

Interests

Machine Learning and Computer Vision: Deep Neural Networks, Adversarial Attacks, Adversarial Robustness, Anomaly Detection, Semantic Segmentation, Object Tracking, Metric Learning, Domain Adaptation, Pose Estimation, Knowledge Distillation and Deep Generative Networks

Education

Ecole Polytechnique Fédérale de Lausanne (EPFL)

Sep 2017 - Aug 2022

Ph.D. in Computer Science

Advisors: Dr. Mathieu Salzmann and Prof. Pascal Fua, Computer Vision Lab

Title: Understanding Deep Neural Networks using Adversarial Attacks

Indian Institute of Technology Kharagpur

Jun 2010 - May 2015

M.Tech with specialization in Signal Processing and Instrumentation,

B.Tech (Honours) in Electrical Engineering (5 year Dual Degree)

GPA: 8.89/10.0

Selected Projects

Anomaly Detection in Street-Scene CNNs via Pix2Pix Image-to-Image Translation

Designed a discrepancy generator-based network to detect unusual and rare anomalous objects at pixel-level in street-scene segmentation networks without any knowledge of them at training time using Pix2Pix generator.

Learning Cross-Domain Generative Adversarial Perturbations to fool DNNs

Proposed a GAN with mid-level feature separation loss to conduct highly transferable black-box attack beyond domain (ImageNet, ChestX), tasks (Recognition, Detection) and architectures (CNNs, Transformers). Further proposed universal attacks to steer Visual Object tracker along dangerous trajectories in an efficient manner.

Improving Adversarial Robustness of CNNs by Discriminative Feature Separation

Proposed an attention-aware CNN with novel latent feature clustering and separation losses based on metric learning to improve robustness to white-box and black-box attacks.

Rethinking Pose-Appearance Disentanglement in Self-Supervised 3D Pose Estimation CNNs

Proposed a testbed to evaluate the disentanglement of self-supervised pose and appearance latent codes in and uncovered that disentanglement is in fact far from complete.

Prototypical Networks to interpret CNNs and Diagnose its Failure Modes

Proposed a bag-of-words based interpretable layer to understand the decisions of CNN through activated prototypes and further analysed the mechanism of adversarial attacks and also designed a detection framework.

Robustness-Performance Tradeoff in Context-dependent Semantic Segmentation Networks

Proposed an indirect local attack framework to fool the dynamic objects like car, bus by perturbing in far away regions such as Cars, building and identified that context (dilation, attention, pooling etc.) as the reason for high vulnerability.

Work Experience

Software Engineer, **Samsung R&D Institute**, Bangalore

Sep 2015 - July 2017

Prototyped a joint reflection-removal and super-resolution of a video sequence captured in indoor scenes.

Intern, **University of Alberta**, Edmonton

May 2014 - July 2014

Evaluated large scale image retrieval methods using product quantization of sub-codebooks.

Intern, **University of Queensland**, Australia

Nov 2013 - Jan 2014

Developed an exponentially decaying non-uniform sampling scheme to shorten acquisition time in spectroscopy experiments.

Intern, **Philips Research Asia**, Bangalore

May 2013 - July 2013

Implemented a part-based human detection model using Adaboost based ensemble of weak SVM classifiers.

Publications And Preprints

1. Krishna Kanth Nakka and Mathieu Salzmann. **Understanding Pose and Appearance Disentanglement in 3D Human Pose Estimation.** *Under review*
2. Krishna Kanth Nakka and Mathieu Salzmann. **Learning Transferable Adversarial Perturbations.** *Neural Information and Processing Systems (NeurIPS), 2021*
3. Krishna Kanth Nakka and Mathieu Salzmann. **Universal, Transferable Adversarial Attacks for Visual Object Trackers.** *Under review*
4. Krishna Kanth Nakka and Mathieu Salzmann. **Towards Robust Fine-grained Recognition by Maximal Separation of Discriminative Features.** *Asian Conference on Computer Vision (ACCV), 2020.*
5. Krishna Kanth Nakka and Mathieu Salzmann. **Indirect Local Attacks for Context-aware Semantic Segmentation Networks.** *European Conference on Computer Vision (ECCV) Spotlight 2020.*
6. Krzysztof Lis, Krishna Kanth Nakka, Pascal Fua, Mathieu Salzmann and Mathieu Salzmann. **Detecting the Unexpected via Image Resynthesis.** *International Conference on Computer Vision (ICCV), 2019.*
7. Krishna Kanth Nakka and Mathieu Salzmann. **Interpretable BoW Networks for Adversarial Example Detection.** *Explainable and Interpretable AI workshop, ICCV 2019.*
8. Krishna Kanth Nakka and Mathieu Salzmann. **Deep Attentional Structured Representation Learning for Visual Recognition.** *British Media Vision Conference (BMVC), 2018.*
9. Jonna S, Nakka KK, Sahay RR. **Deep learning based fence segmentation and removal from an image using a video sequence.** *International Workshop on Video Segmentation, ECCV 2016. Oral.*
10. Jonna S, Nakka KK, Khasare VS, Sahay RR. **Detection and removal of fence occlusions in an image using a video of the static/dynamic scene.** *Journal of Optical Society of America (JOSA) A. 2016.*

Skills

- Languages: Proficient in Python. Familiar with C/C++, HTML, SQL
- Softwares: PyTorch, Tensorflow, Caffe, Keras, MATLAB, Docker, Kubernetes
- Libraries: OpenCV, NumPy, Pandas, Matplotlib

Relevant Courses

Machine Learning, Artificial Neural Networks, Digital Image Processing, Linear Algebra, Probability and Statistics, Distributed Information Systems, Mobile Networks

Teaching Experience

Introduction to Machine Learning, CS233 at EPFL in Fall 2019, Fall 2020, Fall 2021
Machine Learning, CS433 at EPFL in Fall 2018

References

- Dr. Mathieu Salzmann. Senior Researcher, CVLab, EPFL **email:** mathieu.salzmann@epfl.ch
- Prof. Pascal Fua. Professor, Computer Science Department, EPFL. **email:** pascal.fua@epfl.ch

Awards and Honours

EDIC PhD Fellowship (2017) to pursue first year of doctoral studies at EPFL
Mitacs Globalink Scholarship to participate in summer internship at University of Alberta
University of Queensland Summer Research Scholarship to conduct research at CAI
MCM Scholarship for 4 years (2010-14) for excellent academic performance at IIT Kharagpur