CURRICULUM VITAE - DONG HUANG

Title: **Project Scientist**
Affiliation: Human Sensing Laboratory, The Robotics Institute, Carnegie Mellon University
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Research Interests

- **Human Sensing**: Modeling, recognition and understanding human behavior (i.e. facial expressions and body motion) from sensory data (e.g. videos and motion capture data).
- **Time Series Analysis**: Modeling multi-modality time series data (e.g., videos, depth sequences and wearable sensor data), personalized detection of temporal events in human/animal activities and physiology.
- **Robust visual learning** : The building blocks of machine learning approaches used in Human Sensing and Time Series Analysis problems, e.g., regression, classification and clustering. I am interested in developing fast and robust learning methods for data with outlier and missing elements.

Professional Experience

- **Project Scientist**—The Robotics Institute
  Carnegie Mellon University, Pittsburgh, PA, USA
  - Human Sensing Laboratory
  - Feb., 2012 - Present
- **Research Scientist (Part time)**—Facebook Inc.
  Facebook Head Quater, Menlo Park, CA, USA
  - Mar., 2017 - Present
- **Post-doctoral Research Associate**—The Robotics Institute
  Carnegie Mellon University, Pittsburgh, PA, USA
  - Human Sensing Laboratory
  - Jun., 2009 - Jan., 2012

Skills

- Research project management
- Seven-year expertise in Machine Learning and Computer Vision research
- Deep experience and innovative programming
- Fluent in English reading, writing and speaking
- Native Mandarin speaker

Education

- **Ph.D. degree**—Computer Science
  University of Electronic Science and Technology of China, Chengdu, China
  - Thesis: Dimensionality Reduction in High Dimensional Data
  - Supervisor: Professor Zhang Yi
  - Sep.,2005 - Jun., 2009
- **M.S. degree**—Automation
  University of Electronic Science and Technology of China, Chengdu, China
  - Thesis: Error Calibration Algorithm in Spectrum Analyzers
  - Supervisor: Professor Ling Tong
  - Sep., 2002- Jun., 2005

Selected Publications

- **Dong Huang**, L. Han and F. De la Torre, *Soft-Margin Mixture of Regression*, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Accepted, 2017.
- Y. Yang, D. Zhang, **Dong Huang** and F. De la Torre, *Learning Category-Specific 3D Shape Models from Weakly Labeled 2D Images*, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Accepted, 2017.
- **Dong Huang**, R. Silveira and F. De la Torre, *Robust Regression*, IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), 38(2): 363-375, 2016.
- **Dong Huang**, S. Yao, Y. Wang and F. De la Torre, *Sequential Max-Margin Event Detectors*, European Conference on Computer Vision (ECCV), 2014.
- Y. Zhu, **Dong Huang**, S. Lucey and F. De la Torre, *Complex Non-Rigid Motion 3D Reconstruction by Union of Subspaces*, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014.
- **Dong Huang** and F. De la Torre, *Facial Action Transfer with Personalized Bilinear Regression*, European Conference on Computer Vision (ECCV), 2012.
- **Dong Huang**, R. Silveira and F. De la Torre, *Robust Regression*, European Conference on Computer Vision (ECCV), 2012.
- **Dong Huang**, M. Storer, F. De la Torre and H. Bischof, *Supervised Local Subspace Learning for Continuous Head Pose Estimation*, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2011.
- **Dong Huang**, Y. Tian and F. De la Torre, *Local Isomorphism to Solve the Pre-image Problem in Kernel Methods*, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2011.
- **Dong Huang**, K. Meyers, S. Henry, F. De la Torre and C. C. Horn, *Computerized Detection and Analysis of Cancer Chemotherapy-induced Emesis in a Small Animal Model, Musk Shrew*, Journal of Neuroscience Methods, 50(1693-1711), 2010.

