Sandipan Banerjee

Contact Information

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Research Interests

Computer Vision - Synthesis, semi-supervised learning, self-supervision, domain invariance.
Deep Learning - CNNs, GANs, autoencoders, siamese nets, LSTMs.
Biometrics - Face (identity/expression/attributes) and iris (segmentation).

Work Experience

Jul 2019-Present — Computer Vision Scientist at **Affectiva**
- Building a **universal encoding space** that can be used classify facial expressions, lighting, age, pose and subject identity all at once, **invariant to camera type and placement**.
- Built **GAN models**, to manipulate facial expressions, pose and directional lighting, using losses driven by **human perceptual judgements**.
- Designed **weakly supervised network models** for eye gaze/glance prediction in driver videos that are **robust to changes in input domain (camera type and angle)**.
- **Hallucinating synthetic samples** in facial attribute feature space to **detect temporal events like drowsiness** from driver videos.
- Worked on designing **static and temporal expression detection** models (like yawn).

May 2014-May 2019 — Graduate Research Assistant at **University of Notre Dame**
Computer Vision Research Laboratory (CVRL)
- Worked on **generation of natural looking synthetic face images** (2D & 3D) to augment training data for deep neural networks and artificial face image frontalization.
- Developed a **multi-scale cascaded network of GANs** for hallucinating context (forehead, hair, neck, clothes) and background pixels directly from a single face mask.
- Developed the Notre Dame Synthetic Face Dataset, containing **2M face images of 12K synthetic identities**, that can be used without copyright or privacy concerns.
- Previously worked on the PAD Project, **detecting counterfeit pharmaceutical drugs**.

Summer 2016 — Research Intern at **Xerox Palo Alto Research Center (PARC)**
- **Keypoint detection** in the forehead and cheek regions using texture information.
- **Artificial aging of face images** (CNN, GAN, blending) for predicting skin conditions.

Aug 2013-May 2014 — Graduate Teaching Assistant at **University of Notre Dame**
- Graded papers, held office hours and conducted tests for the *Computer Networks (CSE 30264)*, and *Ethical and Professional Issues (CSE 40175)* courses.

Jul 2012-Apr 2013 — Associate Engineer at **Unisys Global Services India**
- Worked on plug-in development for Unisys' proprietary Clearpath mainframe servers.

Education

Aug 2013-May 2019 — **PhD** in Computer Science, University of Notre Dame, USA
M.S. obtained in May 2017 (GPA: 3.6/4).
Advisers: Patrick Flynn & Kevin Bowyer.
Dissertation: Exploring the Effects of Frontalization & Data Synthesis on Face Recognition. [PDF]

Aug 2008-May 2012 — **B.Tech** in Computer Science & Engineering, NIT Durgapur, India
GPA: 7.89/10.

Publications (* denotes equal contribution)

S. Banerjee, W. Scheirer, K. Bowyer, and P. Flynn, *Analyzing the Impact of Shape & Context on the Face Recognition Performance of Deep Networks*, under review. [paper]

S. Banerjee, A. Joshi, J. Turcot, B. Reimer, and T. Mishra, *Driver Glance Classification In-the-wild: Towards Generalization Across Domains and Subjects*, in IEEE International Conference on Automatic Face and Gesture Recognition (FG), 2021. [paper]

S. Banerjee, A. Joshi, P. Mahajan, S. Bhattacharya, S. Kyal, and T. Mishra, *LEGAN: Disentangled Manipulation of Directional Lighting and Facial Expressions by Leveraging Human Perceptual Judgements*, in IEEE Conference on Computer Vision & Pattern Recognition (CVPR) Workshops, 2021. [paper] (*Best Paper Runner Up*)

S. Banerjee, A. Joshi, A. Ghoneim, S. Kyal, and T. Mishra, *Synthesize & Learn: Jointly Optimizing Generative and Classifier Networks for Improved Drowsiness Detection*, in IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2021. [paper]

D. Saavedra, **S. Banerjee**, and D. Mery, *Detection of Threat Objects in Baggage Inspection with X-ray Images using Deep Learning*, in Neural Computing and Applications (NCAA), 2020. [paper]

A. Joshi, S. Kyal, **S. Banerjee**, and T. Mishra, *In-The-Wild Drowsiness Detection from Facial Expressions*, in IEEE Intelligent Vehicles Symposium (IV) Workshops, 2020. [paper]

S. Banerjee, W. Scheirer, K. Bowyer, and P. Flynn, *On Hallucinating Context and Background Pixels from a Face Mask using Multi-scale GANs*, in IEEE Winter Conference on Applications of Computer Vision (WACV), 2020. [paper]

