Ajjen Joshi

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Education

Boston University | Boston, MA

Ph.D., Computer Science 2018

- Thesis: *Personalized Face and Gesture Analysis Using Hierarchical Neural Networks*
- Advisors: Dr. Margrit Betke and Dr. Stan Sclaroff

Boston University | Boston, MA

M.S., Computer Science 2014

- Thesis: *A Random Forest Approach to Segmenting and Classifying Gestures*
- Advisors: Dr. Margrit Betke and Dr. Stan Sclaroff
- GPA: 3.9/4.0

Connecticut College | New London, CT

B.A., Computer Science and Architectural Studies (Double Major) 2012

- Thesis: *Real-time Facial Animation by Gesture Imitation*
- Advisor: Dr. Ozgur Izmirli
- GPA: 3.96/4.0 *Summa Cum Laude*

Experience

Affectiva (acquired by Smart Eye in June 2021) | Boston, MA

Senior Deep Learning Scientist July 2020 - Present

- Lead team to develop algorithms for automated driver monitoring systems, focusing on safety features, such as distraction and drowsiness detection; Supervise the design, implementation and evaluation of data collection protocols, annotation guidelines and machine learning models to enable integration to real-time SDK in embedded systems.

Deep Learning Scientist November 2018 - July 2020

- Researched, prototyped and implemented computer vision and machine learning algorithms to solve problems in automatic analysis of emotional and cognitive states, such as frustration, boredom and drowsiness.

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 explored development of subject-specific hierarchical Bayesian classifiers. Advised by Dr. Hanspeter Pfister, Dr. Soumya Ghosh

Brown University | Providence, RI

Research Intern Summer 2011

- Created interactive multimedia installations in Max/MSP/Jitter using the Microsoft Kinect. Advised by Dr. Todd Winkler.

Research Statement

My research interests lie in the intersectional disciplines of computer vision, machine learning, and human computer interaction. I am interested in the personalized analysis of spatio-temporal human signals, generated for instance by eye-gaze, facial expressions and body gestures, in order to facilitate a computational understanding of human behavior and enable intelligent interaction with the computer.

Refereed Publications

[21] Nataniel Ruiz, Hao Yu, Danielle Allessio, 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*.

[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*.

[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 Allessio, 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

[3] Sandipan Banerjee, Rana el Kaliouby, Ajjen Joshi, Taniya Mishra. **Neural Network Synthesis Architecture Using Encoder-Decoder Models**. *Patent Pending*.

[2] Sandipan Banerjee, Rana el Kaliouby, Ajjen Joshi, Survi Kyal, Taniya Mishra. **Synthetic Data for Neural Network Training Using Vectors**. *Patent Pending*.

[1] Sandipan Banerjee, Rana el Kaliouby, Ajjen Joshi, Survi Kyal, Taniya Mishra. **Synthetic Data Augmentation for Neural Network Training**. *Patent Pending*.

Academic Talks

[11] **Detecting Impediments to Safe Driving and Designing Affective Interventions.**
- IEEE Intelligent Vehicles Symposium (IV) Workshop on In-cabin Human Sensing in Intelligent Vehicles, Invited Talk, 2021.
- Boston University AI4ALL, Guest Speaker, 2021
- Connecticut College Computer Science Seminar. New London, CT. 2021.

[10] **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. New London, CT. 2019.

[9] **In-the-wild Drowsiness Detection from Facial Expressions.** IEEE Intelligent Vehicles Symposium (IV) Workshop on In-cabin Human Sensing in Intelligent Vehicles, Virtual Presentation. 2020.

[8] **Interfaces and Interactions: Towards Personalization using Hierarchical Neural Networks.** Affectiva. Boston, MA. 2018.

[7] **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.

[6] **Personalizing Gesture Recognition Using Hierarchical Bayesian Neural Networks.** New England Computer Vision Workshop. Boston, MA. 2016.

[5] **Deeptween: A Data-Driven Approach to Automatic Inbetweening in Hand-drawn Animations.** Adobe Research Intern Presentation. Cambridge, MA. 2016.

[4] **Predicting Active Facial Expressivity in People with Parkinson's Disease.** PETRA. Corfu, Greece. 2016.

[3] **Hierarchical Bayesian Models for Subject-specific Gesture Recognition.** Disney Research Intern Presentation. Cambridge, MA. 2015.

[2] **Victory Over the Sun: Panel Discussion (along with Harlow Robinson, Larissa Shmailo and Anna Winestein).** Boston, MA. 2015.

[1] **A Random Forest Approach to Segmenting and Classifying Gestures.** AFGR. Ljubljana, Slovenia. 2015.

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 Drivers**. Summer 2019.

[5] Muhammad Zuhayr Raghib, 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)
- Application Programming (Introductory course in programming) Fall 2013
  Rating: 4.43/5 (rated by 44 students)

Awards

[12] AFGR 2021 Best Poster Award (2021)

[11] CVPR AMFG 2021 Best Paper Runner-up Award (2021)

[10] AFGR 2018 Best Reviewer Award (2018)

[9] AFGR 2018 Doctoral Consortium Award (2018)

[8] PETRA 2016 Doctoral Consortium Award (2016)

[7] One of best reviewed papers of Automatic Face and Gesture Recognition (AFGR 2015)

[6] Boston University Computer Science Teaching Excellence Award (2015)

[5] Phi Beta Kappa (2012)

[4] Architectural Studies Award for Outstanding Graduating Senior (2012)

[3] Winthrop Scholar, Connecticut College's highest academic honor (2011)

[2] Keck Research Grant (2010)

[1] Ranked 1st out of 108 students of high school graduating class (2007)

Skills

Programming

- Python, C++, Java, Matlab, HTML/CSS, JavaScript, PHP, MySQL, Processing

Other

- **Deep Learning Libraries:** TensorFlow, PyTorch,

Service

- Reviewer/Program Committee for:
  - Transaction on Cybernetics
  - Pattern Recognition
  - Journal of AI Research
  - ICCV ‘21
  - NEURIPS ‘20
  - ECCV ‘20, ‘18
  - CHI ’20
  - CVPR ‘22, ‘21, ‘18,
  - CVPRW ‘17,
  - AFGR ‘18, ‘17,
  - PSIVT ‘17,
  - PETRA ‘17, ’16
- AI@BU Seminar Coordinator (Fall 2016-Spring 2018)

Github `https://github.com/ajjendj/`

Creative Portfolio `https://www.ajjenjoshi.com/`