

## RESEARCH INTERESTS

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Computer vision and machine learning with focus on 4D scene understanding, visual reasoning, generative models, and self-supervised learning. Specific interests include:

**Generative Models:** Emergence and control in video generation models, temporal consistency in video generation

**Visual Prompting:** Investigating emergent behaviors and controllability in generative models through visual prompting

**4D Grounding:** 4D grounding and spatial-temporal alignment between 3D models and real-world videos

**Self-Supervised Learning:** Self-supervised representation learning for video understanding

## EDUCATION

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**Stanford University**, MSc Computer Science (GPA: 3.9) Sep. 2023 - Present

- Research Assistant with **four quarters** of RAship.

· Published one first author paper at NeurIPS 2024, one co-first author paper submitted to CVPR 2025.

- Anticipated graduation with Distinction in Research

- Selected Courses: *CS148: Introduction to Computer Graphics and Imaging*, *CS348I: Computer Graphics in the Era of AI*, *CS381: Sensorimotor Learning for Embodied Agents*, *CS326: Topics in Advanced Robotic Manipulation*, etc.

**The University of Edinburgh**, BEng Electronics and Computer Science Sep. 2019 - June 2023

- Graduated in joint degree **with Honors**

**The University of Texas at Austin**, Electrical and Computer Engineering (GPA: 3.8) Jan. 2022 - June 2022

- Study Abroad (Completed 18 Credits/Semester)

## PUBLICATIONS [3 (CO)FIRST-AUTHOR PAPERS]

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Eyzaguirre C.\*, **Liu Y.\***, Stojanov S., Gaidon A., Niebles J.C., Wu J. (\*Alphabetically) *Tracking Emergence in Video Generation Models*. In Submission.

**Liu Y.**, Eyzaguirre C., Li M., Khanna S., Niebles J.C., Ravi V., Mishra S., Liu W.\*, Wu J.\* *IKEA Manuals at Work: 4D Grounding of Assembly Instructions on Internet Videos*. NeurIPS 2024.

**Liu Y.\***, Kolluri N\*, Murthy D. *COVID-19 Misinformation Detection: Machine Learned Solutions to the Infodemic*. JMIR Infodemiology 2022; 2(2):e38756.

## RESEARCH EXPERIENCE

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**Tracking Emergence in Video Generation Models** Stanford Vision and Learning Lab  
*with Prof. Jiajun Wu, Prof. Juan Carlos Niebles, Cristobal Eyzaguirre* Jan 2024 - Present

**Self-Supervised Points Tracking:** Developed intervention-based framework using marker prompts to analyze video diffusion models' ability to track points without training. Implemented marker propagation combining EDM-based sampling with classifier-free guidance using blended noise predictions.

**Technical Implementation:** Employed inversion methods with noise extrapolation exploiting near-linear latent trajectories. Developed adaptive tracking strategies with dynamic search spaces based on motion magnitude. Created comprehensive evaluation framework measuring tracking accuracy (PTA@k), temporal consistency, and occlusion handling.

**4D Grounding of Visual Furniture Assembly Instructions** Stanford Vision and Learning Lab  
*with Prof. Jiajun Wu, Prof. Juan Carlos Niebles, Prof. Manling Li, Dr. Weiyu Liu* June 2023 - June 2024

**Led Dataset Development:** As the sole student project leader for the year-long project, led the first dataset enabling spatial-temporal alignment of instructional real-world videos with 3D models. Communicated with a team of 30 annotators, ensuring precision through iterative cross-validation.

**4D Grounding on Internet Videos:** Establish dense correspondences between real-world instructional videos and 3D models. Formulated novel approaches for handling unconstrained internet videos with varying camera parameters and environmental conditions. Developed cross-frame optimization combining PnP-RANSAC with temporal consistency constraints for camera parameter estimation. Designed iterative refinement methods to handle occlusions and maintain consistent part poses across video segments.

**COVID-19 Misinformation Detection** University of Texas at Austin  
*with Prof. Dhiraj Murthy* March 2022 - Jan 2023

**Framework:** Developed systematic comparison framework across classical models (SVM, LR, BNB) and pre-trained models (BERT, RoBERTa, XLNet) on 7 dataset combinations. Demonstrated classical models excel with combined datasets while pre-trained models perform best. Ensembled crowdsourced annotations (31,441 votes) with model predictions.

