

AJJEN JOSHI

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ajjendj@bu.edu \diamond ajjendj.github.io

EDUCATION

Ph.D., Computer Science, Boston University 2018
Thesis: *Personalized Face and Gesture Analysis Using Hierarchical Neural Networks*
Advisers: Dr. Margrit Betke and Dr. Stan Sclaroff

M.S., Computer Science, Boston University 2014
Thesis: *A Random Forest Approach to Segmenting and Classifying Gestures*
GPA: 3.9/4.0

B.A., Connecticut College 2012
Double Major in Computer Science and Architectural Studies
GPA: 3.96/4.0 *Summa Cum Laude*, 🏆 **Phi Beta Kappa**

SKILLS

Research	Affective Computing; Gaze, Face and Hand Analysis; Gestural Interaction
Languages	Python; C++; Processing
Frameworks/Libraries	PyTorch; TensorFlow; Keras; scikit-learn; NumPy; pandas; OpenCV
Others	AWS; Git; Docker; Jupyter; WandB; Metaflow

EXPERIENCE

SmartEye *Boston, MA*
Lead Computer Vision Scientist Feb 2022 - present

- Led, grew and supervised 5-member team to build a subset of features for SmartEye's Cabin Monitoring System product. Features include body pose recognition, hand analysis and tracking, and vehicle occupant classification.
- Continued driving the development of HMI-based features (static and dynamic gesture recognition) as an individual contributor, showcasing novel use-cases of in-car HMI at venues such as CES.

Affectiva (acquired by SmartEye in June 2021) *Boston, MA*
Senior Research Scientist July 2020 - Feb 2022
Research Scientist Nov 2018 - July 2020

- Developed novel methods for analyzing in-vehicle human behavior, including: encoder-decoder models for multi-task facial attribute prediction and face generation, GAN models for facial attribute manipulation, gaze estimation using synthetic data and semi-supervised learning, drowsiness detection using generative data augmentation, multimodal frustration detection, and boredom mitigation using affective conversational agents.
- Designed data collection protocols and annotation guidelines, trained and evaluated research-informed ML models for multiple features, and integrated them into Affectiva's flagship In-Cabin Sensing product.

Adobe Research *Cambridge, MA*
Research Intern Summer 2016

- Explored a deep learning approach to automatically generate inbetween frames in 2D handdrawn animations. Advised by Masha Shugrina

Disney Research *Cambridge, MA*
Research Intern Summer 2015

- Implemented prototype system for performing gesture recognition from glove sensor data and initiated development of subject-specific hierarchical Bayesian classifiers. Advised by Dr. Hanspeter Pfister, Dr. Soumya Ghosh