- **Dong Huang** and Fernando De la Torre, *Bilinear Kernel Reduced Rank Regression for Facial Expression Synthesis*, European Conference on Computer Vision, (Oral), 2010.
- **Dong Huang**, Zhang Yi and Xiaorong Pu, *Manifold Based Learning and Synthesis*, IEEE Transactions on Systems, Man and Cybernetics - Part B, regular paper, 39(3):529-606, 2009.
- **Dong Huang**, Zhang Yi and Xiaorong Pu, *A New Local PCA SOM Algorithm*, Neurocomputing , 71:3544-3552. 2008.
- **Dong Huang** and Zhang Yi, *Shape Recovery by A Generalized Topology Preserving SOM*, Neurocomputing , 72: 573-580, 2008.
- **Dong Huang** and Zhang Yi, *A New Incremental PCA Algorithm With Application to Visual Learning*, Neural Processing Letters, 30(171-185), 2009.
- **Dong Huang**, Zhang Yi and Xiaorong Pu, *Manifold Learning With Local Geometry Preserving and Global Affine Transformation*. IEEE International Conferences on Cybernetics & Intelligent Systems (CIS) and Robotics, Automation & Mechatronics (RAM) (CIS-RAM 2008), 1178-1192, 2008.
- **Dong Huang** and Xiaorong Pu, *A Kernel View of Manifold Analysis for Face Images*. IEEE International Conference on Intelligent System and Knowledge Engineering (ISKE2008), 650-655, 2008.
- **Dong Huang**, Huizhong Qiu and Zhang Yi, *Local-Bandwidth Mean Shift Segmentation of MR Images Using Nonlinear Diffusion*. Dynamics of Continuous, Discrete and Impulsive systems, Series A: Mathematical Analysis, Vol. 14(S1) 737-741, 2007.

Selected Projects

- *Affective state estimation from wearable sensors: Phase 0*
  01/27/2017-03/31/2017
  Sony Corporation (Private Company) PI: **Dong Huang**, RI, CMU
  My Role: Principal Investigator. Responsible for managing the research progress on data analysis, design machine learning techniques and report to Sony.

  Understanding and detecting human affective state is the vital step for improving quality of life and personalized product services. This project aims to develop core technologies of advanced affective state estimation (e.g. stress, concentration, joy etc.) by vital sensors (e.g. ECG/HR, GSR, BP, EEG). The CMU team will integrate cutting-edge technologies of device, psychology, and machine learning towards advanced affective state estimation.
- *STTR Phase I: Wearable system for mining Parkinson's disease symptom states in an ambulatory setting*
  01/01/2016-12/30/2017
  National Science Foundation co-PI: **Britta Ulm**, Abililife Inc. co-PI: **Dong Huang**, RI, CMU
  My Role: co-Principal Investigator. Responsible for managing the research progress on data analysis, design machine learning techniques and report to National Science Foundation and Abililife Inc.

  AbiliLife developed, manufactured, and started commercialization of the CALIBRACE, used to improve Parkinson's patients' posture and balance. This grant is to instrument

CALIBRACE with six sensors and machine learning techniques to further improve Patients' health. The chosen sensors are a plethysmography band to measure breathing rate; an accelerometer for changes in an individual's position; a gyroscope for an individual's physical orientation; a heart rate monitor; a body temperature monitor; and a microphone. The sensors will be integrated into the CALIBRACE using known cut and sew techniques to create the SmartCALIBRACE. Data will be collected from the SmartCALIBRACE and observational logs. These data will be analyzed through machine learning algorithms, developed by the Human Sensing Lab at CMU. The data collected from the six sensors may be used in combination or individually to detect symptoms of ParkinsonŠs disease, such as tremors, bradykinesia, postural instability, or falling. Based on automatic evaluation of patient's posture, SmartCALIBRACE will communicate to the patients and caretakers if the risk of falling has increased, through a personalized algorithm output for each patient. The fall detection feature presents an enormous commercialization opportunity and expands the market from our initial focus on Parkinson's patients to the global senior care industry, where falls can be costly and deadly. However, the team notes that appropriate sensor data may not be found to adequately predict falling; if this is the case, the team will evaluate all of the data collected in Phase I and determine which symptom of Parkinson's disease is most viable to address as development proceeds. In the final product, the algorithm findings will be communicated to the Parkinson's patient or caretaker through an app, web portal, or haptic feedback. AbiliLife's eventual goal is to provide a more holistic view of Parkinson's disease by expanding the number of detectable symptoms.

- *Face De-Identification for Research and Clinical Use*
  09/01/2014-08/31/2016
  National Institutes of Health PI: **Dong Huang**, RI, CMU
  My Role: Principal Investigator. Responsible for managing the research progress, design machine learning techniques and report to National Institutes of Health.

  Recent advances in clinical research requires image and video data of people for either immediate inspection or storage and subsequent analysis. For instance, cameras are used to monitor the elderly in an independent living facility, and algorithms are developed to automatically extract behavioral information to aid physicians in assessing care needs. In order to advance the development of algorithms to analyze video sequences recorded by such systems, sharing of the data with other researchers is crucial. These new trend, however, ignites concerns about the privacy of people identifiable in the scene. In particular, privacy concerns of patients visible and identifiable within the data make this task difficult. These privacy concerns have become the barriers for the widespread use of on videos in health-related behavioral and social science research. To address these concerns, we develop automated methods to de-identify individuals in these videos. Existing methods for de-identification tends to destroy all information involving the individuals by distorting or blurring the face images of the subjects. These methods do not preserve the facial actions of the subjects that contain the valuable information for behavioral and medical studies. In contrast, our advanced face de-identification algorithms are able to obscure the identity of the subject without obscuring the action (i.e. preserving the facial expression that may reveal of a particular medical condition). Our system will be developed by an interdisciplinary team of computer and behavioral scientists, and it will be made available to the medical community.

