Antonios Tragoudaras

https://antragoudaras.github.io/ | antragoudaras | Antonios-Tony-Tragoudaras

Education

University of Amsterdam (UvA) *Amsterdam, Netherlands*

MSc in Artificial Intelligence Aug. 2023 - Present

GPA: 8.28/10 - In track to graduate with cum-laude (highest distinction).

Thesis Project: Physics-Based Dynamics: Quantifying and Instilling Physics-Cognition of Visual Foundation Models (VFMs).

ELLIS MSc Honors Student.

King Abdullah University of Science and Technology (KAUST) *Jeddah, Saudi Arabia*

Visiting Student & Research Assistant in Electrical and Computer Engineering Aug. 2022 - Aug. 2023

Interdisciplinary Research and published in top-tier Journals & Conferences.

Projects on Neural Arcitecture Searh, Efficient Deep Learning & TinyML, Voice Acitvity Detection, and Visual Perception for Autonomous Driving Applications.

University of Thessaly *Volos, Greece*

BEng in Electrical & Computer Engineering (5-years studies; 300ECTS) Sep. 2016 - Nov. 2021

Thesis Grade: 10/10 (Excellent),GPA:Upper Second-Class Honors.

Undergrad. Research Project: Design Space Exploration of MobileNetV2 and inference acceleration on FPGAs.

Research Experience

Physics-Based Dynamics *University of Amsterdam (UvA) / Institute of Science & Technology (ISTA)*

MSc thesis project @ UvA supervised by: Professor Efstratios Gavves.

Academic visitor @ ELLIS IST Austria co-supervised by: Francesco Locatello. Feb. 2025-Present

Description/Goals:

- Leveraging insights from previous research experience, to address fundamental challenges in evaluating physical-reasoning beyond mere semantic and geometric adherence.
- Learn symbolic representations from both in-the-wild and synthetic data capturing the underling physics intrinsics corresponding to objects and environments. The distilled knowledge can serve as coarse signal that can be refined with generative modeling and guide Visual Foundation Models (VFMs) towards more plausible dynamics understanding.

Physical Reasoning of Video Generative Models (VGMs) *University of Amsterdam (UvA)*

Quantifying physics-cognition as an emergent property in video generative modeling.

Pre-print available in arXiv. Research Project under the supervision of Efstratios Gavves. Jul.2024- Feb. 2025

Duties/Tasks:

- Real-world dataset: Capturing simple Newtonian dynamics (falling ball, projectile motion, chaotic pendulum) from real-world controlled experiments.
- Assessing the physical reasoning and plausibility inherent in contemporary Video-Generative (world) Models (VGMs), like COSMOS.
- 10k generated videos: Conditioned the sampling process of four contemporary diffusion-based video generative models (trained with (conditional) flow-matching objectives) on either single or multiple frame(s) for inferring real-world initial conditions (like velocity and acceleration).
- Trajectory Extraction Pipeline: Key aspect for extracting relevant physical information from both real and generated videos. Calculating the 3D trajectory of objects over time/frames, using self-supervised methods in a zero-shot fashion, building upon Vision Foundational Models (for automated object segmentation and open-vocabulary trackers).
- Going beyond mere pixel-to-pixel evaluation, with the introduction of dynamical and physical invariance scores, for deriving interpretable metrics and faithfully assess the physical reasoning and consistency of VGMs.

Key Findings:

- Current video generative models often fail to accurately represent physical laws, generating implausible behaviors despite visually realistic and aesthetic outputs.
- MORPHEUS serves as a stepping stone in understanding and addressing the domain gap as to transform generative models into world models with reliable physical cognition capabilities.

Visual Perception for Autonomous Vehicles - Brightskies Inc. *External Collaboration*

Remote Collaboration, monitored by Mahmoud Serour (Autonomous Driving Team Lead - CTO of BrightDrive) and Mohamed Ezzat (Perception Engineer in Brightskies Inc.). Collaboration Initiated by Research Scientist Hakim Ghazzai (AI Team Lead of our research group). Mar.2023-Jun.2023

Duties/Tasks:

- Combining methods for fusing different perception sensor modalities used in autonomous cars, targeting to acquire better accuracy in downstream tasks.
- Multi-Task Learning Hydra network with multiple heads, each corresponding to a different downstream task, to achieve real-time performance on computationally constrained systems.

