SHEN, MAOHAO

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EDUCATION

University of Illinois at Urbana-Champaign   Aug 2017-May 2021

Major: Computer Engineering (B.S.), Minor: Mathematics   *Champaign*

- GPA: 4.0/4.0
- James Scholar (2017-2020), Dean's List (2017-2020)

PUBLICATIONS & PREPRINTS

* indicates equal contribution

[1] Bowen Jiang*, **Maohao Shen***. Dimensionality Reduction Via Diffusion Map Improved with Supervised Linear Projection. In *IEEE International Conference on Image Processing* (*ICIP'20*), 2020. Presented online on October 27, 2020.

[2] **Maohao Shen**, Jacky Y.Zhang, Leihao Chen, Weiman Yan, Neel Jani, Brad Sutton, Oluwasanmi Koyejo. Labeling Sensitive Batch Active Learning for Brain Tumor Segmentation. In IEEE *International Symposium on Biomedical Imaging* (ISBI'21), 2021. (In Submission)

RESEARCH EXPERIENCES

Labeling Cost Sensitive Batch Active Learning for Brain Tumor Segmentation   Feb 2020-Oct 2020

Machine Learning Group, Dept. of Computer Science, UIUC (Advisor: Prof. Sanmi Koyejo)

- Design a novel active learning framework specially adapted to 3D brain image segmentation, including a novel labeling cost designed to capture radiologists' practical labeling costs.
- Utilize Monte-Carlo dropout to incorporate model uncertainty information, as well as incorporate data similarity to quantify representation information, as two active learning acquisition functions.
- Formulate the batch active learning problem as a constrained combinatorial optimization problem and designed an efficient algorithm.

Image Blind Deconvolution   Jan 2020-Present

Coordinated Science Lab, UIUC (Advisor: Prof. Yoram Bresler)

- Solve natural image deburring problem by integrating multichannel sparse blind deconvolution (MSBD) and Transform Learning (learning sparsifying transform).
- Adapt MSBD algorithm to solve ultrasound microbubble image deconvolution problem, where the PSF is both unknown and spatial varying.

Super Resolution Imaging for Micro Bubble Localization   Sep 2019-Mar 2020

Coordinated Science Lab, UIUC (Advisor: Prof. Yoram Bresler)

- Found a method to reconstruct the clear image (same as a sparse signal) of blurred human vascular image by deconvolution, under the conditions that point spread function (PSF) is known but can be both spatial invariant and spatial varying.
- Recovered the ground truth clear image based on the measurements (blurred image), and known PSF by using CLEAN algorithm, matching pursuit (MP), Orthogonal Matching pursuit (OMP).
- Theoretically proved the equivalence of CLEAN and MP algorithms and explained the reason why OMP has advantages over MP.

Dimensionality Reduction for Image Processing   Feb 2019-Jan 2020

Coordinated Science Lab, UIUC (Advisor: Prof. Ivan Dokmanic)

- Solved the problem about manifold-based image processing.

- Proposed a new nonlinear dimensionality reduction method with linear projection and diffusion map.
- Employed label information to readjust data distribution and increased the data similarity within the same image class, as well as decreased the data similarity between different image classes.

SELECTED COURSE PROJECTS

Performance Predictions for Meta-Learning and Auto ML   Oct 2019-Dec 2019

Dept. of Computer Science, UIUC

- Trained a performance predictor based on provided information including network architecture, hyperparameters, training and validation error history, initialization statistics.
- As feature engineering, encoded network architecture as feature vector, calculated FLOPs (floating points operations per second) based on model parameters and computed the first order derivative of error history.
- Trained several models from regressor to DNN using collected features.
- Our team ranked 4th among 75 teams.

Dictionary Learning with K-SVD Algorithm for Image Inpainting and Image Motion   Oct 2019-Dec2019
Deblurring

Dept. of Electrical & Computer Engineering, UIUC

- Recovered complete image based on missing pixel image and reconstructed clear image based on blur image.
- Studied and utilized the proposed K-SVD algorithm to train such dictionary based on training image to extract their sparse features.
- Solved motion deblurring problem by deconvolution between blurred image with blurring kernel.

Steganography with Image Hidden Inside Image   Mar 2019-May 2019

Dept. of Electrical & Computer Engineering, UIUC

- Implemented an algorithm encoding and decoding watermark image into carrier image.
- Able to hide digital images as the watermark inside larger carrier images as the messages to be transmitted.
- Ensured indistinguishable encoded image with high secure level; extracted hidden image successfully.

Electronic Keyboard Piano with Direct Digital Synthesis Using FPGA   Feb 2019-May 2019

Dept. of Electrical & Computer Engineering, UIUC

- Built an Electronic Keyboard Piano with FPGA; designed an electronic keyboard piano to mimic the real music instruments.
- Used 26 distinct keyboard keys to represent the piano keys.
- Allowed the user to press two keys at the same time and showed the pressed keys in the VGA graphics.

TEACHING EXPERIENCE

- Grader and Tutor for ECE 310 Digital Signal Processing   Jun 2019-Aug 2019
- Grader and Tutor for ECE 210 Analog Signal Processing   Aug 2018-May 2019

HONORS AND AWARDS

Henry O. Koehler Merit Scholarship, ECE Dept.	Sept 2020
TechnipFMC, College of Engineering	May 2020
Sargent and Lundy Engineering Scholarship, College of Engineering	May 2020
Ellery B. Paine Outstanding Junior Award, ECE Dept.	May 2020
George A. and Ina M. Zehr Scholarship, ECE Dept.	Sept 2019

MISCELLANEOUS

- **Skills:** Proficient in C/C++, MATLAB, Python), System Verilog, FPGA
- **Languages:** Fluent English, Native Mandarin