

MAZDAK ABULNAGA

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EDUCATION

Ph. D., Massachusetts Institute of Technology (MIT)

Cambridge, MA
June 2018 – Present

Electrical Engineering and Computer Science
Advisors: Polina Golland and Justin Solomon

S.M., Massachusetts Institute of Technology (MIT)

Cambridge, MA
September 2016 – June 2018

Electrical Engineering and Computer Science
Thesis: Volumetric Mesh Parameterization of the Placenta to a Canonical Template
Advised by: Polina Golland and Justin Solomon
GPA: 4.9/5.0

B.A.Sc., University of British Columbia (UBC)

Vancouver, BC
September 2011 – May 2016

Electrical Engineering (with Co-op), Minor in Commerce
Graduated with Distinction, ranked 1st in the department of Electrical and Computer Engineering
GPA: 4.33/4.33

RESEARCH EXPERIENCE

MIT: Computer Science and Artificial Intelligence Laboratory

Cambridge, MA

Supervised by Polina Golland and Justin Solomon

September 2016 – Present

- Developing a common coordinate system for functional mapping of the placenta by digitally “flattening” fetal MR images of the organ through a piecewise-affine transformation
- Developing a method to visually interpret clinical features used in deep network classifiers to quantify the severity of pulmonary edema in chest X-ray images
- *Research Interests:* Medical image analysis, applied differential geometry, machine learning, computer graphics, computer vision, signal processing, and information theory.

Philips Research North America

Cambridge, MA

Supervised by Jonathan Rubin

June 2018 – August 2018

- Developed a deep learning model to automatically segment ischemic stroke lesions in Computed Tomography (CT) scans of the brain

UBC: Pediatric Anesthesia Research Team

Vancouver, BC

Supervised by Mark Ansermino

May 2013 – August 2016

- Led a research project that aims to improve the treatment and diagnosis of pneumonia in children of the developing world by developing a low-cost wheezing detection system
- Recruited 41 research subjects for respiratory sound analysis at the BC Children’s Hospital
- Developed a low-cost electronic stethoscope to be used in low-resource settings
- Developed a novel algorithm to identify wheezing in respiration through a Synchrosqueezing transform by classifying wheezing and normal breathing in children. Manuscript in preparation

UBC: Electrical and Computer Engineering in Medicine

Vancouver, BC

Supervised by Guy Dumont

May 2012 – April 2016

- Worked on MobileKids, a research project that aims to reduce sedentary lifestyle in youth by developing an active smartphone game

- Led the feasibility study on a group of 60 children by developing the study protocol, meeting with subjects and distributing devices, and collecting and preparing the data for processing

The Johns Hopkins University: Image Analysis and Communications Lab **Baltimore, MD**
Undergraduate Research Assistant, supervised by Jerry Prince *May – July 2015*

- Developed a graphical user interface (GUI) toolbox in MATLAB that enables medical researchers to visually explore the shape change patterns of the cerebellum (part of the brain) associated with cerebellar disease and function loss
- Performed statistical analysis on landmark shape representations of the cerebellum to study the correlation between cerebellar shape change and function loss, and the patterns of shape change in specific disease type

TRIUMF – Canada’s National Nuclear and Particle Physics Laboratory **Vancouver, BC**
Supervised by Ruediger Picker *January – May 2015*

- Worked on an international collaborative research project that is attempting to quantify the electric dipole moment of the neutron by developing an ultra-cold neutron experiment
- Developed and ran simulations of the experiment using Monte Carlo-based simulations and performed statistical analysis on results

INDUSTRY EXPERIENCE

Chevron Canada Ltd. **Burnaby, BC**
Electrical Engineering Co-op Student *April – November 2014*

- Managed and designed the electrical side of an environmental system project comprising an electric motor, a transformer, electric heat tracing, and DCS-relayed safety instrumentation
- Prepared a through commissioning and maintenance manual for a 75kVA uninterruptable power supply (UPS) and directed electrical contractors during the commissioning of the UPS

TEACHING AND MENTORSHIP

Teaching Assistant, MIT **Cambridge, MA**
6.041/6.431 Introduction to Probability *January 2020 - Present*

- Teaching students the foundations of probability theory through interactive tutorial sessions and office hours

Undergraduate Research Supervisor, MIT **Cambridge, MA**
September 2019 – Present

- Mentoring an undergraduate student in research to develop a model to segment the placenta embedded in an MRI image

PUBLICATIONS

Thesis

Abulnaga, S.M., “Volumetric Mesh Parameterization of the Placenta to a Canonical Template,” S.M. Thesis. Cambridge, MA: Massachusetts Institute of Technology, June 2018. **Morris Joseph Levin Award.**

Journal Articles

1. Abaci Turk, E., **Abulnaga, S.M.**, Luo, J., Stout, J.N., Feldman, H.A., Turk, A., Gagoski, B., Wald, L.L., Adalsteinsson, E., Roberts, D.J., Bibbo, C., Robinson, J.N., Golland, P., Grant, P.E.,

Barth, W.H. Jr., "Placental MRI: Effect of maternal position and uterine contractions on placental BOLD MRI measurements," *Placenta* (2020).

