Shengbang Tong

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Education

The University of California, Berkeley
Aug 2019 - May 2023

- Triple Majors: Applied Mathematics, Computer Science, Statistics | College of Letter and Science
- GPA: Currently 3.90/4.00, Honor: Kraft Award, Dean's List
- Selected Graduate Level Courses: High Dim Data Analysis with Low-Dim Models, Introduction to Machine Learning, Convex Optimization, Optimization Models, Convex Optimization Algorithms, Matrix and Numerical Linear Algebra, Design of Societal Scale System and Games, Deep Reinforcement Learning, Theoretical Statistics

Research Interests

- Self-Supervised/Unsupervised Learning, Continual Learning, Generative Model, Sparse and Low rank Model, Network Architecture

Publications & Preprints

(* means equal contribution, I'm happy to share unpublished works by request)

- **Shengbang Tong*,** Yubei Chen*, Yi Ma, Yann Lecun, *Pushing the limit of efficiency in Self-Supervised Learning*, Under Review (CVPR2023)
- Tianjiao Ding, **Shengbang Tong**, Kwan Ho Ryan Chan, Xili Dai, Yi Ma, Benjamin David Haeffele, *Unsupervised Clustering and Manifold Embedding Via Maximal Coding Rate Reduction***,** Under Review (CVPR 2023)
- **Shengbang Tong**, Xili Dai, Ziyang Wu, Mingyang Li, Brent Yi, Yi Ma, *Incremental Learning of Structured Representation via Closed-Loop Transcription*, Under Review (ICLR2023, **Score: 8/8/8**), https://openreview.net/forum?id=XrgjF5-M3xi
- **Shengbang Tong***, Xili Dai*, Yubei Chen, Mingyang Li, Zengyi Li, Brent Yi, Yann Lecun, Yi Ma, *Unsupervised Learning of Structured Representation via Closed-Loop Transcription*, Under Review (ICLR2023, Score:5/5/6/6), https://openreview.net/forum?id=jZdJd1dGF2A
- Xili Dai*, Ke Chen*, **Shengbang Tong***, Jingyuan Zhang*, Xingjian Gao, Mingyang Li, Druv Pai, Yuexiang Zhai, Xiaojun Yuan, Heung Yeung Shum, Lionel M.Ni, Yi Ma, *Closed-Loop Transcription Via Convolutional Sparse Coding*, Under Review (ICLR, Score: 3/5/6/6), https://openreview.net/forum?id=NE5P2sEK4Z5
- Xili Dai*, Mingyang Li*, Pengyuan Zhai, **Shengbang Tong**, Xingjian Gao, Shaolun Huang, Zhihui Zhu, Chong You, Yi Ma, *Revisiting Sparse Convolutional Model for Visual Recognition*, **NIPS 2022,** https://arxiv.org/abs/2210.12945
- Xili Dai*, **Shengbang Tong***, Mingyang Li*, Ziyang Wu*, Kwan Ho Ryan Chan, Pengyuan Zhai, Yaodong Yu, Michael Psenka, Xiaojun Yuan, Heung Yeung Shum, Yi Ma, *Closed-Loop Transcription to an LDR via Minimaxing Rate Reduction,* **Entropy Journal 2021**, https://www.mdpi.com/1099-4300/24/4/456

Research Experiences

Center for Data Science, NYU
June 2022 - Aug 2022

Summer Research Assistant, Advisor: Prof. Yann Lecun & Dr. Yubei Chen

- To construct more efficiency of Self-Supervised Learning algorithms.
- Worked on a unified self-supervised model for image generation and image classification
- Verified the principle behind joint-embedding Self-Supervised Learning methods.

Efficiency in Self-Supervised Learning
June 2022 - Present

Student Research Assistant, Advisor: Prof. Yi Ma

- Proposed unified learning framework for both discriminative and generative models.
- Developed learning methods in extreme settings such as continual learning and unsupervised learning.
- Explored convolutional sparse modelling layers in deep learning on image classification and generation tasks.
- Worked on more principled approaches to problems in unsupervised learning such as self-supervised learning and image clustering, and unsupervised conditional image generation.

