

## Curriculum Vitae of Mohammad H. Mahoor, Ph.D.

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**Professor**  
**Department of Electrical & Computer Engineering**  
**University of Denver**

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**Citizenship:** U.S.

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### **EDUCATION**

**Ph.D. in Electrical & Computer Engineering, 2007**  
University of Miami, Coral Gables, FL  
Dissertation: "A multi-modal approach for face modeling and recognition"  
Advisor: Professor M. Abdel-Mottaleb; Fellow IEEE

**M.S. in Biomedical Engineering, 1998**  
MS Thesis: Biological Systems Modeling and Medical Image Processing  
Sharif University of Technology, Tehran, Iran

**B.S. in Electronics Engineering (with first-class honors), 1996**  
University of Petroleum Technology (Former AIT), Ahwaz, Iran

### **APPOINTMENTS**

**Full Professor, September 2018-present**  
Department of Electrical and Computer Engineering, University of Denver

**Co-Founder and President, October 2014-present**  
DreamFace Tech., LLC, Denver, Co

**Associate Professor with tenure, September 2014-August 2018**  
Department of Electrical and Computer Engineering, University of Denver

**Visiting Professor, June-August 2014**  
Machine Perception Lab., University of California San Diego

**Adjoint Professor, March 2011-present**  
Department of Computer Science, University of Denver

**Assistant Professor, August 2008-August 2014**  
Department of Electrical and Computer Engineering, University of Denver

**Post-Doctoral Fellow Oct. 2007- July 2008**  
University of Miami, Department of Psychology, Coral Gables, FL

- Worked on facial expression analysis and modeling with application in studying emotions of children with autism

### **Summer Internship, 2005**

Beckman-Coulter Inc. Miami FL, US

- Worked as a C# programmer at department of Algorithm Development, Hematology Division
- Developed and implemented unit test routines for the signal processing algorithms utilized in the software under development
- Reduced the computational complexity of the software under development for the blood analyzer instrument

### **Research Assistant, 2003-2007**

University of Miami, Department of Electrical and Computer Engineering Coral Gables, FL

- Prepared research proposals for NSF and NIJ, 2004-2007
- Worked on 2-D and 3-D pattern recognition with application in face recognition
- Worked on 3-D object recognition and matching with application in face recognition
- Worked on data fusion based on Belief theory
- Worked on image stitching using Graph-Cut optimization
- Worked on image quality assessment with application in face recognition

### **Director of Training and Supporting Section, 2000-2003**

Bamdad Computer Company, Tehran, Iran

- Managed a team of 35 people for database and network administration activities

### **Hardware Design Engineer, 1999-2000**

Bamdad Computer Company, Tehran, Iran

- Designed DSP systems using TMS C25 series with application in radar signal processing
- Developed analog and digital microcontroller based system for general applications

### **Research Assistant, 1996-1997**

Sharif University, Tehran, Iran

- Developed a system for object detection with application in breast cancer detection (based on ultrasonic tissue characterization and motion detection using optical flow)

## **RESEARCH INTERESTS**

### ***Theory***

- Computer vision & Pattern recognition
- Machine learning & Deep Neural Networks
- Image processing
- Compressive sensing theory
- Algorithm development
- Data fusion
- Reconfigurable FPGAs

### ***Application***

- Affective computing (Facial expressions recognition and analysis)

- Socially assistive robotics
- Social behavior analysis
- Biological signal processing
- Brain and human computer interfacing

## **TEACHING EXPERIENCES**

### **Courses Taught at University of Denver**

- Modern/Advanced Digital System Design & Lab, × 7 Quarters
- Computer Vision, Winters × 6 Quarters
- HDL Modeling & Synthesis, × 8 Quarters
- (Advanced) Pattern Recognition, × 7 Quarters

### **Teaching Assistant, January 2004-May 2007**

University of Miami, Coral Gables, FL

- Assistant Lecturer: digital image processing, digital signal processing, digital control system, pattern recognition and multimedia systems

### **Lecturer, 1999- 2000**

University of Shahid Sattari, Tehran, Iran

- Courses taught: Digital design and Lab., Electronics I and Lab

### **Lecturer, 2001- 2003**

Bamdad Computer Company, Tehran, Iran

- Lectured Network and Unix/Solaris 2.5 (User & Administration Level )

### **Teaching Assistant, Jan 1998- September 1998**

Sharif University of Technology, Tehran, Iran

- Courses: Mathematical Engineering, Electronics I

### **Teaching Assistant, September 1994- September 1996**

University of Petroleum, Ahwaz, Iran

- Courses: Electromagnetic, Circuit Theory, Electrical Machines

## **HONORS & AWARDS**

- Recipient of the RSJ/KROS Distinguished Interdisciplinary Research Award for a paper presented in the 2016 International Symposium on Robot and Human Interactive Communication (RO-MAN'16), 2016
- Finalist of the best paper award, 2014 IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN'14) conference.
- Scholar of the year Award; School of Engineering and Computer Science, University of Denver, June 2015
- Teacher of the year Award; School of Engineering and Computer Science, University of Denver, June 2013
- Marino Autism Research Institute (MARI) Award for research on " Study Facial Expressions of Children with Autism", 2008. Amount: \$14,000
- Eliahu I. and Joyce Jury Graduate Scholar Award, University of Miami, 2007

- University of Petroleum engineering, Valedictorian, 1996

### **Post-Doc**

1. Dr. Pooran Singh Negi, Research Topic: Deep Neural Networks

### **CURRENT PHD STUDENTS**

1. Hosein Golshan Mojdehi, research topic: Deep Brain Stimulation (Aug 2015-)
2. Howard Feng, research topic: Socially assistive robots for children with Autism (Aug 2015-)
3. Behzad Hasani, research topic: Deep learning (Aug 2015-)
4. Hojjat Abdollahi, Human robot interaction and gaze perception (Aug 2015-)
5. Wassan Hayaleh, Deep Learning and facial expression recognition (Aug 2015-)
6. Rohola Zandieh, Natural Language processing in robotics (June 2017-)
7. Fahad Alhomayani, Visual Navigation (Aug 2016-)
8. Oscar Hasburn-Babich, Machine Learning; Co-advised with Prof. Mario Lopez (Aug 2017-)
9. Diwanshu Shekhar, Spoken Dialog Systems vi Deep Learning ( Sep 2018-)