2. Garde, A., Umedaly, A., **Abulnaga, S.M.**, Junker, A., Chanoine, JP., Ansermino, J.M., Dumont, G.A., "Evaluation of a novel mobile exergame in a school-based environment," *Cyberpsychology, Behavior, and Social Networking* **19**(3), 186-192 (2016).
3. Garde, A., Umedaly, A., **Abulnaga, S.M.**, Robertson, L., Junker, A., Chanoine, JP., Ansermino, J.M., Dumont, G.A., "Assessment of a mobile game (MobileKids Monster Manor) to promote physical activity among children," *Games for Health Journal* **4**(2), 149-158 (2015).

Conference Publications

4. **Abulnaga, S.M.**, Abaci Turk, E., Bessmeltsev, M., Grant, P.E., Solomon, J., Golland, P., "Placental Flattening via Volumetric Parameterization," MICCAI: International Conference on Medical Image Computing and Computer Assisted Interventions, 2019.
5. Rubin, J., **Abulnaga, S.M.**, "CT-To-MR Conditional Generative Adversarial Networks for Ischemic Stroke Lesion Segmentation," IEEE ICHI: International Conference on Healthcare Informatics, 2019.
6. **Abulnaga, S.M.**, Yang, Z., Carass, A., Kansal, K., Jedynek, B.M., Onyike, C.U., Ying, S.H., Prince, J.L., "A toolbox to visually explore cerebellar shape changes in cerebellar disease and dysfunction," SPIE: International Society for Optics and Photonics Medical Imaging, 2016.
7. Yang, Z., **Abulnaga, S.M.**, Carass, A., Kansal, K., Jedynek, B.M., Onyike, C.U., Ying, S.H., Prince, J.L., "Landmark based shape analysis for cerebellar ataxia classification and cerebellar atrophy pattern visualization," SPIE: International Society for Optics and Photonics Medical Imaging, 2016.

Peer-Reviewed Workshop Publications

8. **Abulnaga, S.M.**, Rubin, J., "Ischemic Stroke Lesion Segmentation in CT Perfusion Scans Using Pyramid Pooling and Focal Loss," MICCAI BrainLes 2018: Medical Image Computing and Computer Assisted Intervention BrainLesion Workshop, LNCS 2019.

Peer-Reviewed Abstracts

9. **Abulnaga, S.M.**, Abaci Turk, E., Adalsteinsson, E., Barth, W.H. Jr., Roberts, D.J., Grant, P.E., Solomon, J., Golland, P., "Volumetric Mapping of the Placenta to a Flattened Template for Visualization of Regional Anatomy and Function," In-Utero MRI, 2020.
10. Abaci Turk, E., Gagoski, B., Stout, J., **Abulnaga, S.M.**, Copeland, N., Roberts, D.J., Golland, P., Wald, L., Adalsteinsson, E., Grant, P.E., Rathi, Y., "Assessment of placental microcirculation by joint analysis of flow compensated and non-flow compensated intravoxel incoherent motion data," ISMRM: Annual Meeting of the International Society for Magnetic Resonance in Medicine, 2019.
11. **Abulnaga, S.M.**, Abaci Turk, E., Luo, J., Solomon, J., Wald, L.L., Adalsteinsson, E., Bibbo, C., Robinson, J.N., Barth Jr., W.H., Roberts, D.J., Grant, P.E., Golland, P., "Volumetric Mesh-based Mapping of the Placenta to a Canonical Template for Visualization of Regional Anatomy and Function," ISMRM, 2018.
12. **Abulnaga, S.M.**, Abaci Turk, E., Luo, J., Solomon, J., Wald, L.L., Adalsteinsson, E., Bibbo, C., Robinson, J.N., Barth Jr., W.H., Roberts, D.J., Grant, P.E., Golland, P., "Mapping of the Placenta to a Canonical Template for Visualization of Regional Function," ISMRM Workshop on MRI of the Placenta, 2018.

SELECTED PRESENTATIONS

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1. Placental Flattening via Volumetric Parameterization. *University College London*. Oral. London, UK. 2020.

