Dong Han (Cassey)

Post Doctoral Associate · U.S. Permanent Resident

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scholar.google.com/citations?user=DpDdvX8AAAAJ

Research Interests

My research focuses on accurate multiclass cardiac arrhythmia detection using wearable devices in real-world environment. Combining my extensive experience in signal processing, deep learning, and conducting randomized controlled clinical trials, I aim to develop effective (medical interpretability) and efficient (low computational cost) algorithms to assist cardiologists in diagnostic decision-making.

Education

Post Doctoral Associate in Biomedical Engineering *Aug. 2023 - Present*

University of Connecticut (UConn) *Storrs, CT*

- Advisor: Dr. Ki H. Chon

Ph.D. in Biomedical Engineering *Aug. 2016 – Aug. 2023*

University of Connecticut *Storrs, CT*

- Advisor: Dr. Ki H. Chon, Co-advisor: Dr. David D. McManus (Chair and Professor at UMass Chan Medical School)
- Thesis: Long-term Atrial Fibrillation Monitoring in Older Adults using Smartwatch Photoplethysmography.
- Course track: Electrical Engineering (EE) - Digital Signal Processing (DSP), Advance DSP, Estimation Theory, Neural Networks, Machine Learning, Deep Learning, etc.

Bachelor of Science in Biomedical Engineering *Aug. 2012 – Jun. 2016*

Beijing Jiaotong University *Beijing, China*

- Solid EE + Computer Science Engineering (CS) background with proficient medical knowledge:
  EE: Signal & System, DSP, Medical Electronics Design, Circuit Analysis, Analog Electronics, Digital Electronics, etc.;
  CS: C, Data Structure, Assembly, C++, Java, Database, Computer Graphics, Microcontroller, Digital Image Processing;
  Medical: Human Anatomy & Physiology (lecture + lab), Pathology & Pathophysiology, Fundamentals of Diagnostics, etc.

Patent

Signal Processing & Machine Learning Algo. in Cardiac Arrhythmias Diagnose with Noise:

[1] K. H. Chon, **Han D**, S. K. Bashar, and F. Mohagheghian, Heart Condition Treatment and Analysis, US Patent, Patent Number: US-20220022765-A1, Issue Date: 01/27/2022.

Publications

Deep Learning for Multiclass Cardiac Arrhythmia Classification using Smartwatch PPG

[2] **D. Han** et al., "Multiclass Arrhythmia Classification using Smartwatch Photoplethysmography Signals Collected in Real-life Settings", medRxiv 10.1101/2024.12.03.2431844, under review in the Journal of the American Heart Association (JAHA), **impact factor (IF): 6.107**.

[3] **D. Han**, J. Moon, L. R. M. Díaz, D. Chen, D. Williams, E. Y. Ding, K.-V. Tran, D. D. McManus, K. H. Chon, "Multiclass Arrhythmia Classification using Smartwatch Photoplethysmography Signals Collected in Real-life Settings", (Sept. 10, 2024), 10.48550/arXiv.2409.06147, waiting for the decision on Dec. 18th, 2024 for ICASSP 2025 (top signal processing & machine learning conference).

Deep Learning for Multiclass Cardiac Arrhythmia Classification using ECG

[4] J. Lim, **D. Han**, M. Pirayesh Shirazi Nejad, K. H. Chon, "ECG classification via integration of adaptive beat segmentation and relative heart rate with deep learning networks", Computers in Biology and Medicine 181, 109062 (2024),

10.1016/j.compbiomed.2024.109062, **IF: 7.0**.

Deep Learning for Denoising PPG with Atrial Fibrillation (AF)

[5] F. Mohagheghian, **D. Han**, O. Ghetia, D. Chen, A. Peitzsch, N. Nishita, E. Y. Ding, E. Mensah Otabil, K. Noorishirazi, A. Hamel, E. L. Dickson, D. DiMezza, K.-V. Tran, D. D. McManus, K. H. Chon, "Atrial fibrillation detection on reconstructed photoplethysmography signals collected from a smartwatch using a denoising autoencoder", Expert Systems with Applications 237, 121611 (2024) 10.1016/j.eswa.2023.12161, **IF: 7.5**.

