Amanda Watson, Ph.D.

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RESEARCH INTERESTS

Wearable Technology, Medical Cyber-Physical Systems, Internet of Medical Things, Smart Health, High Performance Athletics, Ubiquitous and Mobile Computing

ACADEMIC APPOINTMENTS

Assistant Professor *July 2023 - present*
Department of Electrical and Computer Engineering
Department of Computer Science
School of Engineering and Applied Sciences
University of Virginia, Charlottesville, VA

Postdoctoral Researcher *June 2020 - June 2023*
PRECISE Center
Department of Computer and Information Sciences
School of Engineering and Applied Sciences
University of Pennsylvania, Philadelphia, PA
Mentor: Prof. Insup Lee and Prof. James Weimer

Teaching Fellow *Jan. 2020 - May 2020*
Department of Computer Science
William & Mary, Williamsburg, VA

EDUCATION

William & Mary, Williamsburg, VA *April 2020*
Ph.D. in Computer Science
Dissertation: *Wearable Technology for Healthcare and Athletic Performance*
Advisor: Prof. Gang Zhou

William & Mary, Williamsburg, VA *May 2016*
M.S. in Computer Science
Advisor: Prof. Gang Zhou

Drury University, Springfield, MO *May 2014*
B.A. in Computer Science and Mathematics
Minor in Global Studies

PUBLICATIONS

1. *Lumos: An Open-Source Device for Wearable Spectroscopy Research*
   Amanda Watson, Claire Kendell, Anush Lingamworthy, Insup Lee, James Weimer
   ACM IMWUT'23: Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies
   Provisional Patent

2. *Magneto: Joint Angle Analysis Using an Electromagnet-Based Sensing Method*
   Amanda Watson, Andrew Lyubovsky, Kenneth Koltermann, Gang Zhou
   IPSN'21: ACM/IEEE International Conference on Information Processing in Sensor Networks, Nashville, Tennessee, 2021
   US Patent 11,169,001

3. *LAX-Score: Quantifying Team Performance in Lacrosse and Exploring IMU Features towards Performance Enhancement*
   Woosub Jung, **Amanda Watson**, Scott Kuehn, Erik Korem, Kenneth Koltermann, Minglong Sun, Shuangquan Wang, Zhenming Liu, Gang Zhou
   ACM IMWUT'21: Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies

4. *RT-ACL: Identification of High-Risk Youth Patients and their Most Significant Risk Factors to Reduce Anterior Cruciate Ligament Reinjury Risk*
   Amanda Watson, Pengyuan Lu, Elliot Greenberg, J. Todd R. Lawrence, Theodore J. Ganley, Insup Lee, James Weimer
   CHASE'21: Proceedings of The 6th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2021
   Best Paper Award Finalist

5. *Parkinson's Disease Action Tremor Detection with Supervised-Leaning Models*
   Minglong Sun, Woosub Jung, Kenneth Koltermann, Gang Zhou, **Amanda Watson**, Gina Blackwell, Noah Helm, Leslie Cloud, Ingrid Pretzer-Aboff
   CHASE'23: Proceedings of The 8th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Orlando, Florida, 2023

6. *DOVE: Shoulder-based Opioid Overdose Detection and Reversal Device*
   Anush Lingamoorthy, **Amanda Watson**, David Gordon, Ayan Mandal, Korey Henderson, Xiaonan Ma, James Weimer, Jacob S. Brenner, Nagarajan Kandasamy
   CHASE'23: Proceedings of The 8th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Orlando, Florida, 2023

7. *AutoWean: Extubation Failure Risk Estimation for Critically Ill Patients*
   Jean Park, **Amanda Watson**, Xianyan Ji, Kyle C. Quinn, James Weimer, Insup Lee
   CHASE'22: Proceedings of The 7th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2022

8. *VitalCore: Analytics and Support Dashboard for Medical Device Integration*
   Hyonyoung Choi, Amanda Lor, Mike Megonegal, Xianyan Ji, **Amanda Watson**, James Weimer, Insup Lee
   CHASE'21: Proceedings of The 6th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2021

9. *TremorSense: Tremor Detection for Parkinson's Disease Using Convolutional Neural Network*
   Minglong Sun, **Amanda Watson**, Gina Blackwell, Woosub Jung, Shuangquan Wang, Kenneth Koltermann, Noah Helm, Gang Zhou, Leslie Cloud, Ingrid Pretzer-Aboff
   CHASE'21: Proceedings of The 6th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2021

10. *A Pain Free Nociceptor: Predicting Football Injuries with Machine Learning*
    Andrew Lyubovsky, Zhenming Liu, **Amanda Watson**, Scott Kuehn, Erik Korem, Gang Zhou
    SmartHealth'22: Elsevier Smart Health, 2022

