Samuel Chun-Pong Lau

Department of Computer Science, Johns Hopkins University
Room 307b, Clark Hall, Baltimore, MD 21218, USA
clau13@jhu.edu https://samuel930930.github.io/

Research Interests

Image Restoration, Turbulence Mitigation, Face Recognition at Long Range, Adversarial Robustness, On-manifold Adversarial Training, Generative Model, Scientific Computing

Education

Johns Hopkins University **USA**
Ph.D. in Computer Science *2020-2021*
- Affiliation: Artificial Intelligence for Engineering and Medicine Lab, Mathematical Institute for Data Science
- Advisor: Prof. Rama Chellappa

University of Maryland, College Park **USA**
M.S. in Applied Mathematics and Scientific Computation *2018-2020*
- Affiliation: University of Maryland Institute for Advanced Computer Studies
- Advisor: Prof. Rama Chellappa

The Chinese University of Hong Kong **Hong Kong**
M.Phil. in Mathematics *2016-2018*
- Advisor: Prof. Ronald Lok Ming Lui
- Thesis: **Deformation Processing for Image Restoration and Retargeting**

The Chinese University of Hong Kong **Hong Kong**
B.Sc. in Mathematics, Second Class Honors Upper Division *2012-2016*
- Streams: Enrichment Stream in Mathematics, Computational and Applied Mathematics Stream

Research Experience

MINDS Postdoctoral Fellow at Johns Hopkins University *2021.10 - present*
- Advisor: Prof. Rama Chellappa
- Collaboration with: Prof. Alan Yuille, Prof. Vishal Patel
- Project: IARPA Biometric Recognition And Identification At Altitude And Range (BRIAR)
  - *Atmospheric Turbulence Restoration*
  - *Biometric Identification in Security Videos*
  - *Body Recognitions at Long Range*
  - *Gait Recognition at Long Range*

Research Assistant at Johns Hopkins University *2020.8 - 2021.10*
- Advisor: Prof. Rama Chellappa
- Collaboration with: Prof. Soheil Feizi
- Project: DARPA Guaranteeing AI Robustness Against Deception (GARD)
  - *On-manifold Adversarial Training with Exact Manifold Information using Normalizing Flow*
  - *Robust Object Detection*

- *Identification of Attack-Specific Signatures in Adversarial Examples*
- *Robust Interpolated On-Manifold Adversarial Training*
- *Transferability of Robustness in Mutual Learning*
- *Foundation Research on On-Manifold Adversarial Robustness*

Research Assistant at University of Maryland, College Park *2018.12 - 2020.8*

- Advisor: Prof. Rama Chellappa
- Collaboration with: Prof. Carlos Castillo
- Project: IARPA JANUS
  - *Single Face Restoration at Long Range*
  - *Single Face Semantic-Aware Restoration and Recognition at Long Range*
  - *Semi-Supervised Facial Landmark Localization and Restoration at Long Range*

Research Assistant at The Chinese University of Hong Kong *2016.8 - 2018.8*

- Advisor: Prof. Ronald Lok Ming Lui
- Project: Mathematical Models for Deformation Analysis and Their Applications
  - *Restoration of Atmospheric Turbulence-Distorted Images via RPCA and Quasiconformal Maps*
  - *Real-Time Turbulence-Degraded Images Restoration in a Variational Framework*
  - *Data-Driven Turbulence-Degraded Images Restoration*

Research Internship at The Chinese University of Hong Kong *2015.9 - 2016.7*

- Advisor: Prof. Ronald Lok Ming Lui
- Conducted research in Convolutional Neural Network with applications to computer vision
- Conducted research in Quasi-conformal Geometry with applications to motion frames interpolation

Book Chapter

[1] **CP Lau** and R Chellappa, Remote Face Recognition. *Encyclopedia of Cryptography, Security and Privacy*, Springer, (2021).

Publications and Preprints

Submitted

- J Liu, A Levine, **CP Lau**, R Chellappa, S Feizi, Segment and Complete: Defending Object Detectors against Adversarial Patch Attacks with Robust Patch Detection. Under review
- **CP Lau**, J Liu, H Souri, WA Lin, S Feizi, R Chellappa, Interpolated Joint Space Adversarial Training for Robust and Generalizable Defenses. Under review
- J Liu, **CP Lau**, S Feizi, R Chellappa, Mutual Adversarial Training: Learning together is better than going alone. Under review
- H Souri*, P Khorramshahi*, **CP Lau**, M Goldblum, R Chellappa, Identification of Attack-Specific Signatures in Adversarial Examples. Under review

Published/Accepted

[10] PH MA, **CP Lau**, N Yu, A Li, JP Sheng, Application of Deep Learning for Image-based Chinese Food Nutrients Estimation. *Food Chemistry*. (2021)

[9] **CP Lau**, C Castillo, R Chellappa, ATFaceGAN: Single Face Semantic Aware Image Restoration and Recognition from Atmospheric Turbulence. *IEEE Transactions on Biometrics, Behavior, and Identity Science* (**TBIOM**). (2021)

[8] PH MA, **CP Lau**, N Yu, A Li, JP Sheng, Q Wang, P Liu, Image-based Nutrient Estimation for Chinese Dishes Using Deep Learning, *Food Research International* (2021)