[6] F. Mohagheghian, **D. Han**, O. Ghetia, A. Peitzsch, N. Nishita, M. Pirayesh Shirazi Nejad, E. Y. Ding, K. Noorishirazi, A. Hamel, E. M. Otabil, D. DiMezza, E. L. Dickson, K.-V. Tran, D. D. McManus, K. H. Chon, "Noise Reduction in Photoplethysmography Signals Using a Convolutional Denoising Autoencoder With Unconventional Training Scheme", IEEE Transactions on Biomedical Engineering 71, 456–466 (2024) 10.1109/TBME.2023.3307400, **IF: 4.756**.

Machine Learning for Motion Noise Detection in PPG with AF

[7] F. Mohagheghian, **D. Han**, A. Peitzsch, N. Nishita, E. Ding, E. Dickson, D. Dimezza, E. Otabil, K. Noorishirazi, J. Scott, D. Lessard, Z. Wang, C. Whitcomb, K. Tran, T. Fitzgibbons, D. Mcmanus, K. Chon, "Optimized Signal Quality Assessment for Photoplethysmogram Signals using Feature Selection", IEEE Transactions on Biomedical Engineering, 1–1 (2022) 10.1109/TBME.2022.3158582, **IF: 4.756**.

Application(app) Design for the *Pulsewatch* Smartwatch-smartphone App

[8] **D. Han**, E. Y. Ding, C. Cho, H. Jung, E. L. Dickson, F. Mohagheghian, A. G. Peitzsch, D. DiMezza, K.-V. Tran, D. D. McManus, K. H. Chon, "A Smartwatch System for Continuous Monitoring of Atrial Fibrillation in Older Adults After Stroke or Transient Ischemic Attack: Application Design Study", JMIR Cardio 7, e41691 (2023) 10.2196/41691, **IF: 2.52**.

Real-time Signal Processing Algorithms for AF Detection

[9] **D. Han**, S. K. Bashar, J. Lázaro, F. Mohagheghian, A. Peitzsch, N. Nishita, E. Ding, E. L. Dickson, D. DiMezza, J. Scott, C. Whitcomb, T. P. Fitzgibbons, D. D. McManus, K. H. Chon, "A Real-Time PPG Peak Detection Method for Accurate Determination of Heart Rate during Sinus Rhythm and Cardiac Arrhythmia", Biosensors 12, 82 (2022) 10.3390/bios12020082, **IF: 4.9**.

[10] S. Bashar, **D. Han**, Z. Fearass, E. Ding, T. Fitzgibbons, A. Walkey, D. McManus, B. Javidi, K. Chon, "Novel Density Poincare Plot Based Machine Learning Method to Detect Atrial Fibrillation from Premature Atrial/Ventricular Contractions", IEEE Transactions on Biomedical Engineering, 1–1 (2020) 10.1109/TBME.2020.3004310, **IF: 4.756**.

[11] **D. Han**, S. K. Bashar, F. Mohagheghian, E. Ding, ..., D. D. McManus, K. H. Chon, "Premature Atrial and Ventricular Contraction Detection using Photoplethysmographic Data from a Smartwatch", Sensors 20, 5683 (2020) 10.3390/s20195683, **IF: 3.9**.

[12] S. K. Bashar, **D. Han**, S. Hajeb-Mohammadalipour, E. Ding, C. Whitcomb, D. D. McManus, K. H. Chon, "Atrial Fibrillation Detection from Wrist Photoplethysmography Signals Using Smartwatches", Scientific Reports 9, 15054 (2019) 10.1038/s41598-019-49092-2, **IF: 3.8**.

[13] E. Y. Ding, **D. Han**, C. Whitcomb, S. K. Bashar, O. Adaramola, A. Soni, J. Saczynski, T. P. Fitzgibbons, M. Moonis, S. A. Lubitz, D. Lessard, M. T. Hills, B. Barton, K. Chon, D. D. McManus, "Accuracy and Usability of a Novel Algorithm for Detection of Irregular Pulse Using a Smartwatch Among Older Adults: Observational Study", JMIR Cardio 3, 10.2196/13850 (2019) 10.2196/13850, **IF: 2.52**.

