Jiachen Lu

Major: Statistics / Electronic and Computer Engineering
Citation: 2300+
Master Student, School of Data Science, Fudan University
Transformer Theory, 3D vision, Autonomous Driving, HD-Maps, 2D/3D generation

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Education

•University of Michigan-Shanghai Jiao Tong University Joint Institute *2017.09 - 2021.08*
B.Eng. in Electronic and Computer Engineering (English immersion) GPA: 3.67, Ranking: 11/148

•Fudan University *2021.09-2024.06 (Expected)*
Master student of Statistics Instructor: Dr. Li Zhang

•Berkeley DeepDrive and Berkeley AI Research (BAIR) *2023.9-present*
Research internship. With: Chenfeng Xu, Dr. Wei Zhan, Prof. Masayoshi Tomizuka
– 3D auto-labeling tool from RGB videos.

Publications / Accepted Papers

[1] Sixiao Zheng, **Jiachen Lu**, Hengshuang Zhao, Xiatian Zhu, Zekun Luo, Yabiao Wang, Yanwei Fu, Jianfeng Feng, Tao Xiang, Philip HS Torr, Li Zhang. Rethinking semantic segmentation from a sequence-to-sequence perspective with transformers. In *CVPR*, 2021..
[2] **Jiachen Lu**, Jinghan Yao, Junge Zhang, Xiatian Zhu, Hang Xu, Weiguo Gao, Chunjing Xu, Tao Xiang, Li Zhang. In *NeurIPS*, 2021..
[3] **Jiachen Lu**, Zheyuan Zhou, Xiatian Zhu, Hang Xu, Li Zhang. Learning Ego 3D Representation as Ray Tracing. In *ECCV*, 2022..
[4] Qiang Wan, Zilong Huang, **Jiachen Lu**, Gang Yu, Li Zhang. SeaFormer: Squeeze-enhanced Axial Transformer for Mobile Semantic Segmentation. In *ICLR*, 2023..
[5] Jiaqi Chen, **Jiachen Lu**, Xiatian Zhu, Li Zhang. Generative Semantic Segmentation. In *CVPR*, 2023..
[6] Zheyuan Zhou, **Jiachen Lu**, Yihan Zeng, Hang Xu, Li Zhang. SUIT: Learning Significance-guided Information for 3D Temporal Detection. In *IROS*, 2023..
[7] **Jiachen Lu**, Renyuan Peng, Xinyue Cai, Hang Xu, Hongyang Li, Feng Wen, Wei Zhang, Li Zhang. Translating Images to Road Network: A Non-Autoregressive Sequence-to-Sequence Approach. In *ICCV*, 2023..

Research Experiences

•Rethinking semantic segmentation from a Sequence2Sequence Perspective with Transformers [1] ***CVPR 2021***
*Sixiao Zheng, **Jiachen Lu**, ..., Tao Xiang, Philip HS Torr, Li Zhang. Fudan University, University of Oxford.*

– Cited by 2100+. Recognized as one of the most notable contributions at CVPR 2021.
– **Pioneered** the introduction of Vision Transformer to segmentation, driving advancements in Vision Transformer.
– Project page: https://github.com/fudan-zvg/SETR.

•SOFT: Softmax-free Transformer with Linear Complexity [2] ***NeurIPS 2021***
***Jiachen Lu**, Jinghan Yao, ..., Tao Xiang, Li Zhang. Fudan University, University of Surrey.*

– NeurIPS 2022 **Spotlight (<5%)**, cited by 88.
– Identified limitations in existing self-attention approximations rooted in softmax-based self-attention.
– Introduced the Gaussian kernel function to replace dot-product similarity, enabling low-rank matrix decomposition for self-attention.
– Project page: https://github.com/fudan-zvg/SOFT.

•Learning Ego 3D Representation as Ray Tracing [3] ***ECCV 2022***
***Jiachen Lu**, Zheyuan Zhou, ..., L Zhang. Fudan University, University of Surrey*

– Introduced a novel architecture for deriving 3D ego representations from multiple unconstrained camera views, inspired by ray tracing principles.
– Developed a polarized grid of "imaginary eyes" for learnable 3D representation, leveraging an adaptive attention mechanism and 3D-to-2D projection.
– Project page: https://fudan-zvg.github.io/Ego3RT/.

•Translating Images to Road Network: A Non-Autoregressive Sequence-to-Sequence Approach [7] ***ICCV 2023***
***Jiachen Lu**, Renyuan Peng, ..., Li Zhang. Fudan University.*

– ICCV 2023 **Oral (<5%)** Presentation.