### **CURRENT MS STUDENTS**

1. Farzaneh Askari, research topic: Social Robotics for Autism Therapy (Sep. 2016-)
2. Siddhesh Padwal, research topic: Affective Computer via Deep Learning (Jan 2018-)

### **GRADUATE STUDENTS ADVISING**

#### ***Advised Ph.D. Students***

1. Ali Mollahosseini, Feb. 2018, dissertation: Developing An Affect-Aware Rear Projected Robotic Agent; current position: Senior researcher at Twitter Inc.
2. Hadi Rezaeilouyeh, October 2017, Dissertation: Computer-aided Cancer Diagnosis and Grading via Sparse Directional Image Representations; current position Senior Imaging Scientist at Lifetouch
3. Mohammad Reza Mohammadi (co-advised with Dr. Fatemizadeh from Sharif University), 2015 Dissertation: “Intensity Measurement of Facial Action Units via Sparse Representation.
4. Seyed Mohammad Mavadati; Graduated Jan. 2015; Current position: Affectiva Inc. Dissertation: “Spontaneous Facial Behavior Computing Human Machine Interaction with Applications in Autism Treatment”.
5. Xiao Zhang; Graduated Feb. 2015; Current position: Fidelity Investment Inc. Dissertation: “Facial Expression Analysis via Transfer Learning”.
6. Salah Althloothi; Graduated August 2013 Dissertation: “Human Action Recognition Via Fused Kinematic Structure and Surface Representation” Primary advisor: Dr. Mahoor, Co-advisor: Dr. Voyles

#### ***Advised MS students***

8. Diwanshu Shekhar, research topic: Spoken Dialog Systems vi Deep Learning ( Sep 2015-)

7. Emile Bahdi, Feb. 2018 MS thesis: Development of a Locomotion and Balancing Strategy for Humanoid Robots
6. Amir Kargar, Jan 2016, MS thesis: Social robots for dialog on depression; current position: Software Engineer at Mya Systems.
5. Soroush Niketeghad June 2015, MS thesis: Human Behavior Recognition Using Brain Signal; Current position: PhD student at UCLA.
4. Howard Feng; June 2014; MS thesis: Studying Eye-Gaze Attention of Children with Autism Spectrum Disorders Using Socially Assistive Robotics; Current position: PhD student at DU;
3. Saba Bakhshi, June 2011; MS thesis: Development of Wearable Sensors for Body joint Angle Measurement; Current position: Software Engineer at Solutelia Inc
2. Kevin Veon, Aug 2011; MS thesis: Video Stabilization Using SIFT Features, Fuzzy Clustering, and Kalman Filtering; Current position: Software Engineer at Dynetics Co.;
1. Guosheng Wu, MS, 2009; Thesis: SIFT-ME: A New Feature for Human Activity Recognition Primary advisor: Dr. Voyles, Co-advisor: Dr. Mahoor; Current position: Hardware Engineer at Xilinx, Inc;

***Served on MS Defense Committee***

1. Frank Agyei-Ntim (ECE department), 2009
2. Kang Li (ECE department), 2010
3. Kav Shrestha (CS department), 2010
4. Guosheng Wu (ECE department), 2009
5. Xiaoting Yang (ECE department), 2010
6. James Balasalle (CS department), 2010
7. Xiaoxiao Dai (ECE department), 2013
8. Meng Wu (ECE department), 2013
9. Guangying Jiang (ECE department), 2013
10. Craig Simons (MME department), 2013
11. Florence Mbithi (ECE department), 2014
12. Mohammed Agha (ECE department), 2017

***Served on PhD Defense Committee***

1. Bahaa Al-Sheikh (ECE department); 2010
2. Xin Jiang (Physics Department); 2012
3. Douglas Miller (ECE department); 2013
4. Arezoo Hanifi (ECE department); 2012
5. Hamid Hanifi (CS department); 2015
6. Kostas (ECE department); 2016
7. Hamdan Alzahrani (CS department of University of Colorado at Colorado Springs), 2016
8. Paree Zarolia, (DU Psychology department), June 2016
9. Lowell Smoger (DU Mechanical Engineering), March 2016
10. Tian Zhou (Purdue University), May 2017

**UNDERGRADUATE STUDENTS ADVISING (Advised Senior Design Project)**

1. Nolan Tallman, Ryan McDonald, 2009
2. Benjamin Natala, Lisette McGlynn, Alan Zukerman, 2010
3. Chris Brune, Tyler Grubb, Alexa Jansey, Donn Sederstrom, 2011
4. John De Witt, Jeff Evans, Peter Neilson, Jordan Rath, 2012

**This project was the finalist for the ASME Rehabilitation and Assistive Devices Undergraduate Design competition and the second runner up for the NIBIB DEBUT Challenge for “Eye Tracking Project”.**

5. Josh Lane, Boe Watters, Tony Che, Allison Hendrix, 2013

### **RESEARCH EXPERIENCE FOR UNDERGRADUAGE (REU) STUDENTS**

Received about \$100K REU Supplementary Funding from NSF and DU PINS.

