DataCity, and FAU MobIntel testbeds.
- ♦ **Frontier model deployment:** Created DART, a real-time open-vocabulary detector with TensorRT deployment, public weights, and 300+ GitHub stars; led UrbanOmniDetect, an oral paper at the CVPR 2026 DriveX Workshop.
- ♦ **Sponsored research:** Contributed proposal development, technical reporting, sponsor reviews, and engineering delivery across approximately \$30M in institutional research supported by NSF, DARPA, AFOSR, and Con Edison, with additional project support from NVIDIA and EmpireAI.
- ♦ **Open scientific platforms:** Built FlyBrainLab in TypeScript with Jupyter Lab integration, OrientDB-backed graph and ontology systems, large-scale query layer, retrieval and question answering workflows, GPU simulation, and interactive 3D visualization.
- ♦ **Teaching and mentorship:** Taught Columbia graduate deep learning courses, mentored Master's and high school researchers, and served as the main engineering instructor for CS3's Research Experience for Teachers in 2024–2026.

EXPERIENCE

- ♦ **Columbia University**, New York, NY Jul 2024 – Present
Associate Research Scientist, Civil Engineering & Engineering Mechanics
 - Lead large-scale applied AI projects in real-time video analytics, open-vocabulary and 3D perception, edge/VLM systems, urban digital twins, and medical robotics foundation models; manage shared high-performance computing and cross-team engineering.
 - Created DART, converting promptable frontier vision models into a real-time multiclass detector through shared backbone inference, batched decoding, adapter distillation, and TensorRT FP16 optimization.
 - Led UrbanOmniDetect, a calibration-free, view-agnostic monocular 3D detector for ego-vehicle, infrastructure, and aerial cameras, with public models and the UrbanOmniView dataset.
 - Contributed to Open-H-Embodiment and surgical world model research for healthcare robotics; developed public model assets for video generation, phase recognition, metric depth, and skills assessment.
 - Co-authored the ACM/IEEE SEC 2025 Best Paper on privacy-preserving urban safety analytics, ICML 2025 work on adaptive data collection, and 2026 papers at CVPR Workshops and IEEE INFOCOM.
 - Designed and led the engineering curriculum for three annual CS3 Research Experience for Teachers cohorts, translating current AI research into reproducible K–12 lesson plans and classroom projects.
- ♦ **Columbia University**, New York, NY Nov 2022 – Jul 2024
Postdoctoral Research Scientist
 - Built real-time digital twins of New York City intersections integrating object detection, multi-object tracking, trajectory forecasting, simulation, and safety warning generation.
 - Developed synthetic data and benchmarking systems for dense urban perception, including Boundless in Unreal Engine 5 and the Constellation high-altitude object detection dataset.
 - Built healthcare AI pipelines with Northwell Health collaborators for surgical phase recognition and automated endoscopy skill scoring, resulting in peer-reviewed journal publications and clinical presentations.
 - Mentored 11 Master's researchers and three high school researchers across computer vision, generative modeling, and urban analytics projects.
- ♦ **Columbia University**, New York, NY Jan 2023 – Dec 2023
Lecturer in Electrical Engineering
 - Designed and taught ECBM E4040 Neural Networks & Deep Learning and EECS E6691 Advanced Deep Learning, including lectures, coding assignments, exams, and conference-style final projects.
 - Co-taught VOA1 0003E Neural Networks and Deep Learning for the Columbia Video Network AI Executive Certificate in Fall 2022 and Summer 2023.

- ◇ **Columbia University**, New York, NY Jan 2017 – Oct 2022
Doctoral Researcher, Bionet Group
 - Co-created FlyBrainLab, an open computing platform for natural language exploration, graph querying, simulation, and visualization of connectome-scale neuroscience data.
 - Developed an early research agent architecture combining programmable ontologies, literature-linked entity retrieval, dense passage retrieval, biomedical BERT question answering, graph database tools, and executable scientific workflows.
 - Built scalable TypeScript and Python interfaces, OrientDB/NeuroArch query services, GPU-backed neural simulations, and interactive 3D tools used in open neuroscience research and education.
- ◇ **Columbia University and ArtGe Technologies** 2014 – 2016
Research and R&D Roles New York, NY and Istanbul
 - Developed deep learning systems for thermal camera infrastructure inspection, solar microgrid control, intelligent building forecasting, stadium-scale face recognition, and agricultural stereo vision.