PUBLICATIONS

- [23] Sandipan Banerjee, Ajjen Joshi, Jay Turcot. **The Universal Face Encoder: Learning Disentangled Representations across Different Attributes**. IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshop on Biometrics, 2023. *Oral*.
- [22] Nataniel Ruiz, Hao Yu, Danielle Alessio, Mona Jalal, Ajjen Joshi, Thomas Murray, John Magee, Kevin Manuel Delgado, Vitaly Ablavsky, Stan Sclaroff, Ivon Arroyo, Beverly P Woolf, Sarah Adel Bargal, Margrit Betke. **ATL-BP: A Student Engagement Dataset and Model for Affect Transfer Learning for Behavior Prediction**. IEEE Transactions on Biometrics, Behavior, and Identity Science (TBIOM), 2022.
- [21] Nataniel Ruiz, Hao Yu, Danielle Alessio, Mona Jalal, Ajjen Joshi, Thomas Murray, John Magee, Jacob Whitehill, Vitaly Ablavsky, Ivon Arroyo, Beverly Woolf, Stan Sclaroff, Margrit Betke. **Leveraging Affect Transfer Learning for Behavior Prediction in an Intelligent Tutoring System**. IEEE International Conference on Automatic Face and Gesture Recognition (AFGR), 2021. *Oral*. 🏆 **Best Poster Award**.
- [20] Sandipan Banerjee, Ajjen Joshi, Jay Turcot, Bryan Reimer, Taniya Mishra. **Driver Glance Classification In-the-wild: Towards Generalization Across Domains and Subjects**. IEEE International Conference on Automatic Face and Gesture Recognition (AFGR), 2021. *Poster*.
- [19] Sandipan Banerjee, Ajjen Joshi, Sneha Bhattacharya, Prashant Mahajan, Survi Kyal, Taniya Mishra. **LEGAN: Disentangled Manipulation of Directional Lighting and Facial Expressions by Leveraging Human Perceptual Judgements**. IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshop on Analysis and Modeling of Faces and Gestures (AMFG), 2021. *Oral*. 🏆 **Best Paper Runner-up Award**.
- [18] Sandipan Banerjee, Ajjen Joshi, Ahmed Ghoneim, Survi Kyal, Taniya Mishra. **Synthesize and Learn: Jointly Optimizing Generative and Classifier Networks for Improved Drowsiness Detection**. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2021. *Oral*.
- [17] Samiha Samrose, Kavya Anbarasu, Ajjen Joshi, Taniya Mishra. **Mitigating Boredom Using an Empathetic Conversational Agent**. ACM International Conference on Intelligent Virtual Agents (IVA), 2020. *Oral*.
- [16] Andrew Kurauchi, Wenxin Feng, Ajjen Joshi, Carlos Morimoto, Margrit Betke. **Swipe & Switch: Text Entry Using Gaze Paths and Context Switching**. ACM Symposium on User Interface Software and Technology (UIST), 2020. *Poster*.
- [15] Ajjen Joshi, Survi Kyal, Sandipan Banerjee, Taniya Mishra. **In-the-wild Drowsiness Detection from Facial Expressions**. IEEE Intelligent Vehicles Symposium (IV) Workshop on Human Sensing in Intelligent Mobility, 2020. *Oral*.
- [14] Ajjen Joshi, Youssef Attia, Taniya Mishra. **Protocol for Eliciting Driver Frustration in an In-vehicle Environment**. IEEE International Conference on Affective Computing and Intelligent Interaction (ACII), 2019. *Poster*.
- [13] Ajjen Joshi, Danielle Alessio, John Magee, Jacob Whitehill, Ivon Arroyo, Beverly Woolf, Stan Sclaroff, Margrit Betke. **Affect-driven Learning Outcomes Prediction in Intelligent Tutoring Systems**. IEEE International Conference on Automatic Face and Gesture Recognition (AFGR), 2019. *Poster*.
- [12] Rohit Agrawal, Ajjen Joshi, Margrit Betke. **Enabling Early Gesture Recognition by Motion Augmentation**. ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), 2018. *Oral*.
- [11] Ajjen Joshi, Soumya Ghosh, Sarah Gunnery, Linda Tickle-Degnen, Margrit Betke, Stan Sclaroff. **Context-Sensitive Prediction of Facial Expressivity Using Multimodal Hierarchical Bayesian Neural Networks**. IEEE International Conference on Automatic Face and Gesture Recognition (AFGR), 2018. *Poster*.
- [10] Ajjen Joshi, Soumya Ghosh, Margrit Betke, Stan Sclaroff, Hanspeter Pfister. **Personalizing Gesture Recognition Using Hierarchical Bayesian Neural Networks**. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017. *Poster*.
- [9] Elham Saraee, Saurabh Singh, Kathryn Hendron, Mingxin Zheng, Ajjen Joshi, Terry Ellis, Margrit Betke. **ExerciseCheck: Remote Monitoring and Evaluation Platform for Home Based Physical Therapy**. ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), 2017. *Oral*.
- [8] Elham Saraee, Ajjen Joshi, Margrit Betke. **A Therapeutic Robotic System for the Upper Body based on the Proficio Robotic Arm**. IEEE International Conference on Virtual Rehabilitation (ICVR), 2017. *Poster*.

- [7] Elham Saraee, Saurabh Singh, Ajjen Joshi, Margrit Betke. **PostureCheck: Posture Modeling for Exercise Assessment using the Microsoft Kinect**. IEEE International Conference on Virtual Rehabilitation (ICVR), 2017. *Poster*.
- [6] Ajjen Joshi, Soumya Ghosh, Margrit Betke, Hanspeter Pfister. **Hierarchical Bayesian Neural Networks for Personalized Classification**. Neural Information Processing Systems (NeurIPS) Workshop on Bayesian Deep Learning, 2016. *Poster*.
- [5] Ajjen Joshi, Linda Tickle-Degnen, Sarah Gunnery, Terry Ellis, Margrit Betke. **Predicting Active Facial Expressivity in People with Parkinson’s Disease**. ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), 2016. *Oral*.
- [4] Ajjen Joshi, Camille Monnier, Margrit Betke, Stan Sclaroff. **Comparing Random Forest Approaches to Segmenting and Classifying Gestures**. Image and Vision Computing (IMAVIS), 2016.
- [3] Andrew Kurauchi, Wenxin Feng, Ajjen Joshi, Carlos Morimoto, Margrit Betke. **EyeSwipe: Dwell-free Text Entry Using Gaze Paths**. ACM Conference on Human Factors in Computing Systems (CHI), 2016. *Oral*.
- [2] Huy Le, Ajjen Joshi, Margrit Betke. **b3.js: A Library for Interactive Virtual Reality Web 3D Graphs**. IEEE Conference on Virtual Reality and 3D User Interfaces (VR), 2016. *Research Demo*.
- [1] Ajjen Joshi, Camille Monnier, Margrit Betke, Stan Sclaroff. **A Random Forest Approach to Segmenting and Classifying Gestures**. IEEE International Conference on Automatic Face and Gesture Recognition (AFGR), 2015. *Oral*.

