

Tianzhe Chu

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EDUCATION

- **ShanghaiTech University** Shanghai, China
B.Eng in Computer Science and Technology; GPA:3.75/4.0 Sep 2020 - Jun 2024
Selected Courses: Introduction to Machine Learning, Probability and Statistics, Computer Architecture I, Data Structure and Algorithms.
- **University of California, Berkeley** Berkeley, CA, US
Visiting undergraduate in EECS; GPA: 3.87/4.0 Aug 2022-May 2023
Selected Courses: Deep Learning, Deep Reinforcement Learning, Foundation of Graphics, Applications of Parallel Computing, Computer Vision.

RESEARCH INTEREST

- I'm broadly interested in **representation learning**. My current research focuses on building **parsimonious** and **interpretable** learning frameworks for visual intelligence.
- In short, unsupervised/self-supervised learning, interpretability, generative models, multimodal models.

PUBLICATIONS

(* means equal contribution)

- Yaodong Yu*, **Tianzhe Chu***, Shengbang Tong, Ziyang Wu, Druv Pai, Sam Buchanan, Yi Ma, *Emergence of Segmentation with Minimalistic White-Box Transformers*, Under Review.
- **Tianzhe Chu***, Shengbang Tong*, Tianjiao Ding*, Xili Dai, Benjamin D. Haeffele, René Vidal, Yi Ma, *Image Clustering via the Principle of Rate Reduction in the Age of Pretrained Models*, Under Review.
- Yaodong Yu, Sam Buchanan, Druv Pai, **Tianzhe Chu**, Ziyang Wu, Shengbang Tong, Benjamin D. Haeffele, Yi Ma, *White-Box Transformers via Sparse Rate Reduction*, Under Review.

RESEARCH EXPERIENCE

- **Berkeley Artificial Intelligence Research (BAIR) in UC Berkeley** Berkeley, CA, US
Undergraduate research assistant advised by Prof. Yi Ma Nov 2022-Now
 - Empirically investigating the probabilities of white-box transformers
 - Exploring mathematically interpretable deep learning architectures driven by optimizing sparse rate reduction.
 - Pushing the limits of image clustering at scale.

ACTIVITIES AND AWARDS

- **Outstanding Individual Award as Leader of Social Practice Group** Enshi, Hubei, China
Affiliation: ShanghaiTech University July 2021
- **Outstanding Individual Award as Member of Industrial Practice Group** Shanghai, China
Affiliation: ShanghaiTech University July 2022
- **Provincial First Prize for 35th National Physics Olympics Competition** Nanjing, Jiangsu, China
Affiliation: Suzhou High School of Jiangsu Province Sep 2018

SKILLS

- **Languages:** Python, C/C++, Matlab, RISC-V, Mandarin(native), Cantonese, English(fluent), Music Sheet
- **Tools:** Pytorch, Jax, Markdown, git, LaTeX

PROJECT HIGHLIGHTS

- **Emergence Properties in White-box Transformers** Berkeley, CA, US
Summer 2023
Mentor: Prof. Yi Ma
 - We discover that white-box transformer leads to the emergence of segmentation properties in the network's self-attention maps, solely through a minimalistic supervised training recipe.
 - Qualitatively, supervised white-box transformer(named CRATE) learns (i) explicit attention maps with semantic meanings; (ii) structured patch-wise representations with less spurious correlations.
 - Quantitatively, supervised CRATE, though not trained for segmentation, achieves a much higher segmentation score than supervised ViT.
- **Clustering via Principle of rate reduction and Pretrained model** Berkeley, CA, US
Mar 2023 - May 2023
Mentor: Prof. Yi Ma and Dr. Benjamin David Haeffele
 - We propose a novel image clustering pipeline (named CPP) that integrates pre-trained models and rate reduction, enhancing clustering accuracy and introducing an effective self-labeling algorithm for unlabeled datasets at scale.
 - Our pipeline learns a highly clusterable image representation that can be extended to CIFAR-100/ImageNet-1k/LAION-Aesthetic, where few previous methods succeeded in achieving a decent performance.
 - Our pipeline goes beyond deep clustering via proposing solutions for (i) measuring optimal number of clusters; (ii) better image-to-image search; (iii) labeling clusters with semantic meanings.
- **White-box Transformers** Berkeley, CA, US
Feb 2023 - May 2023
Mentor: Prof. Yi Ma
 - We develop white-box transformer-like deep network architectures which are mathematically interpretable and achieve performance very close to ViT.
 - The white-box transformer(named CRATE) is designed as an unrolled optimization of the sparse rate reduction objective over layers.