- *A Wearable System for Home-monitoring of Chronic Movement Disorders: Cost-effective*

Solution to Frequent Clinic Visits
09/01/2013-08/31/2015
Highmark (Private company) PI: Jessica Hodgins, RI, CMU
My Role: Investigator. Responsible for developing machine learning techniques for tremor and dyskinesia detection from accelerometer data.

Chronic neurodegenerative movement disorders like ParkinsonŠs disease (PD) pose a serious threat to the elderly population. As many as one million Americans (mostly aged 65 or older) live with PD, which is more than the combined number of people diagnosed with multiple sclerosis, muscular dystrophy and Lou Gehrig's disease. The combined direct and indirect cost of Parkinson's disease, including treatment, social security payments and lost income from inability to work, is estimated to be nearly $25 billion per year in the United States alone. One of the major contributors to these costs is the requirement for periodic assessment of the motor symptoms which is performed during clinic visits. In addition to the cost, there are several shortcomings of this current state-of-the-art, including, a) inconvenience of the patients and most importantly, b) the subjectiveness of the motor symptom assessment tests. In this project, we propose to build a wearable system consisting of a set of low-cost wearable accelerometers and a first-person camera to detect and quantitatively assess the severity of the motor symptoms during daily living environments. This patient-centric system will not only reduce the requirement for frequent clinic-visits but also allow the neurologists to track patientŠs medication cycles which could be very useful to administer more effective personalized care as well as decide good candidates for surgical interventions like deep brain stimulation (DBS). Such a system also has the potential to alert the patients to seek hospital care when the severity of the symptoms threatens their safety.

- *Video De-identification in the Automobile Environment*
  02 / 2014- 01 / 2015
  Federal HighWay Administration(FHWA) PI: Fernando De La Torre, RI, CMU
  My Role: Technical lead, Designing machine learning methods and core algorithms, Managing technical reports, project inspections and the team, Primary liaison with sponsors.

  Studying naturalistic driver behaviors is a fundamental step to understand when and how accidents occur, and improve driving safety. The Second Strategic Highway Research Program (SHRP 2) has launched the Naturalistic Driving Study (NDS) to investigate the underlying causes of highway crashes and congestion. In this study, videos of approximately 3,100 drivers were collected across six states in the United States. The recorded videos capture drivers' head pose and facial movements that provide vital cues to assess drivers' status and awareness. In order to advance the automatic analysis of drivers' videos, sharing the data with researchers is crucial. However, privacy issues prevent such sharing with the research community. To address this problem, we are developing a video face masking system (based on my ECCV2012 paper) to remove the drivers' identifiable facial features, while preserving the information related to driving e.g., the head pose, eye gaze, and facial actions.
- *Human Pose and Motion Behavior Pattern Analysis with Frontal View*
  05/2012-12/2012.

Samsung Electronics Inc. PI: Fernando De La Torre, RI, CMU
My Role: Technical lead, Designing machine learning methods and core algorithms, Managing technical reports, project inspections and the team, Primary liaison with sponsors.

Real-time action recognition is a core technique for the future interactive home appliances, physical exercises assistant system and physiotherapy. In a two-year collaboration with Samsung, we developed novel algorithms that simultaneously find temporal intervals and types of body actions. Based on these algorithms, we developed a Microsoft Kinect-based system can recognize upto 50 daily actions such as physical exercises (e.g., walking, jumping, crutching), sports (e.g., football kicking and baseball swing) and arm gestures.

- *GM-CMU Vehicular Information Technology Collaborative Research Lab*
  01/2009-12/2015
  General Motors Inc. PI: Raj Rajkumar, ECE, CMU
  My Role: Managing technical reports, project inspections and the team, Primary liaison with sponsors.

