

# SHU ZHAO

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## EDUCATION

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<b>The Pennsylvania State University–University Park</b> Ph.D. in Computer Science	<i>Aug. 2022 - Jun. 2027 (expected)</i> <i>Pennsylvania, USA</i>
<b>University of Chinese Academy of Sciences</b> M.E. in Computer Technology	<i>Sep. 2018 - Jun. 2021</i> <i>Beijing, China</i>
<b>Anhui University</b> B.E. in Information Security	<i>Sep. 2013 - Jun. 2017</i> <i>Anhui, China</i>

## RESEARCH INTERESTS

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My research interests include Vision & Language, Perception & Cognition, and Embodied AI. Currently, I am focusing on abstracting structural information from vision to improve understanding and reasoning abilities by involving the commonsense knowledge from language.

## PUBLICATIONS

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- Rescuing Deep Hashing from Dead Bits Problem.**  
International Joint Conference on Artificial Intelligence (IJCAI), 2021.  
**Shu Zhao**, Dayan Wu, Yucan Zhou, Bo Li, Weiping Wang.
- Asymmetric Deep Hashing for Efficient Hash Code Compression.**  
ACM International Conference on Multimedia (ACM MM), 2020. (Oral)  
**Shu Zhao**, Dayan Wu, Wanqian Zhang, Yu Zhou, Bo Li, Weiping Wang.
- Technical Report for EPIC-KITCHENS-100 2021 Multi-Instance Retrieval Challenge.**  
Workshop on EPIC-Kitchens Challenges, in conjunction with CVPR (CVPR Workshop 2021). (Ranked 1st)  
Xiaoshuai Hao, Wanqian Zhang, Dejie Yang, **Shu Zhao**, Dayan Wu, Bo Li, Weiping Wang.

## PREPRINTS

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- Less is More: Toward Zero-Shot Local Scene Graph Generation via Foundation Models.**  
arXiv:2310.01358. 2023.  
**Shu Zhao**, Huijuan Xu.
- NEUCORE: Neural Concept Reasoning for Composed Image Retrieval.**  
arXiv:2310.01356. 2023.  
**Shu Zhao**, Huijuan Xu.

## RESEARCH EXPERIENCE

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**PromptHashing: Learning to Prompt for Few-shot Deep Hashing** Baidu Research, Beijing  
*Advised by Dr. Tan Yu* Apr. 2022 - Jul. 2022

- Proposed a prompt-learning paradigm for few-shot deep hashing.
- Devised Multi-Modal Discrete Cyclic Coordinate Descent (MMDDC) method for effectively utilizing language information because simply adopted the CLIP model for the deep hashing task achieved poor performance.
- Designed Distillation-based Fine-Tuning (DFT) approach because fine-tuning the CLIP model is easy to overfit.
- Extensive experiments on three public demonstrated the excellent effectiveness and efficiency of the proposed PromptHashing.

**Research on Key Technologies of Pretrained Model of Large-Scale Image Retrieval** IIE, CAS, Beijing  
*Advised by Prof. Dayan Wu and Prof. Bo Li* Jun. 2020 - Mar. 2021

- Formalized the problem existing in image retrieval pre-trained model: the cross-entropy loss can not match the retrieval task, leading to the decrease of generalization ability.
- Leveraged metric learning loss to pre-train model on large-scale dataset and adopted RDH module to improve retrieval performance.
- Theoretically analyzed the challenge in large-scale metric learning and employed balanced sampling method and semi-hard negative mining strategy to alleviate it.
- Developed a large-scale image retrieval system. Conducted several experiments and demonstrated the effectiveness of the system.
- The work is formed as the master thesis.

### **Rescuing Deep Hashing from Dead Bits Problem**

*Advised by Prof. Dayan Wu and Prof. Bo Li*

IIE, CAS, Beijing  
Nov. 2020 - Feb. 2021

- Firstly formalized “Dead Bits Problem” (DBP): the saturated area of activation function and existing quantization loss will “kill” more and more hash bits. The problem widely existed in a large number of hashing methods.
- Proposed a gradient amplifier that detects the dead bits and amplifies their gradients to rescue them. Devised an error-aware quantization loss, which will further alleviate the DBP. The proposed gradient amplifier and error-aware quantization loss can be compatible with various deep hashing methods.
- Experimentally observed that our method can alleviate the DBP effectively and efficiently.
- The work is summarized in a paper and accepted to IJCAI 2021.

### **Asymmetric Deep Hashing for Efficient Hash Code Compression**

*Advised by Prof. Dayan Wu and Prof. Bo Li*

IIE, CAS, Beijing  
Oct. 2019 - Jun. 2020

- Devised an efficient and practical deep hashing framework to compress the existing hash codes in databases for saving storage space while keeping the retrieval accuracy.
- Leveraged VAE, instead of one branch of CNN in the siamese network, to compress database hash codes, and built the asymmetric architecture, which can reduce the time consumption and improve the retrieval performance simultaneously.
- Proposed a novel code compression-oriented hashing loss to guide the optimization of the CNN model with both labeled and unlabeled data.
- Improved the compression time largely on different datasets (100,000x) with almost no loss on retrieval accuracy.
- The work is summarized in a paper and accepted to ACM MM 2020.

## **HONORS & AWARDS**

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1st in Multi-Instance Retrieval Track of EPIC-KITCHENS Challenges, CVPR Workshop	2021
Pacemaker to Merit Student, University of Chinese Academy of Sciences	2021
IIE Presidential Scholarship, Institute of Information Engineering	2020
Merit Student, University of Chinese Academy of Sciences	2019

## **REVIEW SERVICES**

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Annual Conference on Neural Information Processing Systems (NeurIPS)  
ACM International Conference on Multimedia (ACM MM)