Project Highlights

Efficiency in Self-Supervised Learning
June 2022 - Present

Mentor: Prof. Yann Lecun, Prof. Yi Ma and Dr. Yubei Chen

- Despite the recent empirical success, current self-supervised learning methods (SimCLR, BYOL, VICReg, etc) must be trained for very long epochs, more than 600 for example. In contrast, supervised learning can be very efficient, converging in just 10 epochs.
- To address the problem above, we proposed a novel new approach that tremendously reduces the training epochs to even less than 10 epochs for self-supervised learning methods to converge.
- We showed that the method not only converges to structured representation in 10 epochs, but also transfers to out-of-domain dataset better than traditional self-supervised learning methods.
- The work is summarized in a paper and submitted to CVPR 2023.

Unsupervised Image Clustering via Rate Reduction
June 2022 - Oct 2022

Mentor: Prof. Yi Ma and Dr. Benjamin David Haeffele

- We proposed a novel image clustering algorithm via doubly stochastic optimization of rate reduction objectives. The work proposes to use neural networks to parameterize representation and membership of the data to avoid the heavy computation cost in doubly stochastic optimization.
- The method has shown much better stability and scalability compared to the current *state-of-the-art* methods. It is able to predict reliable pseudo labels for real-world data up to Tiny-ImageNet scale.
- The work is summarized in a paper and submitted to CVPR 2023.

Convolutional Sparse Coding in Visual Recognition
Feb 2022 - May 2022

Mentor: Dr. Chong You and Prof. Yi Ma

- We proposed a convolutional sparse coding(CSC) layer as drop-in layers in the traditional convolutional neural network such as ResNet.
- We applied the method on different scales of datasets, from CIFAR-10 to ImageNet-1k and showed that a network with CSC layers has performance on par with traditional deep learning neural networks such as ResNet, while enjoying much better robustness to input Perturbation.
- The work is summarized in a paper and accepted to Neurips 2022.

Convolutional Sparse Coding in Image Generation
March 2022 - Oct 2022

Mentor: Prof. Yi Ma

- We explored the invertibility in convolutional sparse coding(CSC) layers in generative models via closed-loop transcription(CTRL).
- The method enjoys striking sample-wise autoencoding without using any explicit sample-wise loss function.
- It is the first work showing that convolutional sparse coding inspired generative models can scale up to ImageNet-1k scale, with performance on par with deep learning based methods.
- The work is summarized in a paper and submitted to ICLR 2023 with scores 3/5/6/6.

Unsupervised Closed-Loop Transcription
Feb 2022 - May 2022

Mentor: Dr. Yubei Chen and Prof. Yi Ma

- We extended the newly proposed closed-loop transcription to unsupervised setting
- The work utilizes the concept of instance-based self-supervised learning into closed-loop transcription and demonstrates that generative models can learn an unified representation for both discriminative and generative tasks.
- Through extensive experiments, we showed that the model learns representation better than all current generative models and on par with *state-of-the-art* discriminative models. Additionally, we showed that the model performs image clustering significantly better than all of the current generative models.
- The work is summarized in a paper and submitted to ICLR 2023 with scores: 5/5/6/6

Incremental Closed-Loop Transcription
Oct 2021 - Feb 2022

Mentor: Prof. Yi Ma

- We extended the newly proposed closed-loop transcription to an incremental learning setting.
- It is the first work to show that models can continually learn representation for both discriminative and generative tasks with fixed-size networks, no exemplars and no task information.
- The method performs much better than the current *state-of-the-art* generative-replay based incremental learning methods in terms of performance and scalability.
- The work is summarized in a paper and submitted to ICLR 2023 with scores: 8/8/8

Closed-Loop Transcription (CTRL) June 2021 - Dec 2021

Mentor: Prof. Yi Ma

- We proposed a new image generative framework via a two-player maximin game of rate reduction.
- The work draws inspiration from closed-loop error feedback from the control system and avoids expensive evaluating and minimizing of approximated distance in either the data space or the feature space.
- Through extensive experiments, the model learns a both discriminative and generative representation for multi-class and multi-dimensional real-world data.
- The work is summarized in a paper and accepted to Entropy 2021.

SKILLS, CERTIFICATIONS & OTHERS

- Skills**:** PyTorch, Python, JAVA, R, Matlab, Word, Excel, PowerPoint, SQL, CSS, HTML, XML