1. Kevin Bartlett, 2010, 2011 (NSF REU, \$4000)
2. Phil Trinh, 2011 (NSF REU, \$4000)
3. Khoa Nguyen (NSF REU, \$4000)
4. Mohammed Agha, 2012 (DU Pins, \$3500)
5. Mary Kastner, 2012 (Start-up Fund, \$2000)
6. Steven Conyers, 2012 (NSF REU, \$8000)
7. Evan Boucher, 2013 (NSF REU, \$8000)
8. Sophia Silver, 2013 (Start-up Fund, \$3000)
9. Gabriel Graitzer, 2013 (NSF REU, \$8000)
10. Peter Schichtel, 2013 (DU Pins, \$3500)
11. Joshua Lane, 2013 (NSF REU, \$8000)
12. Andy Cromer, 2013 (NSF REU, \$4000)
13. William Platista, 2013 (NSF REU, \$4000)
14. Ashton Webberley, 2013 (DU Pins, \$3500)
15. Niteesh Prasad, 2014 (NSF REU, \$8000)
16. Luke Skelly, 2014 (DU Pins, \$3500)
17. Quinn Martindale-George, 2014 (DU Pins, \$3500)
18. Kristin Douglass, 2014 (DU Pins, \$3500)
19. Peyton Sanger, 2014 (NSF REU, \$3000)
20. Kendall Weistroffer, 2015 (NSF REU, \$2000)
21. Benjamin Toofer, 2015 (NSF REU, \$3000)
22. David Chan, 2015 (NSF REU, \$16000)
23. Paul Heinen, 2016 (NSF REU, \$4000)
24. Sophie Marsh, 2016 (NSF REU, \$2500)
25. Sophie Silver (NSF REU, \$4000)
26. Laurel Gaeddert (NSF REU, \$2500)
27. Nathan Saslavsky (NSF REU, \$4000)
28. Raanan Hileman (NSF REU, \$4000)
29. Maddie Sligh, 2016 (NSF REU, \$2500)
30. Amy Kirchoff, 2016 (NSF REU, \$2500)
31. Tori Bryant, 2016 (NSF REU, \$2500)
32. Jonathan Yost, 2016 (NSF REU, \$2500)
33. Mustafa Jachi, 2016 (NSF REU, \$2500)
34. Summer Graham, 2016 (NSF REU, \$2500)
35. Elizabeth Beaver, 2016 (NSF REU, \$2500)
36. Courtney Owen, 2017 (DU PINS, \$3,500)
37. Josiah Alkilo, 2017 (NSF REU, \$6000)

### **COMPETITIVE RESEARCH GRANTS AND FUNDING**

#### **Current**

1. SBIR Fast Track (Phase I and II): R44 AG059483-01: Development of an Intelligent, Emotive, and Perceptive Socially Assistive Robot for Dementia Therapy

Agency: NIH

Role: PI\* I am currently on reduced effort from DU working (51%) on this grant at DFT.

Total Amount: \$1,676,000

Period: 06/01/2018-05/30/2020

Note: This proposal was submitted through DreamFace Tech, LLC.

2. R15: Emergent gaze perception and robot intervention in autism spectrum disorders

Agency: National Institute of Health (NICHD)

Role: Co-PI (PI: Tim Sweeney)

Total Amount: \$444,148; my share: 30%

Period: 09/01/2017-08/31/2020

3. Novel Deep Brain Stimulation Paradigms for Optimization of Behavior in Rat Model of Parkinson's disease.

Agency: University of Denver PROF

Role: PI with Daniel Paredes

Total Amount: \$45,000

Period: 7/01/2018 – 6/30/2020

4. Utility Management (through Rose-HUB IUCRC Center)

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Machine Learning and Signal Processing for Utility Pole Decay Estimation

Role: PI

Total Amount: \$50,000

Period: 02/12/2018-02/11/2019

5. MRI Development: Human Avatars: Enabling Research in Natural Communication with Virtual Tutors, Therapists, and Robotic Companions

Agency: National Science Foundation

Role: PI; Co-PIs: Ron Cole & Wayne Ward (BLT Inc.) and Juan Wachs (Purdue University)

Total Amount: \$1,348,000 (NSF) + \$240,000 (DU Cost-Share)

Period: 09/01/2014-08/30/2018

6. EAGER: Studying Emotional Responses of Children with Autism in Interaction with Facially Expressive Social Robots

Agency: NSF

Role: PI

Total Amount: \$80,000

Period: 09/1/2014-9/30/2018

7. Social Robots for Assisting Children with Autism

Agency: University of Denver Office of Advancement (Family and Individual Gifts)

Role: PI

Total Amount: \$10,502

Period: 01/01/2017-09/31/2018

8. Real Time Behavior Detection From ECoG Brain Recordings: Implication for Closed-Loop Deep Brain Stimulation in Patients With Parkinson's Disease

Agency: Knoebel Institute for Healthy Aging

Role: PI

02/28/2018

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Total Amount: \$45,000  
Period: 6/1/2016/-7/01/2019

**Completed**

9. Developing a Human-Like Social Robotic Head  
Agency: Colorado Office of Economic Development and International  
Role: PI  
Total Amount: \$37,010  
Period: 02/23/2017/-12/31/2018

10. Gaze Perception and Intervention in Autism Spectrum Disorders  
Agency: DU PROF  
Role: PI with Tim Sweeny (Psychology Department)  
Total Amount: \$30,000  
Period: 9/1/2015/-8/31/2018

11. SHB: Large: Collaborative Research: Companionbots for Proactive Therapeutic Dialog on Depression  
Agency: NSF  
Role: PI; Senior personnel: Richard Voyles  
Total Amount: \$468,122  
Period: 9/1/2010/-8/31/2017

12. SBIR Phase I: Development of an Intelligent, Emotive, and Perceptive Socially Assistive Robot for  
Dementia Therapy  
Agency: NSF  
Role: PI (Dream Face Technologies, LLC)  
Total Amount: \$150,000  
Period: 01/1/2016/-8/31/2016  
**Note:** Dr. Mahoor was on 51% leave-of-absence from DU and worked on this grant at his start-up  
company, DreamFace Technologies, LLC.

13. Collaborative Research: Communication, Perturbation, and Early Development  
Agency: NSF  
Role: PI  
Total Amount: \$104,029  
Period: 06/15/2011/-06/15/2015

14. I/UCRC: Collaborative Research: Detecting cancer using advanced computer vision techniques  
Agency: NSF  
Role: Co-PI; PI: Dr. Andrews  
Total Amount: \$107,977; my share: 85%  
Period: 7/01/2012-05/30/2015  
**Note:** Dr. Andrews was the PI of this grant because she is the director of the NSF-I/UCRC center.  
Although, Dr Mahoor was listed as Co-PI, Dr. Mahoor wrote the proposal, did the research, advised  
students, and reported to the NSF).