**Human-AI Integration:** Created large-scale crowdsourced validation dataset (31,441 votes from 756 annotators) with rigorous agreement analysis (Krippendorff  $\alpha = 0.428$ ). Developed methods to leverage low-agreement human data (68.5% agreement) to improve model performance.

## INDUSTRY EXPERIENCE

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### Semiconductor Manufacturing Anomaly Detection

Tianjin, China

NXP Semiconductors

May 2021 - Aug. 2021

**Adaptive Validation Framework:** Created validation methodology integrating domain knowledge with statistical confidence measures. Designed adaptive thresholding mechanism to handle process variations across production lines.

**Probabilistic Anomaly Detection:** Researched and implemented ensemble detection system combining unsupervised learning methods (Isolation Forest, One-Class SVM) with manufacturing constraints. Developed probabilistic modeling approach for high dimensional multi-variate sensor data with temporal dependencies.

### Wind Farm Performance AI Optimization

Beijing, China

Zhineng Technology

Aug 2021 - Sep. 2021

**Multi-Modal Integration:** Developed framework combining LIDAR measurements with multi-spectral satellite imagery for wind pattern analysis. Implemented automated feature extraction pipeline for processing high-dimensional meteorological time series data.

**Hybrid Forecasting Architecture:** Designed and validated forecasting system integrating physical models with learned spatial-temporal features. Created validation framework comparing model performance against traditional physical forecasting methods.

## LEADERSHIP AND COMMUNITY ENGAGEMENT

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**Academic Leadership** [University of Edinburgh, 2020 - 2023] E&EE Programme Representative advocating curriculum improvements for 200+ students. Teaching demonstrator for foundational courses including Discrete Mathematics, Data Structures, and Computer Systems. Mentored international students through Global Buddies Program.

**Volunteer** [Sri Lanka Wildlife Conservation Society (SLWCS) , Summer 2018] Led educational initiatives in rural communities while contributing to wildlife conservation research through data analysis.

## HONORS AND AWARDS

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**UT Austin Cockrell School of Engineering Fellowship (Declined)** [2023] — A \$24,000 fellowship for PhD studies.

**Turing Scheme Funding** [January 2022] — Competitive funding for international academic and leadership exchange.

**Leadership in Student Opportunities Award** [July 2021] — For leadership and 50+ hours of community service.

**1st Year Class Medal** [July 2020] — Top performance student in Electronics and Electrical Engineering.

## OTHER PROJECTS

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**EMO-Mask: Emotional Controllable Motion Generation** [Stanford, 2024 Winter] Developed an emotion-aware extension to MoMask for controllable motion generation. Designed EmotionEmbedder module integrating with transformer architecture at different stages (R-transformer, M-transformer, VQ-VAE). Implemented multi-objective training with MSE and contrastive losses for emotion-motion alignment. Created dataset of 320 emotionally expressive motions across 4 emotions and 2 motion types. Conducted systematic ablation studies comparing integration points and analyzing impact on motion quality.

**GPU-Accelerated Sparse Tensor Auto-differentiation** [Edinburgh, 2023 May] Extended differentiable programming framework for sparse tensors to GPU environments. Developed CUDA implementations focusing on performance optimization and memory efficiency for sparse operations.

**Discourse Relation Analysis** [University of Edinburgh, 2022 June - 2023 Jan] Worked with Prof Bonnie Webber. Investigated relationships between non-canonical syntax (preposing) and discourse relations using large language models. Helped with the development of mask-filling tasks with BERT to analyze implicit discourse relations, achieving quantitative evidence for syntactic effects on relation prediction.

**Open-Source Contribution** [Remote, 2022 May-July] Converted a JAX model to ONNX format to improve its running efficiency, and re-implemented and restructured the code to integrate it into the OpenCV code tree.

**Just Dance Everything (Best Course Project Award)** [UT Austin, 2022 March-June] Developed an accessible dance game that only requires a webcam.

**Energy Monitoring and Control System** [2020] Developed a system to monitor energy usage, analyze power quality, and control inductors' current.(China Patent No. 7670030)

## TECHNICAL SKILLS

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**Programming Languages:** Python, Java, C, CUDA, JavaScript, HTML, Verilog

**ML Framework:** PyTorch, JAX, TensorFlow, OpenCV, Detectron2

**3D/Graphics:** Blender, Unity3D, Open3D, OpenGL, PyTorch3D

**Engineering:** COMSOL, MATLAB/Simulink, Circuit Design, Embedded Systems

**Tools:** Weights & Biases, AWS/GCP, SLURM, Linux HPC, Git, Docker, Alibabacloud