2. Volumetric Mapping of the Placenta to a Flattened Template for Visualization of Regional Anatomy and Function. *In-Utero MRI 2020*. Oral and Poster. Oxford, UK. 2020.
3. Placental Flattening via Volumetric Parameterization. *The University of British Columbia*. Oral. Vancouver, Canada. 2019.
4. Placental Flattening via Volumetric Parameterization. *IPMI 50th Anniversary Summer Short Course and National Doctoral Forum on Medical Imaging*. Oral. Chengdu, China. 2019.
5. Machine Learning for Monitoring Fetal Health in MRI. *MIT College of Computing Launch: Computing Exposition*. Oral. Cambridge, MA, USA. 2019.
6. Placental Flattening via Volumetric Parameterization. *Institute for Pure and Applied Mathematics (IPAM) Workshop on Geometric Learning*. Poster. Los Angeles, USA. 2019.
7. Stroke Lesion Segmentation in Perfusion Images using Fully Convolutional Neural Networks, *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) BrainLesion Workshop*. Poster. Granada, Spain. 2018.
8. Volumetric Mesh Parameterization of the Placenta to a Canonical Template, *EECS Masterworks*. Poster. Cambridge, MA, USA. 2018. **Morris Joseph Levin Award.**
9. Volumetric Mesh-based Mapping of the Placenta to a Canonical Template for Visualization of Regional Anatomy and Function, *International Society for Magnetic Resonance in Medicine*. Poster. Paris, France. 2018.
10. Mapping of the Placenta to a Canonical Template for Visualization of Regional Function, *International Society for Magnetic Resonance in Medicine Workshop on MRI of the Placenta*. Atlanta, GA, USA. 2018.
11. A toolbox to Visually Explore Cerebellar Shape Changes in Cerebellar Disease and Dysfunction, *International Society for Optics and Photonics Medical Imaging*. Poster. San Diego, CA, USA. 2016.
12. Do I Wheeze? Utilizing Respiratory Sounds to Develop an Algorithm for Detecting Wheeze. *Child and Family Research Institute Summer Student Poster Day*. Poster. Vancouver, BC, Canada. 2013. **Best poster award.**

ACADEMIC SERVICE

Reviewer, International Conference on Medical Image Computing and Computer Assisted Interventions	2020
Reviewer, IEEE Transactions on Medical Imaging	2019-20
Reviewer, Pacific Conference on Computer Graphics and Applications	2019

AWARDS

NSF Graduate Research Fellowship (GRFP)	2018-Present
NSERC Postgraduate Scholarship (PGS-D)	2018-Present
Morris Joseph Levin Thesis Presentation Award	2018
Siebel Fellowship	2017
Association of Professional Engineers and Geoscientists Gold Medal in Engineering	2016
Elizabeth and Leslie Gould Scholarship in Engineering	2016
Matti Niit Memorial Prize in Electrical Engineering	2016
UBC Dean's Honour List	2016
UBC Scholarship	2012-15
Jim and Helen Hill Memorial Service Award in Electrical Engineering	2015
Fluor Canada Ltd. Award in Electrical Engineering	2015
Child & Family Research Institute Summer Studentship (Declined for NSF REU)	2015
Charles and Jane Banks Scholarship	2015
Sherwood Lett Memorial Scholarship (Premier Undergraduate Scholarship)	2014-15
UBC Wesbrook Scholar	2014

Western Canada Group of Chartered Engineers Prize	2014
UBC Trek Excellence Scholarship	2013,2015
Edward and Aldine Madsen Scholarship	2013
Best Poster in the Child & Family Research Institute Summer Student Poster Day	2013
NSERC Undergraduate Student Research Award	2013
Peter Wall Institute for Advanced Studies Student Solutions Initiative	2012
UBC President's Entrance Scholarship	2011

LEADERSHIP

EECS Communications Lab: Communications Advisor *March 2019 – Present*

- Coaching graduate students and post-doctoral fellows on communication needs including technical writing, oral and poster presentations, and grant applications
- Developing articles as part of the “CommKit” to act as a general resource on technical communication

EECS Graduate Student Association (GSA): President *October 2017 – January 2020*

- Proposed a \$60,000 budget for academic, social, orientation and recruiting events for the EECS graduate student body containing over 700 graduate students
- Organized weekly meetings with the GSA executive committee to plan events and future for plans for the organization
- Acted as a liaison between the department leadership and graduate students, helping plan academic and organizational changes

EECS GSA: Sports Chair *November 2016 – October 2017*

- Organized intramural sports for EECS graduate students
- Organized graduate student outings to see Boston professional sports team games

PRESS

• MIT News: Using algorithms to build a map of the placenta	2019
• MIT CSAIL News: Better fetal health – by building a map of the placenta	2019
• World Economic Forum: Algorithms can now map placentas and ensure healthy pregnancies	2019
• Fierce Biotech: To bring MRIs into pregnancy monitoring, MIT uses algorithms to chart the placenta	2019
• Engadget: MIT's algorithm could improve imaging techniques during pregnancy	2019
• TechXplore: New technique stretches out MRI scans of placentas so they can be more accurately analyzed	2019
• Health Imaging: New algorithm improves MRI for pregnancy monitoring	2019
• AuntMinnie: New technique unravels 3D MRI scans of the placenta	2019
• SiecleDigital: MIT: un nouvel algorithme pour améliorer les techniques d'imagerie	2019