Neural Architecture Search, Meta-Heuristic Optimization, Transformers for Brain Signal Decoding *King Abdullah University of Science and Technology (KAUST)*

Graduate Student in applied AI, supervised by Postdoc Fellow Charalampos Antoniadis. Sep. 2022 - Feb.2023

Projects/Publications:

- Enhancing DNN models for EEG/ECoG BCI with a Novel Data-Driven Offline Optimization Method.
- Data-Driven Offline Optimization of Deep CNN Models for EEG and ECoG Decoding.

AutoML, Efficient Deep Learning Techniques, and Voice Activity Detection *VSPR - KAUST*

Visiting Student Research Intern, mentored by Postdoc Fellow Charalampos Antoniadis Feb. 2022 - Jul. 2022

Projects/Publications:

- TinyML for EEG Decoding on Microcontrollers.
- Audio-visual Speaker Diarization: Improved Voice Activity Detection with CNN based Feature Extraction.

Accelerating Inference of Deep Neural Networks on FPGAs *University of Thessaly*

Undergraduate-Researcher, Thesis project mentored by Prof. George Stamoulis and Postdoc Fellow George Floros Jul. 2021 - Jan. 2022

Journal Publication:

- Design Space Exploration of a Sparse MobileNetV2 Using High-Level Synthesis and Sparse Matrix Techniques on FPGAs (MDPI Sensors'22)

Publications

Full list is available at Google Scholar

[1] C. Zhang, D. Cherniavskii, A. Zadaianchuk, **A. Tragoudaras**, et al. ... E. Gavves. "MORPHEUS: Benchmarking Physical Reasoning of Video Generative Models with Real Physical Experiments in arXiv 2504.02918.

[2] **Antonios Tragoudaras**, Charalampos Antoniadis, Yehia Masoud. "Enhancing DNN models for EEG/ECoG BCI with a Novel Data-Driven Offline Optimization Method," in *IEEE Access, vol. 11, pp. 35888-35900, 2023*, doi: 10.1109/ACCESS.2023.3265040

[3] **Antonios Tragoudaras**, Charalampos Antoniadis, Yehia Masoud. "TinyML for EEG Decoding on Microcontrollers," in

[4] Konstantinos Fanaras, **Antonios Tragoudaras**, Charalampos Antoniadis, Yehia Masoud. "Audio-visual Speaker Diarization: Improved Voice Activity Detection with CNN based Feature Extraction," in *2022 IEEE 65th International Midwest Symposium on Circuits and Systems (MWSCAS), Fukuoka, Japan, 2022, pp. 1-4*2023 IEEE 56th International Symposium on Circuits and Systems (ISCAS)]

[5] **Antonios Tragoudaras**, Pavlos Stoikos, Konstantinos Fanaras, Athanasios Tziouvaras, George Floros, Georgios Dimitriou, Kostas Kolomvatsos, Georgios Stamoulis. "Design Space Exploration of a Sparse MobileNetV2 Using High-Level Synthesis and Sparse Matrix Techniques on FPGAs," in *MDPI Sensors 22, no. 12: 4318]*

Awards and Honors

Dec. 2024 - Present ELLIS MSc Honours Program: Award and funding for excellent MSc students to conduct their thesis under their joint supervision of UvA ELLIS unit at an ELLIS partner institution outside of the Netherlands. *UvA IvI*

Aug. 2022- Aug. 2023 **KAUST Graduate Fellowship**: Full tuition support, living allowance, housing, and medical coverage. *KAUST*

Teaching Experrience

Graduate Teaching Assistant at UvA's MSc AI Program *UvA, Amsterdam, Netherlands*

Assisted in teaching graduate-level (first-year) courses by making sure students understood the material, answering their questions, creating assignments, giving feedback, and grading exams. Aug. 2024 - Present

Courses:

- Computer Vision 1 (MSc AI) (Aug. 2024 - Oct.2024)
- Deep Learning 1 (MSc AI) (Oct. 2024- Dec.2024)
- Fairness, Accountability, Confidentiality & Transparency in AI (MSc AI) (Jan. 2025 - Feb. 2025)
- Information Retrieval 1 (MSc AI) (Feb.2025 - Mar. 2025)