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EDUCATION & TRAINING

- **Simon Fraser University (SFU)** — Burnaby, BC
  Postdoctoral Research Associate, School of Computing Science — 04/2020-Present

- **University of British Columbia (UBC)** — Vancouver, BC
  Ph.D. in Biomedical Engineering (Research Focus: Deep Learning in Medical Image Analysis) — 04/2020
  M.A.Sc. in Biomedical Engineering — 05/2015

- **Bangladesh University of Engineering & Technology (BUET)** — Dhaka, Bangladesh
  M.Sc. in Electrical and Electronic Engineering — 04/2013
  B.Sc. in Electrical and Electronic Engineering — 02/2011

OFFERS, AWARDS & HONOURS

- **Postdoctoral Fellowship Offer**, Boston Children's Hospital & Harvard Medical School — 2020
- **Postdoctoral Fellowship Offer**, Mass. General Hospital & Harvard Medical School - *Declined* — 2019
- **Postdoctoral Fellowship Offer**, School of Medicine, Stanford University - *Declined* — 2019
- **MICCAI Graduate Student Travel Award**, MICCAI Society — 2019
- **Conference Travel Grant for ICICS Graduate Students**, UBC, Vancouver — 2017
- **Outstanding Reviewer Recognition**, Elsevier — 2016
- **Four Year Fellowship**, UBC, Vancouver — 2015-2019
- **Doctor of Philosophy (DPhil) Admission Offer**, University of Oxford - *Declined* — 2015
- **MICCAI Student Travel Award**, MICCAI Society — 2014
- **Graduate Support Initiative**, UBC, Vancouver — 2013/2015/2016
- **Singapore-Bangladesh Society Scholarship**, BUET — 2009
- **American Association of Bangladeshi Engineers & Architects Scholarship**, BUET — 2009
- **Dean's List Award**, BUET — 2008
- **Ministry of Education Scholarship**, Government of the People's Republic of Bangladesh — 2004-2008

PUBLICATIONS

Google Scholar Profile: https://scholar.google.ca/citations?user=hFwvdQcAAAAJ&hl=en

Journal/Conference Papers Under Review:

R1. Journal: **Hussain MA**, Hamarneh G, Garbi R.: ImHistNet: Deep Radiomics with Learnable Image Histograms for Renal Carcinoma Grading and Staging. *Computerized Medical Imaging and Graphics*, 2020. [**CMIG-D-20-00757**, Impact Factor: 3.750]

R2. Conference: **Hussain MA**, Mirikharaji Z, Momeny M, Marhamati M, Neshat AA, Garbi R, Hamarneh G.: Active Deep Learning from Noisy Teacher for Semi-Supervised 3D Image Segmentation with Application to CT Scans of COVID-19 Pneumonia Infection. *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, 2021.

Journal Papers:

J1. **Hussain MA**, Hamarneh G, Garbi R.: Cascaded Regression Neural Nets for Kidney Localization and Segmentation-free Volume Estimation. *IEEE Transaction on Medical Imaging*, 2021. [PDF] [Accepted, Impact Factor: 6.685, No of Reviewers: 5, DOI: 10.1109/TMI.2021.3060465]

J2. **Hussain MA**, Hodgson AJ, Abugharbieh R.: Strain-initialized Robust Bone Surface Detection in 3-D Ultrasound. *Ultrasound in Medicine & Biology*, 43(3), pp. 648-661, 2017. [PDF] [Impact Factor: 2.514, No of Reviewers: 3, DOI: 10.1016/j.ultrasmedbio.2016.11.003]

J3. **Hussain MA**, Alam F, Rupa SA, Awwal R, Lee SY, Hasan MK.: Lesion Edge Preserved Direct Average Strain Estimation for Ultrasound Elasticity Imaging. *Ultrasonics*, 54(1), pp. 137-146, 2014. [PDF] [Impact Factor: 3.065, No of Reviewers: 3, DOI: 10.1016/j.ultras.2013.05.010]

J4. Hasan MK, **Hussain MA**, Ara SR, Lee SY, Alam SK.: Using Nearest Neighbors for Accurate Estimation of Ultrasonic Attenuation in the Spectral Domain. *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, 60(6), pp. 1098-1114, 2013. [PDF] [Impact Factor: 2.743, No of Reviewers: 3, DOI: 10.1109/TUFFC.2013.2673]