15. MRI Collaborative: Development of an Intelligent, Autonomous, Unmanned, Mobile Sensor

Agency: NSF

Role: Co-PI; PI: Dr. Valavanis

Total Amount: \$1,645,350; my share: ~ 10%

Period: 9/01/2012-05/30/2015

16. I-CORPS Team: Commercialization feasibility research of light-projected ExpressionBot

Agency: NSF

Role: PI

Total Amount: \$50,000

Period: 7/1/2014-12/31/2014

17. Home Telemonitoring for Congestive Heart Failure Risk Management

Agency: Caring for Colorado & Colorado Health Foundation

Role: PI; Co-PIs: Drs. Long and Newman

Total Amount: \$217,247; my share: ~60%

Period: 11/1/2008-9/31/2011

18. EAGER<sup>1</sup>: RI: Developing a Framework for Automated Measurement of the Intensity of Spontaneous Facial Expressions

Agency: NSF

Role: PI

Total Amount: \$87,886; my share: 100%

Period: 11/15/2009-11/14/2011

19. Integrating Ethics in New Undergraduate Engineering Curriculum for the 21<sup>st</sup> Century Interdisciplinary Program

Agency: DU Center for Teaching and Learning Center (Internal Grant)

Role: Co-PI; PI: Dr. M. Matin

Total Amount: \$19,500; my share: 20%

Period: 5/1/2010-4/30/2012

20. I/UCRC: Collaborative Research: A New Miniature Ground/Water Robot

Agency: NSF

Role: PI

Total Amount: \$91,984; my share: 100%

Period: 07/15/2010 - 07/14/2013

21. MRI Development: Heterogeneous, Autonomic Wireless Control Networks for Scalable Cyber-Physical Systems,

Agency: NSF

Role: Senior Personnel; PI: Drs. Andrews/Voyles

Total Amount: \$1,580,219; my share: ~ 15%

Period: 8/1/09-7/31/14

22. RAPID: CRAWLER Robot with Dual-Use Limbed Locomotion and Manipulation for Void Inspection

Agency: NSF

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<sup>1</sup> See List of Acronyms.

Role: Co-PI; PI: Dr. Andrews  
Total Amount: \$64,351; my share: 100%  
Period: 7/01/11 – 6/30/14

**Note:** Dr. Andrews was the PI of this grant because she was the director of the NSF-I/UCRC center. Although, Dr. Mahoor is listed as Co-PI, he wrote the proposal, did the research, advised students, and reported to the NSF.

23. Bed-exit Detection Using Image Processing Techniques  
Agency: TKO Enterprises, Inc. Via NSF I/UCRC Center  
Role: Co-PI; PI: Dr. Zhang  
Total Amount: \$35,000; my share: ~ 30%  
Period: 01/01/2013-12/31/2013

24. Decoding Behavior From Brain Electrical Signals to Optimize Deep Brain Stimulation in Patients With Parkinson's Disease  
Agency: Knoebel Institute for Longevity and Health  
Role: PI; Co-PI: Dr. Hebb  
Total Amount: \$30,000  
Period: 01/15/2013-12/31/2014

25. Collaborative Research: I/UCRC for Safety, Security, and Rescue Research  
Agency: NSF  
Role: Co-PI; PI: Drs. Andrews/Voyles  
Total Amount: \$306,998; my share: ~15%  
Period: 9/1/2009/-8/31/2014

### **Hardware Donation**

Two Tesla K40 GPUs and Two Titan-X GPU were donated by NVIDIA Corporation to support development of deep neural algorithms for facial expression recognition. Worth of \$11,000 at time of donation.

### **Pending**

26. SBRI-Phase 1: Serious Games for Patients with Alzheimer's Disease,  
Agency: NSF  
Role: PI  
Total Amount: \$225,000  
Period: 01/01/2019-12/31/2019

27. SBIR-Phase 1: Developing Serious Brain Games delivered by a Social Robot for Assisting Elderly People with Alzheimer's Disease  
Agency: NIH/NIA  
Role: PI  
Total Amount: \$279,000  
Period: 04/01/2019-12/31/2019

### **PUBLICATIONS, PRODUCTS, MULTIMEDIA**

**Citations According to Google Scholar (as of 9/15/2018): H-Index 24; i10-Index: 53; All Citations: 2327**

### **Patents**

[1] M.H. Mahoor, A. Mollahosseini, Q. Martindale-George and L. Skelly, "Rear-Projected LifeLike Robotic Head", US Patent 15/042,002.

### **Pending US Patent Applications**

[2] M.H. Mahoor, H. Rezaeilouyeh, and Ali Mollahosseini, "'Classification of a Tissue Using Combined Feature Extraction Operations" Pending US Patent Application August 2015, #1018731.

[3] S. Niketeghad, Mohammad H. Mahoor, Adam O. Hebb, Sara Hanrahan, Joshua Nedrud, "Behavior Recognition from Local Field Potential", US Patent Application, October 2015, #62115024.

### **Book Chapters**

[1] D. Messinger, L. L. Duviolier, Z. Warren, M.H. Mahoor, J. Baker, A. Warlaumont, and P. Ruvolo, "Affective Computing, Emotional Development, and Autism", R. Calvo and A. Bachfischer (Eds); Affective Computing Handbook, NY: Oxford University Press, in press.

[2] S. Cadavid<sup>2</sup>, M.H. Mahoor, and M. Abdel-Mottaleb, "Multi-modal Ear and Face Modeling and Recognition", B. Bhanu & V. Govindaraju (Eds.); Multibiometrics for Human Identification, Cambridge University Press, 2011.

[3] D. S. Messinger, M.H. Mahoor, S.-M. Chow, J. D. Haltigan, S. Cadavid, and J. F. Cohn, "Early emotional communication: Novel approaches to interaction", J. Gratch & S. Marsella (Eds.), social emotions in nature and artifact: Emotions in human and human-computer interaction. NY: Oxford, Vol. 14. 2010.

[4] A. Ansari, M.H. Mahoor, and M. Abdel-Mottaleb, "3D Face Mesh Modeling for 3D Face Recognition", Pone J. and Karahoca (Eds), in State of the Art in Face Recognition, A. Publisher: IN-TECH, ISBN: 978-3-902613-42-4, pp. 131- 2009.