Outcome of the *Pulsewatch* Clinical Trial

[14] E. Y. Ding, K.-V. Tran, D. Lessard, Z. Wang, **D. Han**, F. Mohagheghian, E. M. Otabil, K. Noorishirazi, J. Mehawej, A. Filippaios, S. Naeem, M. F. Gottbrecht, T. P. Fitzgibbons, J. S. Saczynski, B. Barton, K. Chon, D. D. McManus, "Accuracy, Usability, and Adherence of Smartwatches for Atrial Fibrillation Detection in Older Adults After Stroke: Randomized Controlled Trial", JMIR Cardio 7, e45137 (2023) 10.2196/45137, **IF: 2.52**.

[15] E. Mensah Otabil, Q. Dai, P. Anzenberg, A. Filippaios, E. Ding, J. Mehawej, J. E. Mathew, D. Lessard, Z. Wang, K. Noorishirazi, A. Hamel, T. Paul, D. DiMezza, **D. Han**, F. Mohagheghian, A. Soni, H. Lin, B. Barton, J. Saczynski, K. H. Chon, K.-V. Tran, D. D. McManus, "Technology engagement is associated with higher perceived physical well-being in stroke patients prescribed smartwatches for atrial fibrillation detection", Frontiers in Digital Health 5 (2023), **IF: 3.2**.

[16] T. J. Paul, K.-V. Tran, J. Mehawej, D. Lessard, E. Ding, A. Filippaios, S. Howard-Wilson, E. M. Otabil, K. Noorishirazi, S. Naeem, A. Hamel, **D. Han**, K. H. Chon, B. Barton, J. Saczynski, D. McManus, "Anxiety, patient activation, and quality of

life among stroke survivors prescribed smartwatches for atrial fibrillation monitoring", Cardiovascular Digital Health Journal, 10.1016/j.cvdhj.2023.04.002 (2023) 10.1016/j.cvdhj.2023.04.002, **IF: 2.6**.

[17] K.-V. Tran, A. Filippaios, K. Noorishirazi, E. Ding, **D. Han**, F. Mohagheghian, Q. Dai, J. Mehawej, Z. Wang, D. Lessard, E. M. Otabil, A. Hamel, T. Paul, M. F. Gottbrecht, T. P. Fitzgibbons, J. Saczynski, K. H. Chon, D. D. McManus, "False Atrial Fibrillation Alerts from Smartwatches are Associated with Decreased Perceived Physical Well-being and Confidence in Chronic Symptoms Management", Cardiology and cardiovascular medicine 7, 97–107 (2023) 10.26502/fccm.92920314, **IF: 3.5**.

[18] E. Y. Ding, M. CastañedaAvila, K.-V. Tran, J. Mehawej, A. Filippaios, T. Paul, E. M. Otabil, K. Noorishirazi, **D. Han**, J. S. Saczynski, B. Barton, K. M. Mazor, K. Chon, D. D. McManus, "Usability of a smartwatch for atrial fibrillation detection in older adults after stroke", Cardiovascular Digital Health Journal, 10.1016/j.cvdhj.2022.03.003 (2022), **IF: 2.6**.

Design of the Randomized Controlled Trial

[19] E. L. Dickson, E. Y. Ding, J. S. Saczynski, **D. Han**, M. Moonis, T. P. Fitzgibbons, B. Barton, K. Chon, D. D. McManus, "Smartwatch Monitoring for Atrial Fibrillation After Stroke – The Pulsewatch Study: Protocol for a Multi-Phase Randomized Controlled Trial", Cardiovascular Digital Health Journal 0, 10.1016/j.cvdhj.2021.07.002 (2021), **IF: 2.6**.

Conference Presentations

** presenting author; + mentored undergraduate*

Invited Talks

EMBC 2019: *Smartwatch PPG Peak Detection Method for Sinus Rhythm and Cardiac Arrhythmia*. Invited talk for Special Session: Detection of Atrial Fibrillation using Smartphones and Smartwatches, 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (Jul. 2019), Berlin, Germany.

Contributed Presentations

BSN 2024: D. Chen*+, **D. Han**, L. R. M. Díaz, J. Moon, D. Chen, K. H. Chon. *Smartwatch Photoplethysmogram-Based Atrial Fibrillation Detection with Premature Atrial and Ventricular Contraction Differentiation Using Densely Connected Convolutional Neural Networks.* Poster Presentation: 2024 IEEE 20th International Conference on Body Sensor Networks (BSN) (Oct. 2024), Chicago, IL.