J5. **Hussain MA**, Anas EM, Alam SK, Lee SY, Hasan MK.: Direct and Gradient-based Average Strain Estimation by Using Weighted Nearest Neighbor Cross-correlation Peaks. *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, 59(8), pp. 1713-1728, 2012. [PDF] [Impact Factor: 2.743, No of Reviewers: 3, DOI: 10.1109/TUFFC.2012.2376]

J6. **Hussain MA**, Alam SK, Lee SY, Hasan MK.: Robust Strain-estimation Algorithm Using Combined Radiofrequency and Envelope Cross-correlation with Diffusion Filtering. *Ultrasonic Imaging*, 34(2), pp. 93-109, 2012. [PDF] [Impact Factor: 1.571, No of Reviewers: 3, DOI: 10.1177/0161734612034002O3]

Conference/Workshop Proceedings (Peer-Reviewed Full-Length):

C1. **Hussain MA**, Hamarneh G, Garbi R.: ImHistNet: Learnable Image Histogram Based DNN with Application to Non-invasive Determination of Carcinoma Grades in CT Scans. *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, pp. 130-138, 2019, Shenzhen, China. [PDF] [Acceptance Rate: 30%, No of Reviewers: 3, DOI: 10.1007/978-3-030-32226-7_15]

C2. **Hussain MA**, Hamarneh G, Garbi R.: Renal Cell Carcinoma Staging with Learnable Image Histogram-based Deep Neural Network. *International Workshop on Machine Learning in Medical Imaging (MLMI)*, pp 533-540, 2019, Shenzhen, China. [PDF] [Acceptance Rate: 30%, No of Reviewers: 3, DOI: 10.1007/978-3-030-32692-0_61]

C3. **Hussain MA**, Hamarneh G, Garbi R.: Noninvasive Determination of Gene Mutations in Clear Cell Renal Cell Carcinoma Using Multiple Instance Decisions Aggregated CNN. *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, pp. 657-665, 2018, Granada, Spain. [PDF] [Acceptance Rate: 30%, No of Reviewers: 5, DOI: 10.1007/978-3-030-00934-2_73]

C4. **Hussain MA**, Amir-Khalili A., Hamarneh G, Abugharbieh R.: Segmentation-free Kidney Localization and Volume Estimation Using Aggregated Orthogonal Decision CNNs. *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, pp. 612-620, 2017, Quebec-City, Canada. [PDF] [Acceptance Rate: 30%, No of Reviewers: 3, DOI: 10.1007/978-3-319-66179-7_70]

C5. **Hussain MA**, Amir-Khalili A., Hamarneh G, Abugharbieh R.: Collage CNN for Renal Cell Carcinoma Detection from CT. *International Workshop on Machine Learning in Medical Imaging (MLMI)*, pp. 229-237, 2017, Quebec-City, Canada. [PDF] [Acceptance Rate: 30%, No of Reviewers: 3, DOI: 10.1007/978-3-319-67389-9_27]

C6. **Hussain MA**, Hamarneh G, O'Connell TW, Mohammed MF, Abugharbieh R.: Segmentation-free Estimation of Kidney Volumes in CT with Dual Regression Forests. *International Workshop on Machine Learning in Medical Imaging (MLMI)*, pp. 156-163, 2016, Athens, Greece. [PDF] [Acceptance Rate: 30%, No of Reviewers: 3, DOI: 10.1007/978-3-319-47157-0_19]

C7. **Hussain MA**, Shourov RM.: Compressively Sensed Ultrasound Radio-frequency Data Reconstruction Using the Combined Curvelets and Wave Atoms Basis. *International Conference on Electrical and Electronic Engineering (ICEEE)*, pp. 209-212, 2015, Rajshahi, Bangladesh. [PDF] [Acceptance Rate: 35%, No of Reviewers: 3, DOI: 10.1109/CEEE.2015.7428257]