– Addressed the challenge of integrating Euclidean and non-Euclidean data structures essential for road network.
– Established a unified representation by projecting both types of data domains into an integer series.
– Boosted efficiency with a 50× acceleration using non-autoregressive dependencies, while also achieving a 7% performance improvement.
– Project page: https://github.com/fudan-zvg/RoadNetworkTRansformer.

•Softmax-free Linear Transformers ***IJCV*** *Major Revision*

Jiachen Lu*, Junge Zhang, ..., Li Zhang. Fudan University.*

– Highlighted the pivotal role of linear spectral norm progression in the normalization of Transformer models for downstream tasks.
– Pioneered by offering the first comprehensive mathematical proof of linear spectral norm growth following attention normalization.
– arXiv: https://arxiv.org/abs/2207.03341.

•SeaFormer: Squeeze-enhanced Axial Transformer for Mobile Semantic Segmentation [4] ***ICLR 2023***

Qiang Wan, Zilong Huang, ***Jjiachen Lu****, ..., Li Zhang. Fudan University, Tencent PCG.*

– Developed the squeeze-enhanced Axial TransFormer (SeaFormer) optimized for mobile semantic segmentation, addressing the computational and memory challenges of Vision Transformers on mobile devices.
– Project page: https://github.com/fudan-zvg/SeaFormer.

•Generative Semantic Segmentation [5] ***CVPR 2023***

Jiaqi Chen, ***Jiachen Lu****, Xiatian Zhu, Li Zhang. Fudan University, University of Surrey.*

– Conceived a novel generative learning approach for semantic segmentation by viewing it as an image-conditioned mask generation problem.
– Replaced traditional per-pixel discriminative learning with latent prior learning, representing segmentation masks as a unique image type termed `maskige`.
– Project page: https://github.com/fudan-zvg/GSS.

•SUIT: Learning Significance-guided Information for 3D Temporal Detection [6] ***IROS 2023***

Zheyuan Zhou, ***Jiachen Lu****, ..., Li Zhang. Fudan University.*

– Addressed challenges in harnessing temporal features from sequential LiDAR point clouds, crucial for 3D object detection in autonomous driving and robotics.
– Proposed the Significance-gUided Information for 3D Temporal detection (SUIT) approach, emphasizing efficient use of sparse features for information fusion across frames.

•Closed-Loop Self-Organizing Agent System *Review:* ***AAAI 2024***

Jiaqi Chen, ***Jiachen Lu****, ..., Li Zhang. Fudan University.*

– Enhanced a multi-agent embodied AI system with a large language model, enabling self-organized AI agents to efficiently formulate and execute tasks in MineCraft.

•World Volume-aware Diffusion for Controllable Multi-camera Driving Scene Generation *Review:* ***CVPR 2024***

Jiachen Lu*, Ze Huang, ..., Li Zhang. Fudan University.*

– Leveraged an explicit world volume to guide the diffusion model generation, ensuring real-world autonomous driving scene synthesis.

•Enhancing High-Resolution 3D Generation through Pixel-wise Gradient Clipping *Review:* ***ICLR 2024***

Zijie Pan, ***Jiachen Lu****, ..., Li Zhang. Fudan University.*

– Addressed limitations of annotated training data for high-resolution 3D object generation. Highlighted the unoptimized gradient propagation pathway in latent representation-based models, such as the Latent Diffusion Model.
– Controlled stochastic gradient magnitudes by efficiently clipping pixel-wise gradients while retaining vital texture-related gradient directions.

•3D Object Detection Enhanced by Temporal Multi-View Input

Jiachen Lu*, Chenfeng Xu, Wei Zhan, Kurt Keutzer, Masayoshi Tomizuka. UC Berkeley.*

– Maked use of two existing cutting-edge techniques to achieve 3D auto-labeling from pure visual inputs: 1. the generalizable 2D co-tracker, 2. the NeRF framework used for rectifying the 3D parameters.

Honors and Awards

•National Scholarship for 2018-2019 academic year by Ministry of Education of China *2019*

•National Scholarship for 2021-2022 academic year by Ministry of Education of China *2022*

•National Scholarship for 2022-2023 academic year by Ministry of Education of China *2023*

•Shanghai Outstanding Graduate by Ministry of Education of Shanghai *2021*

Academic Services

•Organizer/Chair CVPR 2023 workshop on End-to-End Autonomous Driving *CVPR 2023, Vancouver*

– Workshop Page: https://e2ead.github.io/

•Reviewer CVPR, ICCV, NeurIPS, ICLR, AAAI, IEEE TSP, IEEE SPL, IEEE TCSVT