Chuyu Zhang

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EDUCATION

ShanghaiTech University   **Shanghai China**
School of Information Science and Technology, **fourth-year PhD** in Computer Science.
Supervised by Prof. **Xuming He**   *Sep. 2020 - Present*

Wuhan University   **Wuhan China**
School of Electronic Information, B.S. in Electronic and information engineering.   *Sep. 2016 - Jun. 2020*

EXPERIENCE

Research Intern at Shanghai AI Lab   **Shanghai China**
OpenCompass Team. Working on evaluating and enhancing reasoning ability of LLMs.   *Jan. 2024 - Present*

RESEARCH INTERESTS

I previously focused on Open-World learning, particularly in the area of novel class discovery, with the goal of enabling models to cluster new classes autonomously. Currently, my interests have shifted towards evaluating, understanding, and enhancing the reasoning capabilities of large language models (LLMs) or vision-language models (VLMs).

PUBLICATIONS

- Songyang Zhang*, **Chuyu Zhang***, Yingfan Hu*, Haowen Shen, Kuikun Liu, Zerun Ma, Fengzhe Zhou, Wenwei Zhang, Xuming He, Dahua Lin, Kai Chen. CIBench: Evaluating Your LLMs with a Code Interpreter Plugin. Submitted to NeurIPS 2024 Dataset and Benchmark Track.

- Zheng Cai, Maosong Cao, ..., **Chuyu Zhang**, ..., Yicheng Zou, Xipeng Qiu, Yu Qiao, Dahua Lin. InternLM2 Technical Report, Arxiv, 2024.

- **Chuyu Zhang***, Hui Ren*, Xuming He. P^2OT: Progressive Partial Optimal Transport for Deep Imbalanced Clustering, International Conference on Learning Representations (ICLR), 2024.

- **Chuyu Zhang***, Peiyan Gu*, Xuming He. Adaptive Knowledge Transfer for Generalized Category Discovery. Arxiv.

- Ruijie Xu*, **Chuyu Zhang***, Hui Ren, Xuming He. Dual-level Adaptive Self-Labeling for Novel Class Discovery in Point Cloud Segmentation. European Conference on Computer Vision (ECCV), 2024.

- Peiyan Gu*, **Chuyu Zhang***, Ruijie Xu, Xuming He. Class-relation Knowledge Distillation for Novel Class Discovery, International Conference on Computer Vision (ICCV), 2023.

- **Chuyu Zhang***, Ruijie Xu*, Xuming He. Novel Class Discovery for Long-tailed Recognition, Transactions on Machine Learning Research (TMLR), 2023.

- **Chuyu Zhang***, Chuanyang Hu*, Hui Ren, Yongfei Liu, Xuming He. Cascade Sparse Feature Propagation Network for Interactive Segmentation, British Machine Vision Conference (BMVC), 2023.

- Shuailin li*, **Chuyu Zhang***, Xuming He. Shape-aware semi-supervised 3D semantic segmentation for medical images, Medical Image Computing and Computer Assisted Intervention (MICCAI), 2020.

- Zhitong Gao, Yucong Chen, **Chuyu Zhang**, Xuming He. Modeling Multimodal Aleatoric Uncertainty in Segmentation with Mixture of Stochastic Expert, International Conference on Learning Representations (ICLR), 2023.

RESEARCH EXPERIENCES

CIBench: Evaluating Your LLMs with a Code Interpreter Plugin.   Jul. 2024

- We build a new benchmark for agents with code interpreters using an LLM-human cooperative method.
- We devise unique assessment strategies involving both end-to-end and oracle modes. We also introduce several evaluation metrics to assess various outputs, offering a comprehensive gauge of LLMs' coding prowess within the benchmark.
- We conduct thorough experiments with 24 LLMs to analyze their performance on our benchmark.

Algorithm 1: Scaling Algorithm for P²OT

Input: Cost matrix $-\log \mathbf{P}$, ϵ, λ, ρ, N, K, a large value ι

$\mathbf{C} \leftarrow [-\log \mathbf{P}, \mathbf{0}_N]$, $\quad \boldsymbol{\lambda} \leftarrow [\lambda, ..., \lambda, \iota]^\top$

$\boldsymbol{\beta} \leftarrow [\frac{\rho}{K}\mathbf{1}_K, 1-\rho]^\top$, $\quad \boldsymbol{\alpha} \leftarrow \frac{1}{N}\mathbf{1}_N$