C8. **Hussain MA**, Shourov RM, Khan SN.: Towards Real-time 3D Geometric Nonlinear Diffusion Filter and Its Application to CT and MR Imaging. *18th International Conference on Computer and Information Technology (ICCIT)*, pp. 462-467, 2015, Dhaka, Bangladesh. [PDF] [Acceptance Rate: 40%, No of Reviewers: 3, DOI: 10.1109/ICCITechn.2015.7488115]

C9. **Hussain MA**, Guy P, Hodgson AJ, Abugharbieh, R.: Automatic Bone Segmentation in Ultrasound using Combined Ultrasound Strain Imaging and Envelope Signal Power, *2015 International Meeting on Computer Assisted Orthopaedic Surgery (CAOS)*, pp. 1-4, 2015, Vancouver, Canada. [PDF] [No of Reviewers: 3]

C10. **Hussain MA**, Hodgson AJ, Abugharbieh R.: Robust Bone Detection in Ultrasound Using Combined Strain Imaging and Envelope Signal Power Detection. *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, pp. 356-363, 2014, Boston, MA. [PDF] [Acceptance Rate: 30%, No of Reviewers: 3, DOI: 10.1007/978-3-319-10404-1_45]

C11. Kabir HM, Alam SB, Azam MI, **Hussain MA**, Sazzad AR, Sakib MN, Matin MA.: Non-linear Down-sampling and Signal Reconstruction, Without Folding. *4th UKSim European Symposium on Computer Modeling and Simulation*, pp. 142-146, 2010, Pisa, Italy. [PDF] [Acceptance Rate: 40%, No of Reviewers: 3, DOI: 10.1109/EMS.2010.34]

Peer-reviewed Abstracts:

A1. **Hussain MA**, Anas EM, Alam SK, Lee SY, Hasan MK.: Improved Elasticity Imaging by Maximizing the Weighted Peaks of the Nearest Neighbor Cross-correlation Function. *2012 American Institution of Ultrasound in Medicine (AIUM) Annual Convention and Preconvention Program*, Phoenix, Arizona. March 29 - April 1, 2012. [PDF]

A2. **Hussain MA**, Alam SK, Lee SY, Hasan MK.: A Robust Strain Estimation Algorithm Using Combined Radio-frequency and Envelope Cross-correlation. *Ultrasonic Imaging and Tissue Characterization Symposium*, Rosslyn, Virginia. June 11-13, 2012. [PDF]

Non Peer-reviewed Abstracts:

O1. **Hussain MA**, Hamarneh G, Garbi R.: Kidney Cancer Detection and Analysis from CT Using Deep Learning. *2nd Annual School of Biomedical Engineering Symposium*, 2019, Vancouver, Canada. [PDF]

O2. **Hussain MA**, Hamarneh G, Garbi R.: Learnable Image Histogram Based Deep Neural Network with Application to Noninvasive Determination of Renal Cell Carcinoma Grades in CT Scans. *Research Day: The Future of Health Symposium*, Nov 8, 2019, Vancouver, Canada. [PDF]

Theses:

T1. **Hussain MA**.: Volumetric Image-based Supervised Learning for Renal Cancer Detection and Analysis. Ph.D., UBC, 2020. Supervisor: Prof. Rafeef Garbi. [PDF]

T2. **Hussain MA**.: Robust Bone Detection in Ultrasound Using Combined Strain Imaging and Envelope Signal Power Detection. M.A.Sc., UBC, 2015. Supervisors: Prof. Rafeef Garbi & Prof. Antony J. Hodgson. [PDF]

T3. **Hussain MA**: Average Strain Estimation for Ultrasound Elastography Using Exponentially Weighted Nearest Neighbors. M.Sc., BUET, 2013. Supervisor: Prof. Md Kamrul Hasan. [PDF]

T4. Islam MT and **Hussain MA** (Equal Contribution): Ultrasound Strain Imaging in Wavelet Domain. B.Sc., BUET, 2011. Supervisor: Prof. Md Kamrul Hasan. [PDF]

SUMMARY OF RESEARCH ACCOMPLISHMENTS

My research interest lies in developing novel deep learning techniques for real-life applications including medical image analysis and computer vision. Please see my research summary webpage (https://arafathm.github.io/research/) for details. A very brief summary of my research accomplishments are also presented below:

