

Divyansh Aggarwal

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Research Interests

Computer Vision, Machine Learning, Pattern Recognition, Deep Learning, Federated Learning, Image Translation/Manipulation, Image Generation, Biometrics

Education

- **MS in Computer Science and Engineering** Michigan State University (MSU), USA
Advisor: Dr. Anil K. Jain, GPA: 3.95/4.0 2019 – 2021
- **B.Tech. in Computer Science and Engineering** Indian Institute of Technology Jodhpur, India
GPA: 9.53/10.0 (Batch Rank - 1) 2015 – 2019

Publications and Patents

1. Alon Shoshan, Oron Anshel, Nadav Bhonker, Igor Kviatkovsky, **Divyansh Aggarwal**, Manoj Aggarwal, Gerard Medioni and Dilip Kumar, "Storable Representation of Biometric Data", **US Patent, 2023** (Pending)
2. Yichun Shi, **Divyansh Aggarwal** and Anil K. Jain, "Lifting 2D StyleGAN for 3D-Aware Face Generation", **IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2021** 📄
3. Debayan Deb, **Divyansh Aggarwal** and Anil K. Jain, "Identifying Missing Children: Face Age-Progression via Deep Feature Aging", **IEEE International Conference on Pattern Recognition (ICPR), 2020** 📄
4. **Divyansh Aggarwal**, Elchin Valiyev, Fadime Sener and Angela Yao, "Learning Style Compatibility for Furniture", **German Conference on Pattern Recognition (GCPR), 2018** 📄
5. **Divyansh Aggarwal**, Jiayu Zhou and Anil K. Jain, "FedFace: Collaborative Learning of Face Recognition Model", **IEEE International Joint Conference on Biometrics (IJCB), 2021** 📄
6. Daksh Thapar, Aditya Nigam, **Divyansh Aggarwal** and Punjal Agarwal, "VGR-Net: A View Invariant Gait Recognition Network", **IEEE International Conference on Identity, Security and Behavior Analysis (ISBA), 2018** 📄
7. Gaurav Jaswal, Ravinder Nath, **Divyansh Aggarwal** and Aditya Nigam, "FKQNet: A Biometric Sample Quality Estimation Network Using Transfer Learning", **IEEE International Conference on Image Information Processing (ICIIP), 2017** 📄
8. **Divyansh Aggarwal**, Aditi Khandelwal, Rajeev Ranjan, Vishal Kaushal, Manoj Aggarwal and Gerard Medioni, "A Coarse-to-Fine Approach to Large Scale Image Retrieval Using Topological Autoencoders", **Amazon Report, 2023**

Experience

- **Applied Scientist II** Amazon, Bangalore
Organization: Amazon One October 2023 – Present
- **Applied Scientist I** Amazon, Bangalore
Organization: Amazon One September 2021 – September 2023

Worked on several research and development problems pertaining to the Amazon One palm recognition service spanning different components of the pipeline like improving recognition accuracy, rootcausing of failures, sensor obstruction detection, privacy etc. Also mentored an intern, participated in the hiring process and contributed to operational excellence in the team.

- **Graduate Research Assistant** **Pattern Recognition and Image Processing (PRIP) Lab, MSU**
Advisor: Dr. Anil K. Jain *Aug 2019 – May 2021*
 Worked on improving Face Recognition performance under aging, generating realistic 3D faces from 2D in the wild face images and developing a privacy preserving collaborative training framework for face recognition models
- **Research Intern** **Rheinische Friedrich-Wilhelms-Universität Bonn, Germany**
Advisor: Dr. Angela Yao *May 2018 – July 2018*
 Worked on learning stylistic compatibility between furniture images and developing visual textual based embedding networks that can answer retrieval queries based on both images and text
- **Research Intern** **Indian Institute of Technology Mandi, India**
Advisor: Dr. Aditya Nigam *May 2017 – July 2017*
 Worked on improving the performance of gait recognition under multi-view setting, developing an end to end framework for estimating the quality of knuckle images as well as other applications of computer vision in biometrics

