Chong-Yu Zhang

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Education

- **Shandong University** — Jinan, Shandong
  Master of Engineering - Artificial Intelligence; Top 3 — *Sep 2022 -*
- **University of Jinan** — Jinan, Shandong
  Bachelor of Engineering - Network Engineering; Top 3; GPA: 4.55/5; Average score: 90.61 — *Sep 2018 - June 2022*

Research Interests

- **Multimedia Analysis**
  Learning to hash, Hashing-based online image/cross-modal retrieval
- **Incremental Learning**
  Class incremental learning, Learning to prompt, Federated learning
- **Vision-Language Model**
  Prompt tuning, Test-time adaptation, Large vision-language model

Selected Publications

- **Chong-Yu Zhang**, Xin Luo, Yu-Wei Zhan, Peng-Fei Zhang, Zhen-Duo Chen, Yongxin Wang, Xun Yang, Xin-Shun Xu. Self-Distillation Dual-Memory Online Hashing with Hash Centers for Streaming Data Retrieval. In proceedings of the ACM International Conference on Multimedia (**ACM MM**), 2023. (CCF-A)
- Ting Fu, Yu-Wei Zhan, **Chong-Yu Zhang**, Xin Luo, Zhen-Duo Chen, Yongxin Wang, Xun Yang, Xin-Shun Xu. FedCAFE: Federated Cross-Modal Hashing with Adaptive Feature Enhancement. In proceedings of the ACM International Conference on Multimedia (**ACM MM**), 2024. (CCF-A)
- **Chong-Yu Zhang**, Yu-Wei Zhan, Qian Zhang, Kun Wang, Zhen-Duo Chen, Xin Luo, Xin-Shun Xu. Self-Paced Weighting Online Hashing for Image Retrieval. submitted to **IEEE Transactions on Knowledge and Data Engineering**, 2024. Under Review.
- **Chong-Yu Zhang**, Xin Luo, Yu-Wei Zhan, Zhen-Duo Chen, Xin-Shun Xu. Gleaning Wisdom from the Past: Towards Label Incremental Learning for Online Hashing with a Plug-and-Play Framework. submitted to **IEEE Transactions on Multimedia**, 2024. Under Review.
- Jun-Jie Peng, **Chong-Yu Zhang**, Na Wang, Yu-Wei Zhan, Zhen-Duo Chen, Yongxin Wang, Xin Luo, Xin-Shun Xu. OH-CMH: Towards Cross-Modal Hashing for Streaming Data with Hierarchical Labels and Label Incremental Scenario. submitted to **AAAI**, 2025. Under Review.
- Na Wang, **Chong-Yu Zhang**, Yu-Wei Zhan, Zhen-Duo Chen, Xin Luo, Xin-Shun Xu. Dynamic Clustering-Driven Weakly-Supervised Online Hashing with Enhanced Similarity. submitted to **Expert Systems with Applications**, 2024. Under Review.
- Jia-Le Liu, Yu-Wei Zhan, **Chong-Yu Zhang**, Xin Luo, Zhen-Duo Chen, Yinwei Wei, Xin-Shun Xu. Federated Class-Incremental Learning with Prompting. Arxiv.

Selected Projects

- **Efficient Online Hashing Retrieval for Large-Scale Streaming Data**
  - Developed a novel Self-Distillation Dual-Memory Online Hashing with Hash Centers (**SDOH-HC**) method to mitigate **catastrophic forgetting** introduced by data distribution change or concept drifts occurred in online scenario as models may inevitably lose or disrupt the previously obtained knowledge.
  - Introduced a **dual-memory mechanism**: the first one is **hash centers**, which will be updated to adapt to changing environment in online scenario; the other is **exemplars** selected and dynamically updated by a novel replay strategy from data chunks.
  - Crafted a **self-distillation** module, which utilizes former hash centers as teachers to guide the learning of that of current round (students), **strongly** preserving previous learned knowledge.
  - Proposed a **discrete optimization algorithm** with linear complexity to data size and adopted the **two-step hashing** strategy, ensuring accurate and efficient hash learning. Experiments conducted on CIFAR-10, MIRFlickr, NUS-WIDE datasets demonstrate its superiority on mitigate catastrophic forgetting.
- **Privacy-Preserving Federated Cross-Modal Hashing Retrieval in Non-IID Scenarios**
  - Addressed the challenge of handling multi-modal data **in distributed environments**, ensuring privacy, managing training with **non-IID data**, and enabling low storage and efficient retrieval **without data transfer**.