1. **COVID-19 Detection and Analysis from CT and X-ray**
   I am currently investigating the computed tomography (CT)- and X-ray-based discriminatory radiomic features between COVID-19 and community-acquired pneumonia (CAP). My aim is to discover critical differences in seemingly similar COVID-19 and CAP infections in the lungs, which would help clinicians in rapid COVID-19 diagnosis and treatment planning. Meanwhile, I developed an active learning approach [R2] that uses an example re-weighting strategy, where machine-annotated samples are weighted based on the similarity of their gradient directions of descent to those of expert-annotated data. Preliminary study results are available in these links [L1], [L2].
2. **Learnable Image Histogram-based Deep Neural Network**
   I developed a learnable image histogram module in the convolutional neural network (CNN) framework for automatic kidney cancer grading and staging - this approach is the first, to our knowledge, that learns diffused textural features in an image, and it's application in computed tomography (CT)-based cancer grading and staging could be a potential alternative to the invasive renal biopsy-based cancer grading and staging [R1][C1][C2].
3. **Multiple Instance Decision Aggregated CNN for Gene Mutation Prediction**
   I developed a CT-based multiple instance decision aggregated CNN approach for noninvasive determination of gene mutation in kidney cancer - this approach could be used as a potential alternative to the invasive renal biopsy-based whole-genome sequencing for gene mutation detection [C3].
4. **Mask-RCNN and Orthogonal Decision Aggregated CNN for Kidney Localization in CT**
   I developed a CNN-guided Mask-RCNN and an orthogonal decision aggregated CNN-based automatic kidney localization approach for the CT scans that enables the radiologists in rapid subsequent kidney functionality analysis in the clinical environment [J1][C4].
5. **Collage Image Representation in the Multiple Instances Learning Framework**
   I developed a collage image representation in the multiple instances learning framework, enabling the use of sparsely annotated data in 2D CNN, which is a computationally inexpensive alternative to the computationally expensive 3D CNN [C5].
6. **Segmentation-free Kidney Volume Estimation Using Machine Learning**
   I developed two techniques for segmentation-free kidney volume estimation using dual regression forests, CNN, and FCN. These methods are two potential and more accurate alternatives to the manual ellipsoid fitting-based kidney volume estimation approach typically used in the clinical environment. Our methods also bypass the computationally expensive segmentation procedure altogether [J1][C4][C6].
7. **Compressively-sensed Ultrasound RF Data**
   I developed a combined Curvelets and WaveAtoms basis-based compressively sensed ultrasound RF data reconstruction approach [C7].
8. **Geometric Diffusion Filter**
   I developed a near real-time 3D geometric non-linear diffusion filter for the CT/MR image denoising [C8].
9. **2D Strain-initialized Surface Growing for Bone Detection in 3D Ultrasound**
   I developed a 2D strain initialized surface growing approach for automatic bone surface delineation in 3D ultrasound.

This method could be used as an alternative to the time-inefficient manual bone delineation in ultrasound-guided minimally invasive surgery [J2].

10. **Bone Detection in 2D Ultrasound**
    I developed a combined strain imaging and envelope signal power-based robust bone boundary detection approach for the 2D ultrasound. This elastography-based bone detection approach robust to false positives at fatty tissue layer [C9][C10].
11. **Ultrasound Strain Imaging**
    I developed novel ultrasound strain imaging techniques using weighted nearest neighbors for accurate early breast cancer detection [J3][J5][J6][A1][A2].
12. **Ultrasound Attenuation Estimation**
    I developed two novel ultrasound attenuation estimation technique for accurate breast carcinoma analysis [J4].

TEACHING EXPERIENCE

Graduate Teaching Assistant, UBC, Vancouver 01/2014 - 12/2019

Conducted tutorials, invigilation, grading and laboratory demonstrations for the following courses:
- Signals and Systems (Winter T2 2013, Winter T1 2016, 2017, 2018, 2019)
- Electrical Engineering Design Studio (Winter T2 2014)
- Digital Systems and Microcomputers (Winter T2 2015, 2016, 2017)
- Economic Analysis of Engineering Projects (Summer 2016)
- Machine Learning and Data Mining (Summer 2017)
- Introduction to Computation in Engineering Design (Summer 2017, 2018, 2019, and Winter T1-2 2017)
- Engineering Electromagnetics (Winter T2 2018)