[5] M. Abdel-Mottaleb and M.H. Mahoor, "Assessment of Blurring and Facial Expression Effects on Facial Image Recognition," Lecture notes in computer science, ISSN 0302-9743, pp 12-18, Springer 2006.

### **Refereed/Peer-Reviewed Journal Papers**

#### **Pending**

[1] Pooran S. Negi and Mohammad H. Mahoor, "Deep Learning Based on Quadratic and Higher Order Forms", (In preparation), IEEE Transactions on Neural Networks and Learning Systems.

#### **Published**

[2] Howard Feng, Hosein Golshan, and Mohammad H. Mahoor, "A wavelet-based feature extraction approach for emotion classification using the EDA signals", expert systems and applications, vol. 112, pages 77-86, 2018 (**Impact Factor: 3.768**)

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<sup>2</sup> Name of students are underlined in the citations.

- [3] Ali Mollahosseini, Hojjat Abdollahi, Timothy Sweeny, Ron Cole and Mohammad H. Mahoor, “Role of embodiment and presence in human perception of robots’ facial cues.” International Journal of Human-Computer Studies, August 2018 (**Impact Factor: 2.30**)
- [4] Sroush Niketeghad, Adam O. Hebb, Sara J. Hanrahan, Mohammad H. Mahoor, “ Motor Task Detection from Human STN using Interhemispheric Connectivity”, in press, IEEE Transactions on Neural Systems and Rehabilitation Engineering (**Impact Factor: 3.410**)
- [5] Hosein Golshan, Adam O. Hebb, Joshua Nedrud, Sara J. Hanrahan, and M.H. Mahoor, "A Hierarchical Structure for Human Behavior Classification using Local Field Potentials", accepted, Journal of Neuroscience Methods. (**Impact Factor: 2.255**)
- [6] Ali Mollahosseini, Behzad Hasani, and Mohammad H. Mahoor, “AffectNet: A Database for Facial Expression, Valence, and Arousal Computing in the Wild”, in Press, IEEE Transactions on Affective Computing. (**Impact Factor: 1.873**)
- [7] M. R. Mohammadi, E. Fatemizadeh, M.H. Mahoor, “A Joint Dictionary Learning and Regression Model for Intensity Estimation of Facial AUs”, Journal of Visual Communication and Image Representation, Volume 47, August 2017, Pages 1–9. (**Impact Factor: 1.553**)
- [8] M.R.Mohammadi, E. Fatemizadeh, and M.H. Mahoor, “A Bayesian Source Separation Method for Intensity Estimation of Action Units”, In press, IEEE Transactions on Affective Computing. (**Impact Factor: 1.873**).
- [9] Sara J. Hanrahan, Joshua J. Nedrud, Bradley S. Davidson, Sierra Farris, Monique Giroux, Aaron Haug, “Long-Term Task and Dopamine Dependent Dynamics of Subthalamic Local Field Potentials in Parkinson’s Disease”, Brain Sciences, 2016 Nov 29;6(4). pii: E57.
- [10] Hadi Rezaeilouyeh, Ali Mollahosseini, and M. H. Mahoor, “A Microscopic Medical Image Classification Framework Via Deep Learning And Shearlet Transform”, Journal of Medical Imaging, 2016 Oct;3(4):044501. Epub 2016 Nov 3.
- [11] H. Rezaeilouyeh and M.H. Mahoor “Automatic Gleason Grading in H&E Images using Multiple Kernel learning”, Journal of Imaging, September 2016, <http://www.mdpi.com/2313-433X/2/3/25/html>
- [12] Yanzhe Cui, Richard M Voyles, Josh T Lane, Akshay Krishnamoorthy, M. H Mahoor, “A mechanism for real-time decision making and system maintenance for resource constrained robotic systems through ReFrESH“, Autonomous Robots, July 2015. (**Impact Factor: 1.547**).
- [13] Xiao Zhang and Mohammad H. Mahoor, “Task-Dependent Multi-task Multiple Kernel Learning for Facial Action Unit Detection“, Pattern Recognition, Volume 51, March 2016, Pages 187–196. (**Impact Factor: 3.399**).
- [14] Yongqiang Li, S.M. Mavadati, Qiang Ji, and Mohammad H. Mahoor, “Measuring the Intensity of Spontaneous Facial Action Units with Dynamic Bayesian Network”, Pattern Recognition, Volume 48, Issue 11, November 2015, Pages 3417–3427, (**Impact Factor: 3.399**).
- [15] M.R. Mohammadi, E. Fatemizadeh, M.H. Mahoor, “Intensity Estimation of Spontaneous Facial Action Units Based on Their Sparsity Properties”, IEEE Transactions on Cybernetics, Volume: 46 , Issue: 3, 2015 (**Impact Factor 4.943**).
- [16] X. Zhang, M.H. Mahoor, and S.M. Mavadati, “A Lp-norm Multiclass-SVM Framework for Facial Expression Recognition”, Machine Vision and Applications, May 2015, Volume 26, Issue 4, pp 467–483, (**Impact Factor: 1.103**).
- [17] M.R. Mohammadi, E. Fatemizadeh, M.H. Mahoor, “PCA-Based Dictionary Building for Accurate Facial Expression Recognition via Sparse Representation”, Journal of Visual Communication and Image Representation, Volume 25, Issue 5, July 2014, Pages 1082–1092. (**Impact Factor 1.530**).
- [18] J. M. Girard, J. F. Cohn, M.H. Mahoor, S. M. Mavadati, Z. Hammal, and D.P. Rosenwald, “Nonverbal social withdrawal in depression: Evidence from manual and automatic analyses”, Journal of Image and Vision Computing, Volume 32, Issue 10, October 2014, Pages 641–64.7 (**Impact Factor:1.959**)  
(**editor selection of high quality F&G’13 conference papers**)

- [19] M.R. Mohammadi, E. Fatemizadeh, M.H. Mahoor, “Non-Negative Sparse Decomposition Based on Constrained Smoothed L0 Norm”, Journal of Signal Processing, Volume 100, Pages 42–50, July 2014. **(Impact Factor:2.063)**.
- [20] S. Althloothi, M.H. Mahoor, X. Zhang, R. M. Voyles, “Human Activity Recognition Using Multi-Features and Multiple Kernel Learning”, Journal of Pattern Recognition, Volume 47, Issue 5, Pages 1800–1812, May 2014 **(Impact Factor: 3.399)**
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***Peer-Reviewed Conference Papers:***

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- [1] Pooran Singh Negi, David Chan, Mohammad H. Mahoor, "Mixed Cross Entropy Loss: Prior Beliefs For Training Deep Neural Networks", to submit to CVPR 2019.
- [2] Pooran Singh Negi, Mohammad Mahoor, "Deep Neural Network Based on Higher Degree Forms", to submit to CVPR 2019.