AHA 2021: E. Y. Ding*, **D. Han**, E. L. Dickson, D. DiMezza, J. Scott, F. Mohagheghian, A. Peitzsch, J. Saczynski, M. Moonis, T. P. Fitzgibbons, B. Barton, K. Chon, D. D. McManus. *Abstract 9886: Use of a Smartwatch and App Designed by Stroke Survivors for Atrial Fibrillation Detection in Older Adults After Stroke/Transient Ischemic Event: Preliminary Findings from an Ongoing Randomized Clinical Trial.* Poster Presentation: American Heart Association Scientific Sessions (Nov. 2021), virtual.

BHI/BSN 2021: **D. Han**, F. Mohagheghian, A. Peitzsch, K. H. Chon*. *Challenges of Atrial Fibrillation Detection Using Smartwatches.* Invited talk: Conference IEEE BHI-BSN2021 IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI'21) Jointly Organised with the 17th IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks (BSN'21) (Jul. 2021), virtual.

EMBC 2020: S. K. Bashar*, **D. Han**, F. Zieneddin, E. Ding, A. J. Walkey, D. D. McManus, K. H. Chon. *Preliminary Results on Density Poincare Plot Based Atrial Fibrillation Detection from Premature Atrial/Ventricular Contractions.* Oral presentation: 2020 42nd Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC) (Jul. 2020) pp. 2594–2597, 10.1109/EMBC44109.2020.9175216, virtual at Montreal, Canada.

EMBC 2020: **D. Han**, S. K. Bashar, F. Zieneddin, E. Ding, C. Whitcomb, D. D. McManus, K. H. Chon. *Digital Image Processing Features of Smartwatch Photoplethysmography for Cardiac Arrhythmia Detection.* Oral presentation: 2020 42nd Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC) (Jul. 20–24, 2020), pp. 4071–4074, 10.1109/EMBC44109.2020.9176142, virtual at Montreal, Canada.

EMBC 2019: **D. Han**, S. K. Bashar, J. Lazaro, E. Ding, C. Whitcomb, D. D. McManus, K. H. Chon. *Smartwatch PPG Peak Detection Method for Sinus Rhythm and Cardiac Arrhythmia.* Oral presentation: 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (Jul. 2019), pp. 4310–4313, 10.1109/EMBC.2019.8857325, Berlin, Germany.

EMBC 2019: S. K. Bashar*, **D. Han**, E. Ding, C. Whitcomb, D. D. McManus, K. H. Chon. *Smartwatch Based Atrial Fibrillation Detection from Photoplethysmography Signals.* Oral presentation: 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (July 2019), pp. 4306–4309, 10.1109/EMBC.2019.885692, Berlin, Germany.

BHI 2018: S. K. Bashar*, **D. Han**, A. Soni, D. D. McManus, K. H. Chon. 2019. *Developing a novel noise artifact detection algorithm for smartphone PPG signals: Preliminary results.* Oral presentation: 2018 IEEE EMBS International Conference on Biomedical Health Informatics (BHI) (Mar. 2018), pp. 79–82, 10.1109/BHI.2018.8333374, Berlin, Germany.

CHASE 2017: E. Ding*, D. Liu, A. Soni, O. Adaramola, **D. Han**, S. K. Bashar, Y. Noh, K. H. Chon, D. D. McManus. *Impressions of Older Patients with Cardiovascular Diseases to Smart Devices for Heart Rhythm Monitoring.* Oral presentation: 2017 IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE) (Jul. 2017), pp. 270–271, 10.1109/CHASE.2017.97, Philadelphia, PA.