Senior Lecturer, Eastern University, Dhaka, Bangladesh 05/2015 - 08/2015

Conducted lectures, invigilation, grading and laboratory demonstrations for the following courses:
- Microprocessor and Interfacing (Spring 2015)
- Microprocessor and Interfacing Laboratory (Spring 2015)
- Measurement and Instrumentation (Spring 2015)
- Measurement and Instrumentation Laboratory (Spring 2015)
- Solid State Devices (Spring 2015)
- Electronic Project Design (Spring 2015)

SUPERVISORY EXPERIENCE

- **Rohit Somasundaram** Professional Master's Intern, School of Computing Science, SFU
  Project title: COVID-19 diagnosis from chest X-ray images
- **Yilin Shi** Professional Master's Intern, School of Computing Science, SFU
  Project title: COVID-19 diagnosis from CT scans

REVIEWING EXPERIENCE

- IEEE Transactions on Neural Networks and Learning Systems
- IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control
- IEEE Access
- Ultrasonics Journal - Elsevier
- Computers in Biology and Medicine Journal - Elsevier
- Deep Learning in Medical Image Analysis - Springer
- Medical Image Computing and Computer Assisted Intervention - Springer

INVITED TALKS/PRESENTATIONS

- **University of British Columbia, School of Biomedical Engineering, Vancouver, BC** 10/2020
  Title: Volumetric Image-based Supervised Learning Approaches for Kidney Cancer Detection & Analysis
- **Harvard University, Center for Advanced Medical Computing and Analysis, Boston, MA** 11/2019
  Title: Volumetric Image-based Supervised Learning for Renal Cancer Detection & Analysis
- **Stanford University, Division of Developmental-Behavioral Pediatrics, Palo Alto, CA** 10/2019
  Title: Kidney Cancer Analysis Using Volumetric Image-based Supervised Learning
- **University of British Columbia, Centre for Molecular Medicine and Therapeutics, Vancouver, BC** 09/2019
  Title: Kidney Cancer Detection and Analysis from CT Using Deep Learning

LEADERSHIP SKILLS

- **Secretary** (Elected Position) 05/2016 - 04/2017
  Electrical and Computer Engineering Graduate Student Association (ECEGSA), UBC
- **Field Volunteer** (Awarded the honorary 'Life Membership' for outstanding service) 01/2003 - 12/2007
  Bangladesh Red Crescent Society
- **Lead of Event Organizers** 01/2006 - 12/2010
  Department of Electrical & Electronic Engineering, BUET, Dhaka, Bangladesh

COMPUTATIONAL SKILLS

- HPC on Compute Canada clusters
- C/C++, MATLAB, Python, TensorFlow/Keras, PyTorch, Caffe, LaTeX

SELECTED WORKSHOPS/TRAINING ATTENDED

- **Privacy and Information Security Fundamentals** 2019
  University of British Columbia, Vancouver
- **Teaching Skills for Engineering Teaching Assistants** 2016
  University of British Columbia, Vancouver
- **Preventing and Addressing Workplace Bullying and Harassment** 2014
  University of British Columbia, Vancouver

EMPLOYMENT HISTORY

- **Postdoctoral Research Associate** 04/2020 - Present
  SFU, Burnaby, BC
- **Laboratory Technologist/Admin** 06/2018 - 04/2020
  Biomedical Signal and Image Computing Laboratory, UBC, Vancouver
- **Graduate Research Assistant** 05/2013 - 03/2020
  UBC, Vancouver
- **Graduate Teaching Assistant** 01/2014 - 12/2019
  UBC, Vancouver
- **Senior Lecturer** 05/2015 - 08/2015
  Eastern University, Dhaka, Bangladesh
- **System Engineer** 01/2013 - 04/2013
  Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh
- **Research Engineer** 07/2011 - 12/2012
  BUET, Dhaka, Bangladesh
- **Software Engineer** 02/2011 - 06/2011
  Samsung R&D Institute, Dhaka, Bangladesh

REFERENCES

Prof. Ghassan Hamarneh, Ph.D.
School of Computing Science,
Simon Fraser University, Burnaby, BC V5A 1S6, Canada
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Prof. Antony Hodgson, Ph.D.
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