$\mathbf{b} \leftarrow \mathbf{1}_{K+1}$, $\quad \mathbf{M} \leftarrow \exp(-\mathbf{C}/\epsilon)$, $\quad \boldsymbol{f} \leftarrow \frac{\lambda}{\lambda+\epsilon}$
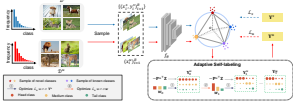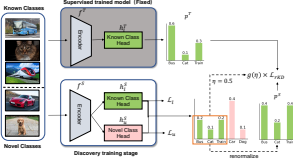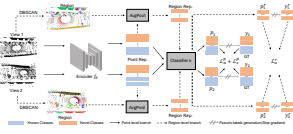
while b *not converge* **do**
    $\mathbf{a} \leftarrow \frac{\alpha}{\mathbf{Mb}}$
    $\mathbf{b} \leftarrow (\frac{\beta}{\mathbf{M}^\top \mathbf{a}})^{\circ \boldsymbol{f}}$
end

$\mathbf{Q} \leftarrow \text{diag}(\mathbf{a})\mathbf{M}\text{diag}(\mathbf{b})$

return $\mathbf{Q}[:, :K]$
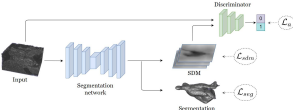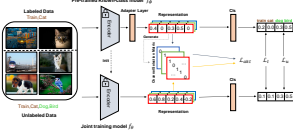
P²OT: Progressive Partial Optimal Transport for Deep Imbalanced Clustering. Sep. 2023

- We generalize the deep clustering problem to more realistic and challenging imbalance scenarios, and establish a new benchmark.
- We propose a novel progressive PL-based learning framework for deep imbalance clustering, which formulates the pseudo label generation as a novel P²OT problem, enabling us to consider class imbalance distribution and progressive learning concurrently.
- We reformulate the P²OT problem as an unbalanced OT problem with a theoretical guarantee, and solve it with the efficient scaling algorithm.

Adaptive Knowledge Transfer for Generalized Category Discovery. Sep. 2023

- We propose a novel explicit knowledge transfer framework for generalized category discovery, which can transfer known-class knowledge more effectively to novel class learning.
- We develop an adapter layer and a channel selection matrix for better knowledge alignment, and a new contrastive loss to encourage the knowledge transfer in model learning.
- We conduct extensive experiments on several benchmarks to validate the effectiveness of our method, which outperforms the SOTA by a significant margin. Particularly, we introduce iNat21, a new benchmark with three difficulty levels, to assess our framework's performance.

Dual-level Adaptive Self-Labeling for Novel Class Discovery in Point Cloud Segmentation. Sep. 2023

- We propose a novel adaptive pseudo-labeling algorithm that adaptively generates higher-quality imbalanced pseudo-labels, improving the clustering of novel classes.
- We develop a dual-level framework, which clusters novel classes at both the point-level and region-level, aiming to enhance the representation of novel classes.
- We achieve outstanding performance on both the SemanticPOSS and SemanticKITTI datasets on almost all experiments.

Class-relation Knowledge Distillation for Novel Class Discovery. Mar. 2023

- We propose a simple and effective learning framework to facilitate knowledge transfer from the known to novel classes, which provides a new perspective to solving novel class discovery problems.
- We propose a new regularization strategy to model class relation between known and novel classes in known classifier space, and develop a novel simple but effective gate function to adaptively transfer knowledge based on the strength of classes relation.
- Our method significantly outperform previous works on various public benchmarks, illustrating the efficacy of our design.

Novel Class Discovery for Long-tailed Recognition. Mar. 2023

- We present a more realistic novel class discovery setting, where the class distributions of known and novel categories are long-tailed.
- We introduce a novel adaptive self-labeling learning framework that generates pseudo labels of novel class in an adaptive manner and extends the equiangular prototype-based classifier to address the challenge in imbalanced novel-class clustering.
- We formulate imbalanced novel class discovery as a relaxed optimal transport problem and develop a bi-level optimization strategy for efficient class learning.

Shape-aware semi-supervised 3D semantic segmentation for medical images. Mar. 2020

- We propose a novel shape-aware semi-supervised segmentation approach by enforcing geometric constraints on labeled and unlabeled data.
- We develop a multi-task loss on segmentation and SDM predictions, and impose global consistency in object shapes through adversarial learning.
- Our method achieves strong performance on the Atrial Segmentation Challenge dataset with only a small number of labeled data.

RESEARCH SERVICE

- Reviewer of CVPR 2024, ECCV 2024, NeurIPS 2024.

AWARD

- First Place in SSB: Generalized Category Discovery Track (ImageNet-1k). A Challenge for Out-of-Distribution Generalization in Computer Vision (OOD-CV) in conjunction with ICCV 2023, Paris, Frances.