Awards, Fellowships, & Grants

2023	**3rd Place of BME Graduate Research Presentation Competition**, Dept. of BME, UConn	*$ 500*
	Doctoral Dissertation Fellowship, Graduate School, UConn	*$ 2,000*
2020	**Student Paper Competition Open Finalists (as 2nd Author)**, 42nd Annual International Conferences of the IEEE Engineering in Medicine and Biology Society (EMBC 2020)	
2019	**Doctoral Student Travel Award**, Graduate School, UConn	*$ 750*
	BME Travel Award, Dept. of BME, UConn	*$ 900*

Industry Experience

May. 2023	**Consulting Scientist**, for bidding proposal to detect 50 different types of cardiac arrhythmia in ECG using deep learning methods, ScottCare, Cleveland, OH.
Mar. 2022	**Contract Consulting Scientist**, for FDA Clearance of Cardiac Arrhythmia Detection Algorithms Deployed in Wearable Electrocardiogram (ECG) Devices, ScottCare, Cleveland, OH.
Aug. 2016 - May 2017	**Contract Algorithm Engineer**, for AF Detection under Motion Noise Artifact using Smartwatch PPG, Mobile Sense Technologies, Inc., DE, and Samsung Semiconductor Inc., San Jose, CA.

Teaching Experience

Spring 2017	**BME3900: Biomedical Engineering Junior Design**, Teaching Assistant
Fall 2016	**BME4900: Biomedical Engineering Senior Design**, Teaching Assistant
Fall 2016	**BME4500: Bioinstrumentation**, Teaching Assistant

Mentoring

2022-2025	**Darren Chen**, Honors Biomedical Engineering Undergraduate Student, UConn
2021-2023	**Om Ghetia**, Honors Nutritional Sciences and Public Health Undergraduate Student, UConn
2021-2023	**Nishat J. Nishita**, Master of Public Health, UConn Health
2022	**Ohm Ghutadaria**, Neurobiology and Physiology Undergraduate Student, UConn

Community Service

Service and Outreach

May 2023	**BME Department Head Search Interview**, Graduate Student Interviewer	*UConn*
2018-2020	**BME Department and Chon Lab**, Website Administrator	*UConn*

Research Topic Coordinator

2023-2025	**Frontiers of Stroke**, Research Topic 57974 - Mobile Health for Assisting Stroke Survivors	*UConn*

Peer Review

Journal review: IEEE Journal of Biomedical and Health Informatics (IEEE JBHI) (2024/10/24, 2024/07/14, 2021/06/07),
Frontiers in Stroke (2024/10/22),
Computer Methods and Programs in Biomedicine (2024/12/05, 2024/10/18, 2024/09/03, 2023/10/12, 2023/09/15),
Digital Signal Processing (2024/08/02),
IEEE Transactions on Systems, Man, and Cybernetics: Systems (2024/05/16, 2024/02/27),
Artificial Intelligence In Medicine (2024/02/22),
Mathematical Biosciences and Engineering (2023/11/06, 2023/09/27),
Biomedical Signal Processing and Control (2023/10/28, 2023/09/15, 2023/06/22),
Cardiovascular Digital Health Journal (2023/09/30, 2023/01/28, 2021/11/01),
International Journal of Medical Informatics (2023/09/13),
Journal of Medical Internet Research (2023/08/05),
JMIR AI (2023/06/06),
mHealth (2023/05/06),
Computer Methods in Biomechanics and Biomedical Engineering (2023/05/03),
Npj Digital Medicine (2023/03/07, 2022/11/07, 2022/09/15, 2020/08/06),
Scientific Reports (2022/11/16, 2022/10/25, 2022/09/18),
Journal of Cardiology and Cardiovascular Medicine (2022/10/17),
Journal of Medical Systems (2022/08/02),
Smart Health (2022/03/20),
Frontiers in Physiology (2021/11/24, 2021/10/28),
Acta Scientiarum - Technology (2021/09/30),
BMC Medical Research Methodology (2021/09/22, 2021/08/07),
IEEE Journal of Translational Engineering in Health and Medicine (2020/08/23), Sensors (2020/08/06);
Conference review: Conference of the European Study Group on Cardiovascular Oscillations (ESGCO) 2024 (2024/06/20),
IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2025 (2024/11/09, 2024/11/02, 2024/10/29, 2024/10/27),
Heart Rhythm (2023/06/11),
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT) 2021 (2021/12/17, 2021/09/29),
ACM International Joint Conference on Pervasive and Ubiquitous Computing (Ubicomp-ISWC) 2021 (2021/07/10),
Annual International Conference of the IEEE Engineering in Medicine and Biology (EMBC) 2020 (2020/03/01).