  The amount of time with Eyes-Off-The-Road (EOTR) of the driver has increased by up to 400%, due to the use of cell phone, eating/drinking and fatigue. Developing an automatic monitoring system for eye gaze is crucial to driving safety. However, due to the different height, facial features, seat positions of drivers and unknown illumination condition, eye gaze detection is extremely difficult. To address these difficulties, we developed novel facial feature localization, geometric calibration and facial feature detection approaches, and successfully built a reliable real-time driver EOTR classifying system. We are currently working with GM for systematic evaluation and improvements.
- *Computerized Detection and Analysis of Cancer Chemotherapy-induced Emesis in a Small Animal Model, Musk Shrew* 01/10/2009-01/06/2010
  Hillman Cancer Center-Research Pavilion PI: Charles C. Horn, University of Pittsburgh
  My Role: Technical lead from CMU, Designing and implementing computer vision methods and algorithms, Managing technical reports, Primary liaison with sponsors.

  Vomiting is a common side effect of cancer chemotherapy and many drug treatments and diseases. Understanding and suppressing such side-effects in animal study are crucial to the clinical treatment and well-being of cancer patients. Traditional approach requires direct observation of the animals, which is time consuming and often lacks temporal precision. In collaboration with Hillman Cancer Center at University of Pittsburgh, we developed novel algorithms that automatically detect and characterize emetic episodes of musk shrews induced by the cancer chemotherapy agent cisplatin. The findings of the work has been published in Journal of Neuroscience Methods in 2010.

Patents

- *Video Face De-Identification* Patent No. pending
  Carnegie Mellon University and Federal Highway Administration
  Inventors: **Dong Huang** (contribution 30%), Fernando De la Torre, Jeffrey F. Cohn, Xuehan Xiong

- *Driver Gaze Detection System* Patent No. P024137-GMC12201
  Carnegie Mellon University and General Motors Inc.
  Inventors: **Dong Huang** (contribution 25%), Fernando De la Torre, Wende Zhang, Dan Levi

Invention Disclosures

- *Video Face De-Identification*
  Carnegie Mellon University
  Inventors: **Dong Huang**, Fernando De la Torre, Jeffrey F. Cohn, Gines Hidalgo Martinez
- *Automatic Face Editing*
  Carnegie Mellon University
  Inventors: **Dong Huang**, Fernando De la Torre, Shitong Yao
- *Photo-realistic Face Transfer*
  Carnegie Mellon University
  Inventors: **Dong Huang**, Fernando De la Torre, Javier Lopez, Marc Estruc
- *Photo-realistic Facial Expression Synthesis*
  Carnegie Mellon University
  Inventors: **Dong Huang**, Fernando De la Torre

Professional Services

- Faculty Reviewer of Admission Committee for Master program in Computer Vision (MSCV), Year 2015, Year 2016; Carnegie Mellon University.
- Invited Reviewer of International Journals: Institute of Electrical and Electronics Engineers(IEEE) Transaction(Trans.) on Pattern Analysis and Machine Intelligence; IEEE Trans. Circuits and Systems for Video Technology; IEEE Trans. Systems, Man, and Cybernetics, Part B; Pattern Recognition;IEEE Trans. Cybernetics; Computers and Graphics
- Invited Reviewer of International Conferences: Computer Vision and Pattern Recognition, European Conference on Computer Vision, Asian Conference on Computer Vision

Other Professional Activities

- Invited Talk at the People Image Analysis (PIA) Consortium Workshop, Carnegie Mellon University, 2013
- Invited Talk at VASC seminar, Carnegie Mellon University, 2010
- Oral presentation at European Conference on Computer Vision, Greece, 2010.

References

- Fernando De la Torre, Ph.D., Associate Research Professor of Robotics Institute, Carnegie Mellon University, USA, E-mail: ftorre@cs.cmu.edu
- Jeffrey Cohn, Ph.D., Professor of Psychology and Psychiatry, University of Pittsburgh, USA, E-mail: jeffcohn@pitt.edu
- Jessica Hodgins, Ph.D., Professor, Computer Science and Robotics, Carnegie Mellon University, USA, E-mail: jkh@cs.cmu.edu

- Charles Christopher Horn, Ph.D., Associate Professor of Medicine and Anesthesiology, University of Pittsburgh Cancer Institute, USA, E-mail: chorn@pitt.edu
- Mel Siegel, Ph.D., Associate Research Professor of Robotics Institute, Carnegie Mellon University, USA, E-mail: mws@andrew.cmu.edu
- James Pol, Technical Director, Office of Safety Research and Development, Federal Highway Administration, U.S. Department of Transportation, E-mail: james.pol@dot.gov
- João Paulo Cunha, Ph.D., Associate Professor at University of Porto, Portugal and senior researcher at the INESC-TEC, E-mail: jpcunha@fe.up.pt
- Jungsub Kim, Principal Engineer/Ph.D., Advanced Device Team, DMC R&D Center, Samsung Electronics CO.,LTD, E-Mail: jungsubs.kim@samsung.com