HENGYUAN ZHAO

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EDUCATION

- B.S., Communication Engineering, Nanjing University of Posts and Telecommunications, 2016-2020.

EXPERIENCE

- 2020/12-present, Research Intern, Vision Technology (VIS), Baidu Inc.
- 2019/09-present, Research Intern, Shenzhen Institutes of Advanced Technology (SIAT), Chinese Academy of Sciences (CAS).

PUBLICATIONS

1. **Hengyuan Zhao***†, Wenhao Wu*, Yihao Liu, Dongliang He, "Real-Time Exemplar-Based Image Colorization with Self-Reference Learning and Deep Feature Modulation", **submitted to ACM MM, 2021**. † indicates corresponding author.

2. Yihao Liu*, **Hengyuan Zhao***, Kelvin CK Chan, Xintao Wang, Chen Change Loy, Yu Qiao and Chao Dong, "Temporally Consistent Video Colorization with Deep Feature Propagation and Self-regularization Learning", **submitted to ICCV, 2021**.

3. Xiangtao Kong, **Hengyuan Zhao**, Qiao Yu and Chao Dong, "ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic", *IEEE Conference on Computer Vision and Pattern Recognition*, **accepted by CVPR, 2021**.

4. Yihao Liu, Jingwen He, Xiangyu Chen, Zhengwen Zhang, **Hengyuan Zhao**, Chao Dong, Yu Qiao, "Very Lightweight Photo Retouching Network with Conditional Sequential Modulation", **submitted to TPAMI, 2021**.

5. **Hengyuan Zhao**, Xiangtao Kong, Jingwen He, Yu Qiao and Chao Dong, "Efficient Image Super-Resolution using Pixel Attention", *European Conference on Computer Vision Workshop* (**ECCV Workshop**), 2020.

6. **Hengyuan Zhao**, Wenze Shao, Bingkun Bao and Haibo Li, "A Simple and Robust Deep Convolutional Approach to Blind Image Denoising", *International Conference on Computer Vision Workshop* (**ICCV Workshop**), 2019.

MAIN RESEARCHES

Baidu VIS, mentored by Wenhao Wu

Research Intern *December 2020 to present*

- **Deep Exemplar-based Colorization (submitted to MM 2021)**
  Motivation: Deep exemplar-based colorization is an unsupervised and unpaired learning task. It is difficult to retrieve the semantically related exemplar images for target grayscale images during training. Furthermore, there are not the paired ground truth color images for the predicted colorized image. Existing methods always adopt complex realization to construct training dataset. These approaches tend to utilize abundant training losses such as adversarial loss.
  Contribution: We implement the exemplar-based colorization with the self-augmented self-reference learning scheme and deep feature modulation module. To alleviate the difficulty of training such a deep model for exemplar-based colorization, we generate reference images by applying geometric transformation on the ground truth color images. Moreover, we disentangle this problem into two stages. The first stage is color information extraction implemented by a ColorEncoder. The second stage is color information transfer. We adopt the deep feature modulation module similar to StyleGAN2 to modulate the multi-scale feature maps. Due to such a simple yet effective design, our method could achieve real-time application. Moreover, since we have found that the we only adopt two widely used loss functions reconstruction loss and perceptual loss.

SIAT, supervised by Chao Dong

Research Assistant *Sept 2019 to present*

- **TCVC (submitted to ICCV 2021)**:
  Motivation: Video colorization is a challenging and highly ill-posed problem. Although recent years have witnessed remarkable progress in single image colorization, there is relatively less research effort on video colorization and existing methods always suffer from severe flickering artifacts (temporal inconsistency) or unsatisfying colorization performance.
  Contribution: We address this problem from a new perspective, by jointly considering colorization and temporal consistency in a unified framework. Specifically, we propose a novel temporally consistent video colorization framework (TCVC). TCVC effectively propagates frame-level deep features in a bidirectional way to enhance the temporal consistency of colorization. Furthermore, TCVC introduces a self-regularization learning (SRL) scheme to minimize the prediction difference obtained with different time steps. SRL does not require any ground-truth color videos for training and can further improve temporal consistency.
- **ClassSR (CVPR 2021)**:
  Motivation: With the development of high definition displays, the resolution of image and video is growing gradually. The large images are usually decomposed into small sub-images for practical usages. Based on this processing, we found that different image regions have different restoration difficulties and can be processed by networks with different capacities. Obviously, smooth areas are easier to super-resolve than complex textures. To utilize this property, we can adopt appropriate SR networks to process different sub-images after the decomposition.
  Contribution: We propose a new solution pipeline – ClassSR that combines classification and SR in a unified framework. In particular, it first uses a Class-Module to classify the subimages into different classes according to restoration difficulties, then applies an SR-Module to perform SR for different classes. We test our accelerating framework on three kinds of network divided by network complexity.

- **PAN (ECCVW 2020)**:
  Motivation: Up to 2020, extensive super-resolution algorithms have been proposed, the parameters and FLOPs growing gradually. It is hard to use such a heavy model in real-world application.
  Contribution: We participate the Efficient Super Resolution Challenge of AIM 2020. In this challenge, we proposed a newly attention scheme named "Pixel Attention", which is designed for saving more parameters and accquiring higher performance. Based on this "Pixel Attention", we design a efficient feature block with two branches and develop a network which has only 272k parameters for super resolution.

CONFERENCE PRESENTATIONS

- ECCVW 2020 (Poster) "Efficient Image Super-Resolution using Pixel Attention"
- IScIDE 2019 (Spotlight) “Iterpretable Representation Learning for Image Inpainting“

AWARDS

- 2020 4th place of AIM 2020 Efficient Super-Resolution Challenge (**lowest Parameters and FLOPs**)
- 2018 Smart Service System Cup National University Bio-Internet Technology and Application
- 2018 Merit Student

TECHNICAL SKILLS

- **Python:** Pytorch, Numpy, Opencv, Pandas, Matplotlib.
- **Neural Network:** Convolutional neural network, Non-local neural network. Iterative neural network. Path-select Network.
- **Image Colorization** Automatic image/video colorization, Exemplar-based image colorization.
- **Image/Video Super-Resolution:** Efficient and Accelerate algorithm for Image Super-Resolution.
- **Image Denoising:** Gaussian denoising, Signal-dependent noise denoising.
- **Generative Model:** Super-Resolution Generative Adversarial Networks. Image colorization via Gererative Adversarial Networks.