PATENTS

- [4] Sandipan Banerjee, Ajjen Joshi, Jay Turcot. **Neural Network Multi-attribute Facial Encoder and Decoder**. *US Patent App. 63/354,723*.
- [3] Taniya Mishra, Sandipan Banerjee, Ajjen Joshi. **Neural Network Synthesis Architecture Using Encoder-Decoder Models**. *US Patent App. 17/458,639*.
- [2] Sandipan Banerjee, Rana el Kaliouby, Ajjen Joshi, Survi Kyal, Taniya Mishra. **Synthetic Data for Neural Network Training Using Vectors**. *US Patent 11,769,056*.
- [1] Rana el Kaliouby, Ajjen Joshi, Survi Kyal, Abdelrahman Mahmoud, Mohammad Mavadati, Jay Turcot. **In-vehicle drowsiness analysis using blink rate**. *US Patent 11,318,949*

INVITED TALKS

- [5] **KDD 2022 Health Day: Panel Discussion on Data Mining and Healthcare** (along with Jianying Hiu and Hamed Alemohammad). Virtual Presentation, 2022.
- [4] **Detecting Impediments to Safe Driving and Designing Affective Interventions**.
 - Boston University Applied Deep Learning Course, Guest Lecture, 2022
 - IEEE Intelligent Vehicles Symposium (IV) Workshop on In-cabin Human Sensing in Intelligent Vehicles, Invited Talk, 2021.
 - Boston University AI4ALL, Guest Lecture, 2021
 - Connecticut College Computer Science Seminar, Invited Talk, New London, CT. 2021.
- [3] **Computational Human Sensing: Applications of Face, Gesture and Affect Analysis**.
 - ICC Workshop on Applications of Affective Sensing in Communication Networks (AffectiCom), Invited Keynote and Panel Discussion. 2021.
 - Affectiva EMPATH Talk Series. Virtual Presentation. 2020.
 - Boston University Guest Lecture CS585. Virtual Presentation. 2020.
 - Connecticut College Computer Science Seminar, Invited Talk, New London, CT. 2019.
- [2] **Analysis of Facial Expressivity in Parkinson’s Disease Patients using Hierarchical Bayesian Neural Networks**. Tufts University Health Quality of Life Lab Seminar. Medford, MA. 2017.
- [1] **Personalizing Gesture Recognition Using Hierarchical Bayesian Neural Networks**. New England Computer Vision Workshop. Boston, MA. 2016.

MENTORING

- [7] Samiha Samrose, Kavya Anbarasu. Affectiva Summer Intern Project on **Mitigating Boredom Using An Empathetic Conversational Agent**. Summer 2019. [Publication 17]
- [6] Eleni Rally. Affectiva Summer Intern Project on **Analyzing EEG signals of Drowsy and Distracted Drivers**. Summer 2019.
- [5] Muhammad Zuhayr Raghieb, Master's Project on **Using 3D-CNNs for Student Engagement Prediction in Intelligent Tutoring Systems**. Spring 2018.
- [4] Pratikkumar Patel, Master's Project on **Using LSTMs To Improve Text Input Speed In Eye Typing Systems**. Fall 2017.
- [3] Rohit Agrawal, Master's Project on **Enabling Early Gesture Recognition by Motion Augmentation**. Fall 2017. [Publication 12]
- [2] Srivathsa Rajagopal, Master's Project on **Facial Expression Analysis of US Presidential Debates**. Fall 2016.
- [1] Huy Le, Senior Undergraduate Research Project on **Building a Library for Data Visualization in Virtual Reality**. Fall 2015. [Publication 2]

TEACHING

Teaching Fellow at Boston University for:

Artificial Intelligence (Senior undergraduate course in AI) Spring 2017
Rating: 4.65/5 (rated by 32 students)

Artificial Intelligence (Senior undergraduate course in AI) Spring 2016
Rating: 4.68/5 (rated by 19 students)

Image and Video Computing (Graduate course in computer vision) Fall 2014
Rating: 4.82/5 (rated by 22 students)

🏆 **Boston University Computer Science Award in Teaching Excellence**

Application Programming (Introductory course in programming) Fall 2013
Rating: 4.43/5 (rated by 44 students)

SERVICE

Guest Editor IEEE Communications Magazine '22

Reviewer/Program Committee for:

- Transaction on Cybernetics
- Pattern Recognition
- Journal of AI Research
- ICCV '21
- NEURIPS '20
- ECCV '20, '18
- CHI '20
- CVPR '23, '22, '21, '18,
- CVPRW '17,
- AFGR '18 (🏆 **Best Reviewer Award**), '17,
- PSIVT '17,
- PETRA '17, '16

AI@BU Seminar Coordinator (Fall 2016-Spring 2018)

CREATIVE PORTFOLIO

<https://www.ajjenjoshi.com/>