[7] **CP Lau**, A Kumar, R Chellappa, AT-Key: Semi-Supervised Landmarks Guided Restoration of Atmospheric Turbulent Images, *IEEE Journal of Selected Topics in Signal Processing* (**JSTSP**).(2021)

[6] WA Lin[1], **CP Lau**[1], A Levine, R Chellappa, S Feizi, Dual Manifold Adversarial Robustness: Defense against Lp and non-Lp Adversarial Attacks, *Conference on Neural Information Processing Systems (**NeurIPS**)* (2020)

[5] WH Chak, **CP Lau**, LM Lui, Subsampled Turbulence Removal Network. *Journal on Mathematics, Computation and Geometry of Data* (2020)

[4] **CP Lau**, H Souri, R Chellappa, ATFaceGAN: Single Face Image Restoration and Recognition from Atmospheric Turbulence. *IEEE International Conference and Workshops on Automatic Face and Gesture Recognition* (2020) (**Oral**) (**Honorable Mention Award**)

[3] **CP Lau**, YH Lai, LM Lui, Restoration of Atmospheric Turbulence-distorted Images via RPCA and Quasiconformal Maps. *Inverse Problem* (2019).

[2] **CP Lau**, YH Lai, LM Lui, Variational models for joint subsampling and reconstruction of turbulence-degraded images. *Journal of Scientific Computing*, 1-38 (2018).

[1] **CP Lau**, CP Yung, LM Lui, Image retargeting via Beltrami representation. *IEEE Transactions on Image Processing* (**TIP**), 27(12), 5787-5801 (2018).

Selected Awards

IEEE International Conference and Workshops on Automatic Face and Gesture Recognition **USA**
- *Best Paper (Honorable Mention Award)* *2020*

NeurIPS 2020 **USA**
- *Travel Award* *2020*

University of Maryland, College Park **USA**
- *Dean's Fellowship* *2018-2020*

2017 Imaging Science Camp, VISSA **Shenzhen, China**
- *Presidential Prize for Best Presentation by Prof. Tony F. Chan* *2017*

The Chinese University of Hong Kong **Hong Kong**
- *Postgraduate Studentship* *2016-2018*

Talks

1. NeurIPS 2020, December 6-12, 2020, Virtual
   Title: Dual Manifold Adversarial Robustness: Defense against Lp and non-Lp Adversarial Attacks (**Link**)

[1] First two authors contributed equally

2. 15th IEEE International Conference on Automatic Face and Gesture Recognition (FG), November16-20, 2020, Virtual
   Title: ATFaceGAN: Single Face Image Restoration and Recognition from Atmospheric Turbulence (**Link**)
3. SIAM Conference on Imaging Science (IS18), June 5-8, 2018, Bologna, Italy
   Title: Variational Models for Joint Subsampling and Reconstruction of Turbulence-degraded Images
4. (Invited talk) The International Conference on Image Processing: Theory, Method and Applications (ICIPTMA), May 19-21, 2017, Heilongjiang, China
   Title: Restoration of Atmospheric Turbulence-distorted images via RPCA and Quasiconformal Maps
5. 2017 Imaging Science Camp, March 10-12, 2017, Shenzhen, China
   Title: Restoration of Atmospheric Turbulence-distorted images via RPCA and Quasiconformal Maps

Professional Service

Reviewer **2018-present**

- *IEEE Transactions on Neural Networks and Learning Systems*
- *IEEE Transactions on Pattern Analysis and Machine Intelligence*
- *IEEE Transactions on Multimedia*
- *IEEE Transactions on Computational Imaging*
- *The IEEE International Conference on Advanced Video and Signal-based Surveillance*
- *AAAI Conference on Artificial Intelligence*
- *Conference on Computer Vision and Pattern Recognition (CVPR)*

Teaching Experience

Department of Electrical and Computer Engineering, Johns Hopkins University

- *Teaching Assistant, Guest Lecturer* *2020-2021*
  - EN.520.665 Machine Perception. Fall 2021
  - EN.520.650 Machine Intelligence. Spring 2021
  - EN.520.665 Machine Perception. Fall 2020

Department of Mathematics, University of Maryland, College Park

- *Teaching Assistant* *2018-2019*
  - MATH120 Elementary Calculus I. Spring 2019
  - MATH141 Calculus II. Fall 2018

Department of Mathematics, The Chinese University of Hong Kong

- *Teaching Assistant* *2016-2018*
  - MATH4250 Game Theory. Spring 2018
  - MATH3360 Mathematical Imaging. Fall 2017.
  - MATH4250 Game Theory. Spring 2017.
  - MATH3360 Mathematical Imaging. Fall 2016.

References

1. Prof. Rama Chellappa
   Bloomberg Distinguished Professor
   Johns Hopkins University
   Department of Electrical and Computer Engineering
   Email: rchella4@jhu.edu

2. Prof. Alan Yuille
   Bloomberg Distinguished Professor
   Johns Hopkins University
   Department of Computer Science
   Email: ayuille1@jhu.edu

3. Prof. Ronald Lok Ming Lui
   Professor
   The Chinese University of Hong Kong
   Department of Mathematics
   Email: lmlui@math.cuhk.edu.hk

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