EDUCATION

- ◇ **Columbia University**, New York, NY 2022
 - Ph.D. in Electrical Engineering; Systems Biology and Neuroengineering, GPA 4.10.
- ◇ **Columbia University**, New York, NY 2016
 - M.S. in Computer Science; Machine Learning and Thesis Track, GPA 3.97.
- ◇ **Istanbul Technical University**, Istanbul, Turkey 2015
 - B.S. in Electronics and Communication Engineering, GPA 3.75.

AWARDS AND RECOGNITION

- ◇ **Best Paper Award**, ACM/IEEE Symposium on Edge Computing 2025
- ◇ NVIDIA research grant, *Edge AI for Equitable and Safe Intersections in Urban Metropolises* 2025
- ◇ EmpireAI award, *AI Computing for Community, Health, Safety and Climate* 2025
- ◇ INRIX x MetroLab Challenge finalist 2025
- ◇ Columbia University Electrical Engineering Distinguished Teaching Award 2024
- ◇ Smart Cities North America Award winner in Transportation, IDC Government Insights 2023
- ◇ National Postdoc Appreciation Week Excellence Award, Columbia University 2023
- ◇ Herbert French Fellowship, Columbia University; Helmsley Fellowship, CSHL 2017–2019

SPONSORED RESEARCH CONTRIBUTIONS

Institutional award totals; dates indicate my period of contribution.

- ◇ **NSF Engineering Research Center for Smart Streetscapes (CS3)** (EEC-2133516) 2022 – Present
Research staff; research coordination, annual reporting, and sponsor reviews \$26M center award
 - Coordinate applied AI research and cross-team demonstrations across a five-institution center; present DART, UrbanOmniDetect, and related systems at annual NSF site visits.
- ◇ **NSF CPS: Hybrid Twins for Urban Transportation** (CNS-2038984) 2021 – Present
Technical, reporting, and sponsor review lead \$1.3M Columbia award
 - Led engineering delivery, prepared annual technical reports, and presented project reviews to NSF for traffic sensing, prediction, and digital twin systems spanning individual intersections and citywide operations.
- ◇ **DARPA Robust Learning in Brain Circuits of Synthetic Miniature Insects** (HR0011-19-9-0035) 2019 – 2020
Proposal and technical report contributor \$620K Columbia award
 - Proposal and technical report contributor; contributed to proposal development, authored project reports, and conducted grant-supported doctoral research on robust learning and executable brain circuit models.
- ◇ **AFOSR Foundations of Neuroinformation Processing** (FA9550-16-1-0410) 2017 – 2021
Grant-supported doctoral researcher \$1.11M Columbia award
 - Developed computational systems and models for phase- and spike-based neural information processing, including work underlying the FlyBrainLab platform.
- ◇ **NSF Collaborative Research: The Digital Fly Brain** (DBI-1544383) 2017 – 2019
Grant-supported doctoral researcher \$795K Columbia award
 - Engineered connectome data, graph query, simulation, and visualization capabilities for the open-source Fruit Fly Brain Observatory and FlyBrainLab systems.

- ◇ **Con Edison Underground Infrastructure and Public Safety Analytics (CU09-1331)** 2015 – 2016
Graduate Researcher; Amendments 21–23 Con Edison
- Developed theoretical models, implementations, and data processing pipelines for a Visual Data Capture pilot using thermal imagery, high-resolution photographs, and video of underground electrical structures; examined automated hotspot detection, inspection targeting, and estimation of avoided serious events.
- Extended the system with infrared camera data assimilation, equipment and cable density models, temperature differential extraction along cable lengths, and visual features associated with later failures; delivered project outputs to Con Edison.
- Contributed cost-benefit and portfolio optimization analysis for secondary public safety programs.