S. Banerjee, W. Scheirer, K. Bowyer, and P. Flynn, *Fast Face Image Synthesis with Minimal Training*, in IEEE Winter Conference on Applications of Computer Vision (WACV), 2019. [paper]

S. Banerjee*, J. Brogan*, J. Krizaj, A. Bharati, B. RichardWebster, V. Struc, P. Flynn, and W. Scheirer, *To Frontalize or Not To Frontalize: Do We Really Need Elaborate Pre-processing To Improve Face Recognition?*, in IEEE Winter Conference on Applications of Computer Vision (WACV), 2018. [paper]

D. Mery, and **S. Banerjee**, *Recognition of Faces and Facial Attributes using Accumulative Local Sparse Representations*, in IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2018. [paper]

S. Banerjee*, J. Bernhard*, W. Scheirer, K. Bowyer, and P. Flynn, *SREFI: Synthesis of Realistic Example Face Images*, in IAPR/IEEE International Joint Conference on Biometrics (IJCB), 2017. [paper]

D. Mery, E. Svec, M. Arias, V. Riffo, J. Saavedra, and **S. Banerjee**, *Modern Computer Vision Techniques for X-ray Testing in Baggage Inspection*, in IEEE Trans. on Systems, Man, and Cybernetics: Systems (SMC), 47 (4), pp. 682 - 692, 2017. [paper]

W. Scheirer, et al., *Report on the BTAS 2016 Video Person Recognition Evaluation*, in IEEE International Conference on Biometrics Theory, Applications and Systems (BTAS), 2016. [paper]

S. Banerjee, J. Sweet, C. Sweet, and M. Lieberman, *Visual Recognition of Paper Analytical Device Images for Detection of Falsified Pharmaceuticals*, in IEEE Winter Conference on Applications of Computer Vision (WACV), 2016. [paper]

S. Banerjee, and D. Mery, *Iris Segmentation using Geodesic Active Contours and GrabCut*, PSIVT Workshop on 2D & 3D Geometric Properties from Incomplete Data, 2015. [paper]

Patents

T. Mishra, **S. Banerjee**, and A. Joshi, *Neural Network Synthesis Architecture using Encoder-Decoder Models*, U.S. Provisional Patent Application Serial No. 63/071,401.

S. Banerjee, R. el Kaliouby, A. Joshi, S. Kyal, and T. Mishra, *Synthetic Data for Neural Network Training Using Vectors*, U.S. Provisional Patent Application Serial No. 17/136,083.

Skill Set

PROGRAMMING LANGUAGES: Python, Matlab
APPLICATIONS: OpenCV, Keras, Tensorflow, Caffe, Dlib, pyOpenGL
PLATFORMS: Ubuntu, Windows, EC2

Other Relevant Information

OUTSTANDING REVIEWER AWARD:
- IEEE Conference on Computer Vision & Pattern Recognition (CVPR) 2021.

PROGRAM COMMITTEE MEMBER:
- Human Behavior Understanding (HBU) Workshop at IEEE WACV 2021.

JOURNAL REVIEWER:
- IEEE Trans. on Pattern Analysis & Machine Intelligence (TPAMI)
- IEEE Trans. on Image Processing (TIP)
- IEEE Trans. on Information Forensics & Security (TIFS)
- IEEE Trans. on Biometrics, Behavior, and Identity Science (TBIOM)
- The Visual Computer Journal (TVC).

CONFERENCE REVIEWER:
- IEEE Conference on Computer Vision & Pattern Recognition (CVPR) 2020, 2021, 2022
- IEEE International Conference on Computer Vision (ICCV) 2021
- IEEE Winter Conference on Applications of Computer Vision (WACV) 2020, 2021, 2022
- Asian Conference on Computer Vision (ACCV) 2020
- IEEE/IAPR International Joint Conference on Biometrics (IJCB) 2020, 2021
- IEEE Conference on Biometrics: Theory, Application & Systems (BTAS) 2019
- IAPR International Conference on Biometrics (ICB) 2019.

INVITED TALKS:
- Dept. of Computer Science, Colorado State University (04/2021)
- The MIT AgeLab/Advanced Vehicle Technology (AVT) Consortium (01/2021)
- Doctoral Consortium at IEEE WACV 2019
- Midwest Vision Workshop 2018
- Amazon Graduate Research Symposium 2017
- NSF Data Science Workshop 2016.

MENTORING: Kunjal Panchal (UMass Amherst), Prashant Mahajan (Amazon), Sneha Bhattacharya (Silver Spoon Animation).

References

Available upon request.