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- [1] Fahad Al-homayani, Mohammad Mahoor, Improved Indoor Geomagnetic Field Fingerprinting for Smartwatch Localization Using Deep Learning, 2018 International Conference on Indoor Positioning and Indoor Navigation (IPIN), September 2018, Nantes, France
- [2] Ali Mollahosseini, Hojjat Abdollahi, Mohammad Mahoor, "Studying Effects of Incorporating Automated Affect Perception with Spoken Dialog in Social Robots", 27th IEEE International Conference on Robot and Human Interactive Communication (Ro-Man), August 2018, China.
- [3] Farzaneh Askari, Howard Feng, Timothy Sweeny, Mohammad Mahoor, "A Pilot Study on Facial Expression Recognition Ability of Autistic Children Using Ryan, a Rear-Projected Humanoid Robot", 27th IEEE International Conference on Robot and Human Interactive Communication (Ro-Man), August 2018, China.
- [4] Hosein M. Golshan, Adam Hebb, Joshua Nedrud, and Mohammad H. Mahoor, "Studying the Effects of Deep Brain Stimulation and Medication on the Dynamics of STN-LFP Signals for Human Behavior Analysis", 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, July 2018, Honolulu, USA
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- [10] Hosein M. Golshan, Adam O. Hebb, Sara Hanrahan, Joshua Nedrud, Mohammad H. Mahoor, "An FFT-based Synchronization Approach to Recognize Human Behaviors using STN-LFP Signal", IEEE Conference on ICASSP, New Orleans, March 2017.
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- [13] Hosein M. Golshan, Adam O. Hebb, Sara Hanrahan, Joshua Nedrud, Mohammad H. Mahoor, “A Multiple Kernel Learning Approach for Human Behavioral Task Classification Using STN-LFP Signal”, 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando, USA, 2016.
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### Abstracts

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- [2] Mohammad H. Mahoor, S. Mohammad Mavadati, Howard Feng, Peyten Sanger, Sophia Silver, Anibal Gutierrez, "Using Robots As Therapeutic Agents to Teach Children with Autism Recognize Facial Expression", IMFAR 2015: international Meeting For Autism Research.
- [3] S.M. Mavadati, H. Feng, S. Silver, A. Gutierrez, M. H. Mahoor, Children-Robot Interaction: Eye Gaze Analysis of Children with Autism during Social Interactions, Poster presented in International Meeting for Autism Research (IMFAR 2014).
- [4] M.H. Mahoor, A.O. Hebb, J. Nedrud, and S. Niketeghad "Human Behavior Coding from Brain LFP Signal", poster to be presented at Neuroscience 2013, San Diego, Nov. 2013.
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- [7] H. Feng, M. Kastner, J.J. Zhang, A. Gutierrez, S. Hepburn, and M.H. Mahoor “Using Social Robots to Improve Directed Eye Gaze of Children with Autism Spectrum Disorders”, poster presented at the 2013 International Meeting for Autism Research (IMFAR), Spain, 2-4 May, 2013.
- [8] W.I. Mattson, J.F. Cohn, M.H. Mahoor, D.S. Messinger, “Duchenne Smiling in the Face-to-Face/Still Face”, poster presented at the 2012 International Conference on Infant Studies, Minneapolis, MN, 2012.
- [9] W.I. Mattson, J.F. Cohn, M.H. Mahoor, and D.S. Messinger, “Beyond Smiles: Duchenne Distress in Infants”, poster presented at the Association for Psychological Science (APS) Annual Convention, Chicago, IL, USA, 2012.
- [10] S. Bakhshi, M. Matin, and M.H. Mahoor, “Human Joint Angle Measurement Using Fiber Bragg Grating Sensor”, poster presented at the Covidien 2011 R&D Summit.
- [11] W.I. Mattson, M.H. Mahoor, S. Cadavid, O.L. Martinez, D.S. Messinger, and J.F. Cohn, “Eye Constriction in Positive and Negative Emotional Expressions”, poster session presented at the International Conference for Infant Studies, Baltimore, MD, 2010.
- [12] D.S. Messinger, L. Ibanez, J.F. Cohn, M.H. Mahoor, JD. Haltigan, K. Kelley, and J. Baker, “University of Miami Sibling Study Measuring Infant Learning and Emotion”, oral presentation to the annual meeting of the NIH/Autism Speaks Baby Sibs Research Consortium, Miami Beach, FL., 2009.
- [13] M.H. Mahoor, D.S. Messinger, L.V. Ibanez, S. Cadavid, J.F. Cohn, “Automated Measurement of Gaze Direction in Infants”, poster presented at the meeting of the Society for Research in Child Development, Denver, CO., 2009.
- [14] M.H. Mahoor, D. S. Messinger, L. Ibanez, M. Kimijima, Y. Wang, S. Cadavid, and J.F. Cohn, “Studying Facial Expressions Using Manifold Learning and Support Vector Machines”, poster presented at the IEEE 7th International Conference on Development and Learning, Monterey, California, Aug. 2008.
- [15] M.H. Mahoor, D.S. Messinger, M. Kimijima, R. Brewster K.M. Kelley, J.F. Cohn, “Automatic Measurement of Smile Intensity”, poster presented at Marino Autism Research Institute Scientific Symposium, Vanderbilt University, Nashville, TN. April 2008.