SELECTED SOFTWARE AND DATA

- ◇ **DART:** Real-time open-vocabulary detection; PyTorch, TensorRT, distillation, public weights, and deployment benchmarks.
- ◇ **UrbanOmniDetect:** Calibration-free monocular 3D detection with public models and the UrbanOmniView multi-view dataset.
- ◇ **Loom:** Analytical looped-transformer computer with C compilation, ONNX/WebGPU demos, FPGA verification, and 140+ tests.
- ◇ **FlyBrainLab:** Natural language and ontology interfaces, OrientDB graph querying, GPU simulation, and 3D scientific visualization.
- ◇ **Boundless:** Unreal Engine 5 synthetic data pipeline and datasets for infrastructure and aerial object detection.
- ◇ **bikeped:** Real-time fisheye perception, safety alerts, simulator scenarios, and conformance testing for urban intersections.
- ◇ **GPTune:** Early GPT-2 fine-tuning and sampling toolkit for custom language model adaptation.

SELECTED PUBLICATIONS AND PREPRINTS

1. **Calibration-Free View-Agnostic Monocular 3D Object Detection for Urban Scenes.** Mehmet Kerem Turkcan, D. Gumaste, and Z. Kostic. *CVPR Workshops (DriveX), oral presentation, 2026.*
2. **Worst-Case Attacks in Reactive Edge-Cloud Systems: Expected Latency and SLA Violation.** J. Tavori, Mehmet Kerem Turkcan, Z. Kostic, J. Ghaderi, and G. Zussman. *IEEE INFOCOM, 2026.*
3. **Digital Eyes on the Road: Using Street Cameras to Verify Traffic Integrity and Detect Sybil Attacks at City Scale.** J. Tavori, Mehmet Kerem Turkcan, Z. Kostic, S. Stolfo, and G. Zussman. *USENIX VehicleSec, to appear, 2026.*
4. **Open-H-Embodiment: A Large-Scale Dataset for Enabling Foundation Models in Medical Robotics.** N. Nelson, J.-T. Chen, J. Haworth, et al., including Mehmet Kerem Turkcan. *arXiv:2604.21017, 2026.*
5. **A Real-Time Bike-Pedestrian Safety System with Wide-Angle Perception and Evaluation Testbed for Urban Intersections.** Mehmet Kerem Turkcan. *arXiv:2604.17046, 2026.*
6. **Loom: A Scalable Analytical Neural Computer Architecture.** Mehmet Kerem Turkcan. *arXiv:2604.08816, 2026.*
7. **Detect Anything in Real Time: From Single-Prompt Segmentation to Multi-Class Detection.** Mehmet Kerem Turkcan. *arXiv:2603.11441, 2026.*
8. **A Vision-Based Analysis of Congestion Pricing in New York City.** Mehmet Kerem Turkcan, J. Tavori, J. Ghaderi, G. Zussman, Z. Kostic, and A. Smyth. *arXiv:2602.03015, 2026.*
9. **Harnessing Floating Car Data, Traffic Camera Observations, and Network Flow Analysis for Traffic Volume Estimation.** A. Kosikova, Mehmet Kerem Turkcan, A. Darrat, and A. Smyth. *arXiv:2605.09891, 2026.*
10. **Computer Vision Scoring of Endoscopically Traced Line Figures in an Inanimate Scope Tip Coordination Training Model.** N. Mitra, S. Narasimhan, Mehmet Kerem Turkcan, et al. *Surgical Endoscopy, 2026.*
11. **Real-Time Video Analytics for Urban Safety: Deployment over Edge and End Devices.** M. Ghasemi, Y. Fu, X. Ouyang, P. Wang, Mehmet Kerem Turkcan, et al. *ACM/IEEE SEC, Best Paper Award, 2025.*
12. **Adaptive Data Collection for Robust Learning Across Multiple Distributions.** C. Zang, Mehmet Kerem Turkcan, G. Zussman, Z. Kostic, and J. Ghaderi. *ICML, 2025.*
13. **Distributed VLMs: Efficient Vision-Language Processing through Cloud-Edge Collaboration.** Y. Li, D. Gumaste, Mehmet Kerem Turkcan, J. Ghaderi, G. Zussman, and Z. Kostic. *IEEE PerCom Workshops, 2025.*
14. **Towards Suturing World Models: Learning Predictive Models for Robotic Surgical Tasks.** Mehmet Kerem Turkcan, M. Ballo, F. Filicori, and Z. Kostic. *arXiv:2503.12531, 2025.*
15. **StreetNav: Leveraging Street Cameras to Support Precise Outdoor Navigation for Blind Pedestrians.** G. Jain, B. Hindi, Z. Zhang, et al., including Mehmet Kerem Turkcan. *ACM UIST, 2024.*