- Developed **FedCAFE**, a federated framework for cross-modal hashing retrieval. FedCAFE introduced a **memory mechanism** using K-means to generate class centers both locally and globally, which is then used to construct enhanced features. FedCAFE incorporates a novel **adaptive feature enhancement** module and a **weighted aggregation strategy**, enabling effective utilization of global information to guide local training.
- Conducted extensive experiments on four datasets with both IID and non-IID scenarios. The results demonstrate FedCAFE improves the capability to process massive data effectively in isolated environments.

- **Dual-Guidance Prompt for Test-Time Generalization of Vision-Language Models (In Progress)**
  - Developed **DGPT**, a novel method with a **dual-guidance strategy** to address the challenges in adapting large-scale vision-language models like CLIP for downstream tasks, particularly **poor visual and textual modalities interaction and alignment** and feature space broken when fine-tuning all parameters.
  - Introduced a **retention module** to prevent the model from forgetting general knowledge during fine-tuning, ensuring **better generalization** performance on unseen classes.
  - For normal ways of adaptation, we outperformed SOTA methods **across 11 datasets**, particularly excelling in base-to-new generalization and few-shot learning tasks. Work for test-time scenario is in progress.
- **Efficient Hashing Retrieval with Vision-Language Models (In Progress)**
  - Existing hashing methods either rely on traditional discrete optimization techniques or use simple backbone networks as feature extractors. **None of them** have considered leveraging the rich and highly condensed knowledge in **large vision-language models (LVLMs)** to generate hash codes.
  - We are designing a unsupervised hashing method, which utilizes **language model** to mine high-level semantic concept information and construct a language-based similarity matrix to guide hash learning.
  - We are developing a LVLM-based instruction tuning hashing method. Crafted instructions enable LVLMs such as **LLaMA 3.2-Vision** and **LLaVA**, to be flexibly fine-tuned and smoothly transfer the knowledge for hashing retrieval. A hashing layer is added after the model outputs to generate hash codes.
- **Human Cognitive Learning Inspired Online Hashing Retrieval with Self-Paced Weighting**
  - Pioneered in **account for the difficulty level of the samples and categories** in the learning process, boosting the capability to cope with outliers and noise, while most existing works implicitly assume that streaming data is clean and ideal, treating every sample and category equally.
  - Designed a novel Self-PAced weighting Online Hashing (**SPAOH**) method, aiming to automatically allocate weights to samples and categories according to their difficulty levels, where the acquisition of knowledge **begins with simpler concepts and builds up to more intricate ones**, which mimics the human learning process.
  - Comprehensively validate the model on three benchmark datasets. The experimental results indicate the effectiveness and efficiency of the self-paced weighting mechanism.
- **Class-Incremental Online Hashing Retrieval with Plug-and-Play Framework**
  - Identified the challenge of **emerging new labels in real-world streaming data**, where most prevailing online hashing methods struggle to update hash models or even fail entirely, assuming a constant label space.
  - Developed **IPOH**, a **Plug-and-Play** Online hashing framework, enabling existing methods to adapt to evolving label space rather than designing an entirely new model tailored specifically for class incremental problem.
  - Introduced two core components, i.e., **incremental hash learning** which extracts patterns of old classes using previous hash codes and learns hash codes for newly coming data by modeling correlations between old and new labels and further learn the patterns for the unseen new classes, and **adaptive hashing fusion**, which fuses these new hash codes with those from the original method to boost overall performance.
  - Thoroughly assessed IPOH on two datasets, showcasing significant profit in handling class-incremental scenarios.

Working Experience

- **Bilibili Inc. - Business Algorithms Department** Onsite
  Ad Traffic Strategy Algorithm Engineer Intern *June 2024 - Sep 2024*
  - **Multi-path Recall system. Learning to Rank** recall, **LLM-based** & tags recall, Search Ads optimization
- **Institute of Electrics, Chinese Academy of Sciences** Remote
  Research Assistant *Jan 2021 - May 2021*
  - **Satellite remote sensing image semantic segmentation.** Multi-level features from optical remote sensing images branch and DSM elevation branch are extracted through a pyramid attention mechanism to achieve precise segmentation.

Selected Honors and Awards

- Weichai Power Scholarship, 2024
- Graduate First-Class Scholarship, Shandong University (2023, 2024)
- Undergraduate First-Class Scholarship, University of Jinan (2019-2022)

Services & Experience

- Conference Reviewer: ACM MM(2024), ICME(2023), PAKDD(2023), ECML-PKDD(2023), etc.

Skills Summary

- **Programming Languages** Python, Matlab
- **Tools and Softwares** Bash, **ChatGPT**, Git, LaTex, Vim, Draw.io, Matplotib, Packet Tracer, Wireshark