### ***Multimedia Coverage and Interviews***

- [1] Interview with BusinessDen Magazine, September 2016 [Online Link](#)
- [2] Interview with Forbes online, How Robots Could Improve Social Skills In Kids With Autism – Forbes, SEP 25, 2015; [Online Link](#)
- [3] Interview with Colorado Public Radio (CPR) on Robot May Help Kids With Autism Become More Sociable, Aug 23, 2013; [Online Link](#)
- [4] Interview with University of Denver Advancement office on DU Professor Uses New Techniques to Treat Autism; Feb. 2013; [Online Link](#)
- [5] Interview with DU Magazine on Using Robots to Help Kids with Autism Disorders, July 2013; [URL](#)

### ***Scientific Datasets for Research***

#### **[1] Denver Intensity of Spontaneous Facial Action (DISFA/DISFA+) Database**

**Release date:** November 2012 (DISFA) and June 2016 (DISFA+)

**Description:** DISFA/DISFA+ is a non-posed facial expression database for those who are interested in developing computer algorithms for automatic action unit detection and their intensities described by

FACS. It contains stereo videos of 27 adult subjects (12 females and 15 males) with different ethnicities. The intensity of AU's (0-5 scale) for all the video frames were manually scored by two human FACS experts. The database is available for distribution for research purposes. DISFA has been downloaded 350 times and have been cited 158 times according to Google Scholar.

The **Extended Denver Intensity of Spontaneous Facial Action Database (DISFA+)** is an extension of DISFA, a previously released and well-accepted face dataset. Extended DISFA (DISFA+) has the following features: 1) it contains a large set of **posed and non-posed** facial expressions data for a same group of individuals, 2) it provides the manually labeled frame-based annotations of 5-level intensity of twelve FACS facial actions, 3) it provides meta data (i.e. facial landmark points in addition to the self-report of each individual regarding every posed facial expression).

Ref: <http://mohammadmaoor.com/disfa/>

## [2] *AffectNet Database*

**Release date:** June 2017

**Description:** *AffectNet* contains more than one million images with faces and extracted facial landmark points. Twelve human experts manually annotated 440,000 of these images in both categorical (seven basic emotions) and dimensional (valence and arousal) models and tagged the images that have any occlusion on the face. *AffectNet* was created by querying the web (Google, Yahoo, Bing) and is currently the largest in-the-wild annotated databases of facial expressions.

Ref: <http://mohammadmaoor.com/affectnet/>

## **LABARATORY ESTABLISHMENT**

- Computer Vision and Machine Learning Lab at DU, 2008-
- Social Robotics Lab at DU, 2010-

## **UNIVERSITY SERVICES AND OUTREACH**

### *University*

- Intellectual Property and Technology Transfer Review Committee, 2014- present
- Strategic research plan committee appointed by associate provost for research, 2010-2011
- Undergraduate Research Council, 2017-present
- Distinguished University Professor selection committee, 2018-present

### *Division/School*

- Faculty search committee, 2017-2018
- Strategic research plan committee, 2016
- Dean search committee, 2013, 2014

### *ECE department*

- Tenure and Promotion Committee (DU ECE Dept), 2015-present
- Ad-Hoc Faculty Promotion Reviewer, University of South Florida, University of Arkansas
- Member of ECE faculty hiring search committee, 2009, 2010, 2011, 2012
- Member of undergraduate curriculum development committee (Computer Eng. Program), 2009-2010
- Graduate seminar organizer/coordinator, 2009-2011
- Graduate program curriculum committee, 2009-2011

- PhD qualifying exam, 2009-present
- Chair of CpE undergraduate assessment committee, 2011-present

#### ***External Grant Reviewer***

- National Science Foundation, Panelist
  - 2010, (x2) 2012, 2013, 2015, 2017 (CISE and ENGR Divisions)
- Reviewed research proposal for the American University of Sharjah, UAE, 2011
- Review research proposal for UAE University, 2016
- Reviewed proposals for undergraduate research for Qatar National Research Foundation, 2011, 2012, 2016
- Canada Research Chairs, 2015

### **PROFESSIONAL ACTIVITIES and SERVICES**

#### ***Editorial Board member***

- Associate Editor (AE) of the IEEE Transactions Cybernetics (TCyb), 2017-present
- Associate Editor of Journal of Intelligent and Robotic Systems, Springer, 2011-present
- Editorial Member of Int. Journal of Socio-Cognitive Engineering, Scientia Iranica, 2017-present

#### ***Society membership***

- Senior Member of Institute of Electrical and Electronics Engineers (IEEE) 2013-present
- Member of the Society for Imaging Science and Technology, 2010

#### ***Paper reviewer***

##### ***Journals***

- IEEE Transactions on Automation Science and Engineering
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Information Technology in BioMedicine
- IEEE Transactions on Affective Computing
- IEEE Transactions on Information Forensics and Security
- IEEE Transactions on Image Processing
- Journal of Pattern Recognition
- Journal of Computer Vision and Image Understanding
- Journal of Intelligent and Robotic Systems
- IEEE Sensors Journal
- ASME Journal of Medical Devices

##### ***Conferences***

- IEEE Conferences on ICCV, CVPR, WACV, ACCV 2007-present
- IEEE International Conference on Image Processing (ICIP), 2005-2015
- International Conference on Biometrics, 2006
- IEEE International Conference on Robotics and Automation (ICRA), 2009, 2013
- Fifth International Conference on Body Area Networks, 2010
- First ACM International Health Informatics Symposium, 2010
- The IEEE International Conference on Automatic Face and Gesture Recognition (2011, 2013, 2015, 2017)

### ***Chair and Co-chair for Conference Sessions***

- Session Chair: UAV'10 Conférence, Dubai, June 2010
- Session Chair: International Workshop on Safety, Security, and Rescue Robotics, Denver, Nov. 2009
- Session Co-Chair; IROS'11 conference, Vision from features to applications San Francisco, Sep. 2011