16. **Boundless: Generating Photorealistic Synthetic Data for Object Detection in Urban Streetscapes.** Mehmet Kerem Turkcan, Y. Li, C. Zang, J. Ghaderi, G. Zussman, and Z. Kostic. *arXiv:2409.03022*, 2024.
17. **A Programmable Ontology Encompassing the Functional Logic of the Drosophila Brain.** Mehmet Kerem Turkcan, A. A. Lazar, and Y. Zhou. *Frontiers in Neuroinformatics*, 2022.
18. **Accelerating with FlyBrainLab the Discovery of the Functional Logic of the Drosophila Brain.** Mehmet Kerem Turkcan, A. A. Lazar, T. Liu, and Y. Zhou. *eLife*, 2021.

TEACHING AND CURRICULUM LEADERSHIP

- ♦ **Main Engineering Instructor, CS3 Research Experience for Teachers** 2024 – 2026
Center for Smart Streetscapes New York, NY
 - Designed and led a four-week curriculum covering neural networks, model evaluation, computer vision, object tracking, generative AI, annotation, YOLO training, and edge deployment; supported teachers in producing classroom-ready lesson plans.
- ♦ **Lecturer, Columbia University** 2022 – 2023
Advanced Deep Learning; Neural Networks and Deep Learning New York, NY
 - Taught EECS E6691, ECBM E4040, and VOA1 0003E across Fall 2022, Spring 2023, Summer 2023, and Fall 2023.
- ♦ **Course and Teaching Support, Columbia University** 2017 – 2021
Computational neuroscience and neuroengineering courses New York, NY
 - Supported Computing with Brain Circuits of Model Organisms, Fruit Fly Brain as a Neuroinformation Processor, and Computational Neuroscience.

SELECTED PRESENTATIONS

- ♦ **CS3 NSF Annual Site Visit** May 12–15, 2026
DART and UrbanOmniDetect research demonstrations Columbia University
 - Presented multiple live applied AI systems during the center’s annual NSF review.
- ♦ **From Sensors to Systems: Real-Time Traffic Analysis for Faster Decision-Making** Feb. 5, 2026
Panelist, CS3 Innovation Summit Columbia University
 - Discussed real-time sensing, edge AI, and operational urban analytics for faster public-sector decision-making.
- ♦ **Port Authority Tomorrow Summit** Jan. 7, 2026
Workshop host World Trade Center, New York
 - Led a technology workshop at the Port Authority of New York and New Jersey headquarters.
- ♦ **Evaluating Micromobility & Dangerous Riding Behaviors** Nov. 19, 2025
Eighth Annual Vision Zero Research on the Road New York, NY
 - Presented camera-based methods for evaluating micromobility patterns and dangerous riding behavior to New York City transportation stakeholders.
- ♦ **FlyBrainLab: An Interactive Open Computing Platform** Nov. 2020
PyData Global Online
 - Presented the platform’s graph query, neural simulation, and interactive scientific computing architecture.

PROFESSIONAL SERVICE

Peer reviewer: CVPR 2026; ICML 2026; ICMLA 2026; WACV 2025; ACM MobiCom 2024; IEEE/ACM ToN; IEEE TVLSI; Sensors, Electronics, and Smart Cities (MDPI).

TECHNICAL SKILLS

- ♦ **AI and deployment:** PyTorch, JAX, TensorFlow, Hugging Face, TensorRT, ONNX, WebGPU, NVIDIA Jetson; detection, tracking, 3D perception, VLM/VLA systems, RAG, agents, diffusion, and world models.
- ♦ **Languages, systems, and data:** Python, C/C++, CUDA, TypeScript/JavaScript, SQL, MATLAB; OrientDB, RPC, distributed querying, HPC, Docker, GitHub Actions; large-scale data collection and annotation, synthetic data, Unreal Engine 5, JupyterLab, Three.js/WebGL, scientific visualization, and Adobe Creative Suite.