# Xutong Ren

401 Shady Ave, Pittsburgh, PA 15206

xutongr@andrew.cmu.edu

https://tonghelen.github.io/


## Education

**Peking University** — Beijing, China

Bachelor of Science in Computer Science. — Sept. 2015 – July 2019

- Major GPA: 3.81/4.00.
- Teaching Asistant: Introduction to Computer Systems.
- Honorable Degree of bachelor of Science.

**Carnegie Mellon University** — Pittsburgh, PA, U.S.

Master of Science in Machine Learning. — Aug. 2019 – Dec. 2020

## Publication

[1] Chen Wei, Lingxi Xie, **Xutong Ren**, Yingda Xia, Chi Su, Jiaying Liu, Qi Tian and Alan Yuille, "Iterative Reorganization with Weak Spatial Constraints: Solving Arbitrary Jigsaw Puzzles for Unsupervised Representation Learning," *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2019.

[2] **Xutong Ren**, Mading Li, Wen-Huang Cheng and Jiaying Liu, "Joint Enhancement and Denoising Method via Sequential Decomposition," *IEEE International Symposium on Circuits and Systems (ISCAS)*, May 2018, pp. 1–5. (**oral**)

[3] **Xutong Ren**, Lingxi Xie, Chen Wei, Siyuan Qiao, Chi Su, Jiaying Liu, Qi Tian, Elliot Fishman and Alan Yuille, "Generalized Coarse-to-Fine Visual Recognition with Progressive Training," *Arxiv e-print 1811.12047.*

[4] **Xutong Ren**, Wenhan Yang, Wen-Huang Cheng, Jiaying Liu, "LR3M: Robust Low-Light Enhancement via Low-Rank Regularized Retinex Model," submitted to *IEEE Transactions on Image Processing (TIP).*

[5] Keqiang Yan, Shuai Yang, Wenjing Wang, **Xutong Ren** and Jiaying Liu, "Multitask Attentive Network for Text Effects Quality Assessment," under review.

## Patent

[1] Jiaying Liu, **Xutong Ren**, Mading Li, Zongming Guo, "Method, System and Computer Device of Low-light Enhancement and Denoising," CN201810243551.9

## Research Experience

### Spatial and Temporal Restoration, Understanding and Compression Team

Institute of Computer Science and Technology, Peking University. — Beijing, China

Advisor: Prof. Jiaying Liu, PKU. — May 2017 – June 2019

- **Low-light Image Enhancement and Denoising**
  - Solved the problem that low-light enhancement methods ignore intensive noise in original images which leads to simultaneously enhance the noise as well. We demonstrated that noise has a negative effect on visual quality of enhanced results and is also a non-negligible factor in low-light enhancement. Most previous methods suppress noise by pre/post-processing, which easily leads to residual noises or over-smoothed details in the results. Thus, we designed a method which handles noise adaptively through the whole enhancement process.
  - Proposed a robust low-light enhancement method that can both enhance the low-light image/video and denoise jointly in a sequential manner. We demonstrated that an alternative Retinex decomposition causes remaining noise in both illumination and reflectance maps, which impairs overall visual quality.
  - Injected a low-rank prior into the Retinex decomposition to suppress noise in the reflectance map. We further considered the inter-frame coherence of illumination maps in videos and found matched blocks through reflectance images of successive frames so as to maintain temporal consistence. This project was published in *ISCAS* and its extension was submitted to *TIP*.
- **Text Effects Quality Assessment**
  - Explored a new issue of text effect assessment for estimating the quality of images generated by text effect transfer models. Text effects transfer aims to migrate the text effects from a source style image to the target text in the content image. Different from the conventional evaluation standard of IQA systems, the matching in style and content should also be taken into account.
  - Proposed a novel multitask network for no reference text effect assessment. The tasks of text effect reconstruction, destylization and stylization make the network better in extracting image features and alleviate over-fitting. We proposed

an attentive network to simulate the process of human high-level visual judgement, paying more attention to interested areas. The proposed multitask attentive network improves SRCC and PLCC of 2-4%.

◦ Introduced a new Text Effect Assessment dataset, containing 151k images generated by 16 different kinds of transfer models and 28k aesthetic opinion scores. It solves the problem of lacking large-scale corresponding datasets with user mean opinion scores in this recently studied domain. This paper is submitted to *ACM MM*.

### Computational Cognition, Vision, and Learning Research Group

Center for Imaging Science, Johns Hopkins University. Baltimore, MD, U.S.
Advisor: Prof. Alan Yuille, JHU. July 2018 – Sept. 2018

- **Representation Learning via Jigsaw Puzzle**
  ◦ Focused on visual representation learning in a self-supervised manner. We provided a fundamental and generalized principle that weaker cues are easier to be learned in an unsupervised manner and also transfer better, and achieved this goal by enforcing neural networks to learn from spatial contexts.
  ◦ Built a recurrent solution to jigsaw puzzles of arbitrary permutations. We use an iterative manner which, instead of solving the puzzle all at once, adjusts the order of the patches in each step until convergence. In each step, we combine both unary and binary features on each patch into a cost function judging the correctness of the current config- uration.
  ◦ In addition to general visual recognition tasks of classification, detection, and segmentation, we applied our approach to initialize a 3D network with unlabeled medical data, and verified its effectiveness in segmenting an abdominal organ from CT scans. This paper is published in *CVPR*.
- **Coarse-to-Fine Learning with Progressive Training**
  ◦ Proposed a unified coarse-to-fine framework that can bring gains in a wide range of visual recognition tasks, like classification, localization and segmentation. We encoded the coarse prediction into a dense matrix and concatenated to the original input, so that the fine model takes the same design of the coarse model but sees additional information, which can generalize to different vision tasks and model structures.
  ◦ Presented a progressive training strategy which starts with feeding the ground-truth instead of the coarse output into the fine model, and gradually increases the fraction of coarse output, to alleviate over-fitting and make information transfer better between coarse and fine models.
  ◦ Demonstrated performance boosting in vision recognition tasks of classification, localization and segmentation. Our improvement on few-shot classification further verifies the ability of alleviating over0fitting. This work is available at *Arxiv 1811.12047*.

## Project Experience

### Google AI ML Winter Camp

Beijing, China, Jan. 2019

◦ Focused on the domain of image to image translation and realized local face attribute transfer on real human images in an unsupervised way, using cartoon images as a bridge. Supervised methods perform well, but rely heavily on annotations. On the other hand, unsupervised methods most focus on whole image, not capable of specific attributes transfer. Therefore, we used disentanglement knowledge to extract cartoon structures form real face images and made manipulations on cartoons able to reflect on original images.

### Robotic Programming

Boston, MA, U.S., Jan. 2018 - Feb.2018

◦ Participated in an education program held by Peking University and Massachusetts Institute of Technology, which was a robotic programming. I manually assembled a robot and then programmed on it. I coded a program to guide the robot to go along the road in a printed map from a randomly set start location to a corresponding final location in a fast and stable manner, using visual sensors.

## Honors

- Best Technical Project Award at Google AI ML Winter Camp 2019
- Peking University Award for Academic Excellents 2018, 2017
- Wang Shengdi Scholarship (top 10%) 2018
- 8108 College Scholarship (top 10%) 2017
- The Third Prize of Peking University ACM ICPC 2017
- Peking University Award for Excellent Volunteers 2016

## Skills

- Program Languages: C/C++, Python, MATLAB, Lua;
- Deep Learning Framework: PyTorch, Torch, TensorFlow.