Selected Projects

- **Detecting Sensor Obstruction** *September 2023 - Present*
Amazon One
 - Designed and implemented vision algorithms for the detection of obstructions (eg. dirt, marker, water spills, smudges etc.) on the IR camera of the Amazon One devices.
 - Developed the logic to raise relevant tickets and alarms so that the devices can be cleaned and thus mitigating false positive risk.
 - Collaborated cross-functionally with multiple teams on crafting a comprehensive solution to feed the algorithm's output into the device health dashboards so that merchants can be appropriately notified.
- **Storable Representation of Biometric Data** *September 2021 - September 2022*
Amazon One
 - Developed POC algorithms to transform palm images into a secure, non-human-interpretable and cancellable proxy representation which facilitates various downstream tasks like training, evaluation, rootcausing, extracting features for recognition etc. Notably, the proxy representation ensures that reconstruction into the original image is impossible.
 - Demonstrated comparable recognition performance between the proxy representation and the original images. Also, filed a patent on this work which is currently pending.
- **Improving the Rootcausing Engine** *November 2022 - September 2023*
Amazon One
 - Developed vision algorithms to automate the process of rootcausing of failure interactions such as FTE(Failure to Enroll), FTA (Failure to Acquire) and FN (False Negatives) into appropriate error buckets.
 - Reduced the manual effort spent by researchers and contractors in performing the rootcausing from 20 hrs/week to 2 hrs/week
 - Improved the automation coverage of FTE from 80% to 95% and of FNIR from 82% to 96% and achieved an accuracy of >99% on the automatically rootcaused interactions.
- **Improving the Decision Fusion Logic** *September 2022 - May 2023*
Amazon One
 - Worked on coming up with an alternate score level fusion scheme for the two modalities used in the amazon one palm recognition.
 - The proposed fusion scheme was able to reduce the False Negative Identification Rate by 30% over the existing decision fusion logic while being simpler and requiring fewer parameters to tune.
- **FedFace: Collaborative Learning of Face Recognition Model** *December 2020 – April 2021*
PRIP Lab, Michigan State University
 - Developed FedFace, a federated learning framework for training face recognition models in a collaborative and privacy preserving manner to address the growing legal restrictions in accessing and sharing face datasets.
 - Our experiments show that FedFace can utilize face images available on 1,000 mobile devices to enhance the performance of a pre-trained face recognition model while ensuring the privacy of the training face images.

○ **Lifting 2D StyleGAN for 3D-Aware Face Generation**

PRIP Lab, Michigan State University

May 2020 – November 2020

- Developed a self-supervised framework called LiftedGAN for disentangling the latent space of pre-trained StyleGAN into texture, shape, lighting and viewpoint and using these 3D components to render synthetic face images.
- LiftedGAN is able to output both the 3D shape and texture while allowing explicit pose and lighting control over the generated face images from just a single 2D face image.

○ **Identifying Missing Children: Face Age-Progression via Deep Feature Aging**

PRIP Lab, Michigan State University

August 2019 – April 2020

- Developed a feature aging module that can age-progress deep face features output by a pre-trained face matcher to improve the recognition accuracy of age-separated child face images to facilitate identifying young children who are possible victims of child trafficking or abduction.
- Moreover, we proposed a generator that synthesizes realistic age-progressed face images and can enhance the cross-age recognition accuracy of any commodity face matcher.

○ **Learning Style Compatibility for Furniture**

Rheinische Friedrich-Wilhelms-Universität Bonn, Germany

May 2018 – July 2018

- Collected a first of its kind large scale dataset of 90,000 Furniture images along with their annotations about color, material, style etc. to facilitate research in furniture recommendation.
- Achieved state of the art performance on learning stylistic compatibility between these furniture images and developed visual-text based embedding models which can answer retrieval queries based on both images and text.

○ **VGR-Net: A View Invariant Gait Recognition Network**

Indian Institute of Technology Mandi

June 2017 – July 2017

- Developed a two-step hierarchical 3-D Convolutional Neural Network for recognition of gait videos using only the silhouettes of the captured frames and obtained state-of-the-art results on the publicly available CASIA-B dataset.

Achievements

- Received the **President's Gold Medal award** for best academic performance among all B.Tech. graduates, IIT Jodhpur, 2019
- Received the **DAAD WISE scholarship** to pursue research internship in Germany, 2018.
- Received **Academic Distinction Awards** for Sessions 2015-2016 and 2016-2017 for best academic performance in the department, Computer Science and Engineering, IIT Jodhpur
- Successfully **cleared KVPY examination**, 2015
- Among the top 300 students in the country to **successfully clear the National Standard Examination of Physics (NSEP)**, 2015

Skills

Python, C++, Tensorflow, Keras, PyTorch, OpenCV, Sklearn, Numpy, Deep Learning, Machine Learning, Pattern Recognition, Matlab, Latex, Technical Writing, SQL (MySQL and sqlite)

Coursework

Computer Vision, Computational Foundations of AI and ML, Pattern Recognition and Analysis, Machine Learning, Design and Theory of Algorithms, Theory of Probability and Statistics, Distributed Systems, Database Systems, Deep Learning, Artificial Intelligence