### ***Conference Program Committee Member/ Area Chair/Editor***

- Demo Chair and Area Chair, 13<sup>th</sup> IEEE Conference on Face and Gesture Recognition, 2018
- Local Arrangement Chair, International Joint Conference on Biometrics, Denver, October 2017
- Area Chair, Winter Conference on Application of Computer Vision (WACV) 2017, 2018
- Associate Editor (AE) for the Conference Editorial Board (CEB) of the IEEE Robotics and Automation Society for ICRA 2017 , ICRA 2018, ICRA 2019.
- Program Committee Member of Facial Expression Recognition and Analysis Challenge (FERA) @FG2017
- Program Committee Member of the 1<sup>st</sup> International Workshop on Deep Affective Learning and Context Modeling (DAL-COM) (CVPR2017)
- Program Committee of the Fourth International Workshop on Context Based Affect Recognition CBAR 2016 (conjunction with IEEE CVPR 2016)
- Technical Program Committee of the IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN 2014, 2015)
- Program Committee: IEEE International Health Informatics Conference, 2013
- Program Committee Member: IEEE International Symposium on Safety, Security, and Rescue Robotic, 2013
- Program Committee Member: IEEE Conference on Face and Gesture Recognition, 2013
- International Program Committee: International Conference on Informatics, Electronics & Vision 2012 (ICIEV12)
- Program Committee Member: IEEE Face and Gesture Special Session on 3D Facial Expression, 2011
- Program Committee Member: First ACM International Health Informatics Symposium (IHI), 2010, 2012
- Local Arrangement Chair: 2011 International Conference on Unmanned Aircraft Systems (former UAV conference)
- Program Committee: Body Nets conference, 2011.
- Program Committee: 3D facial expressions recognition workshop, 2011
- Associate Editor of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2011)

### ***Invited Talks/Seminars***

- Denver Regional Council of Governments, Aging and Disability Resources for Colorado, September 2017.
- Purdue University, Affect-Aware Robotic Agents, May 2017
- Provost Luncheon, University of Denver, November 2016
- TEDx Talks, Longmont Colorado, Social Robotics, October 2015
- Daniel's College of Business, Social Robots for Assisting People with Dementia, Marketing Department, March 2016.
- Keynote Speaker, Technology for Behavioral Change (TECH B) Conference, Miami, FL, March 2015
- Seminar, DU Physics Department, presentation title: Facial Modeling and Analysis: Applications in Social Robotics, March 2014

- Computational Optical Sensing and Imaging (COSI) Seminar series, University of Colorado, Boulder, presentation title: Facial Expression Recognition Using Computer Vision Techniques, Oct. 2013
- 13<sup>th</sup> Annual Coleman Institute National Conference on the State-of-the-science on Social Assistive Robotics, University of Colorado, School of Medicine, presentation title: Social Assistive Robotics, Sep. 2013
- ECE Seminar, Colorado School of Mines, presentation title: Facial Modeling and Analysis: Applications in Social Robotics, October 2012
- ECE Seminar, University of Colorado, Denver, presentation title: Facial Modeling and Analysis for Biometrics and Biomedical Applications, Feb. 2012
- Dads & Granddads Weekend, University of Denver, presentation title: Social Assistive Robotics for Autism Therapy, Feb. 2012
- All-campus lecture presentation, University of Denver, presentation title: Facial Modeling and Analysis for Biometrics and Biomedical Applications, Sep. 2010
- Identix Inc. New Jersey, presentation title: Multimodal Face Recognition, May 2007

***Invitation to conferences:***

Dr. Mahoor was invited two times to the **National Academies Keck Futures Initiative (NAKFI)** conference. In the 8<sup>th</sup> annual meeting, the meeting was about Seeing the Future with Imaging Science, which was held Nov. 16-19, 2010 in Irvine, CA. The final meeting will be held in Nov. 2017 in Irvine, CA. NAKFI is a 15-year effort of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine to catalyze interdisciplinary inquiry and to enhance communication among researchers, funding organizations, universities, and the general public. The objective is to support the climate for conducting interdisciplinary research, and to break down related institutional and systemic barriers. NAKFI works towards these objectives by harnessing the intellectual horsepower of approximately 150 individuals from diverse backgrounds who apply to attend its annual “think-tank” style conference; and by awarding \$1 million in seed grants – on a competitive basis – to conference participants to enable further pursuit of bold, new ideas and connections stimulated by the conference.

**Rennet Collaborators**

- Purdue University, IN; Professors Richard M. Voyles and Juan Wachs
- Boulder Learning, Inc; Ronald Cole and Wayne Ward
- University of Denver; Psychology department, Tim Sweeny
- University of Miami, FL; Professor Daniel Messinger
- University of Miami; Professor Anibal Gutierrez
- Rensselaer Polytechnic Institute; Professor Qiang Ji
- University of Colorado, Denver; School of Medicine; Professor Susan Hepburn
- University of Pittsburgh/Carnegie Mellon University; Professor Jeffrey Cohn
- University of North Texas; Professor Rodney Nielsen
- Denver Health Medical Center; Professor of Medicine Carlin Long
- University of Colorado School of Medicine; Dr. Wilson Pace
- Colorado Neurological Institute/Kaiser Permanente; Dr. Adam Hebb and Dr. Sara Hanrahan
- Sharif University of Technology; Professor Emad Fatemizadeh
- Washington State University; Professor Hassan Ghasemzadeh

**List of Acronyms**

RI: Robust Intelligence  
 I/UCRC: Industry University Research Center  
 EAGER: Early-concept Grants for Exploratory Research



MRI:	Major Research Instrumentation
CRI:	Computational Research Infrastructure
RAPD:	Research to Aid Persons with Disabilities Program
SHB:	Smart Health and Well-Being
SCH:	Smart Connected Health
MRI-R2:	Major Research Instrumentation-Recovery 2
R01:	NIH Research Project Grant
R21:	Research Projects, Exploratory/Developmental Grants
RAPID:	Rapid Response Research Grants
EUREKA:	Exceptional, Unconventional Research Enabling Knowledge Acceleration
NRI:	National Robotics Initiative
II:	Institutional Infrastructure
CAREER:	Faculty Early Career Development
NIBIB	National Institute of Biomedical Imaging and Bioengineering
DEBUT	DEsign by Biomedical Undergraduate Teams