11. *Observational Clinical Outcomes of Postpartum Hemorrhage Detection Device Development Study*
    Stefanie Modri, Kimberly Trout, James Weimer, **Amanda Watson**
    JOGNN'22: Journal of Obstetric, Gynecologic & Neonatal Nursing, 2022

12. *MobiGesture: Mobility-Aware Hand Gesture Recognition for Healthcare*
    Hongyang Zhao, Yongsen Ma, Shuangquan Wang, **Amanda Watson**, Gang Zhou
    CHASE'18: Proceedings of The 3rd IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., pages 1-10, 2018

13. *TracKnee: Knee Angle Measurements Using Stretchable Conductive Fabric Sensors*
Amanda Watson, Minglong Sun, Samhita Pendyal, Gang Zhou
CHASE'19: Proceedings of The 4th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2019

14. *Wearable Computing of Freezing of Gait in Parkinson's Disease: A Survey*
Minglong Sun, **Amanda Watson**, Gang Zhou
SmartHealth'20: Elsevier Smart Health, 2020

15. *BBAid: Using Smartwatches to Improve Back Blows*
Amanda Watson, Gang Zhou
SmartHealth'19: Elsevier Smart Health, 2019

16. *BreathEZ: Using Smartwatches to Improve Choking First Aid*
Amanda Watson, Gang Zhou
SmartHealth'18: Elsevier Smart Health, 2018

17. *Wearable Motion Sensor-Based Chewing Side Detection*
Shuangquan Wang, Gang Zhou, **Amanda Watson**, Lei Xie, Minglong Sun, Woosub Jung
SmartHealth'21: Elsevier Smart Health, 2021

18. *Inferring Food Types through Sensing and Characterizing Mastication Dynamics*
Shuangquan Wang, Gang Zhou, Jiexiong Guan, Yongsen Ma, Zhenming Liu, Ben Ren, Hongyang Zhao, **Amanda Watson**, Woosub Jung
SmartHealth'21: Elsevier Smart Health, 2021

WORKSHOP PUBLICATIONS AND ABSTRACTS

1. *Clinician-Informed Machine Learning-Based Prediction of Secondary Anterior Cruciate Ligament Injury Risk and Identification of Modifiable Risk Factors in Children*
Elliot Greenberg PT, DPT, PhD, **Amanda Watson PhD**, Alexandra Stevens BS, Kim Helm MS, J. Todd Lawrence MD, PhD, Theodore Ganley MD
PRISM'23: 11th Annual Meeting for the Pediatric Research in Sports Medicine Society, Anaheim, California, 2023

2. *SpectraVue - An Interactive Web Application Enabling Rapid Data Visualization and Analysis for Wearable Spectroscopy Research*
Tarek Hamid, Insup Lee, **Amanda Watson**
UBICOMP'23: Adjunct Proceedings of the 2023 ACM International Joint Conference on Pervasive and Ubiquitous Computing & the 2023 ACM International Symposium on Wearable Computing, Cancun, Mexico 2023

3. *CareLoop: Closed-Loop Sensing and Intervention for Gerontological Social Isolation and Loneliness*
Xianyan Ji, Ahhyun Yuh, Hyonyoung Choi, **Amanda Watson**, Claire Kendell, Xian Li, James Weimer, Hajime Nagahara, Teruo Higashino, Teruhiro Mizumoto, Viktor Erdélyi, Oleg Sokolsky, Insup Lee
ICCPS'23: ACM/IEEE International Conference on Cyber Physical Systems, San Antonio, Texas 2023

4. *Integrated Sensing Platform for Detecting Social Isolation and Loneliness In the Elderly Community*
Xianyan Ji, Xian Li, Ahhyn Yuh, Claire Kendell, **Amanda Watson**, James Weimer, Hajime Nagahara, Teruo Higashino, Teruhiro Mizumoto, Viktor Erdelyi, Oleg Sokolsky, Insup Lee
CHASE'23: Proceedings of The 8th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Orlando, Florida, 2023

5. *Medical Cyber-Physical Systems: IoMT Applications and Challenges*
   Amanda Watson, Jean Park, Sydney Pugh, Oleg Sokolsky, James Weimer, Insup Lee
   56th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, California, 2022 (Invited)

6. *GlucoScan: Noninvasive Glucose Monitoring Device*
   Claire Kendell, **Amanda Watson**, Insup Lee, James Weimer
   CHASE'22: Proceedings of the 6th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2022

7. *DOVE: Noninvasive Shoulder-based Opiod Overdose Detection Device*
   Anush Lingamoorthy, **Amanda Watson**, Ethan Donlon, James Weimer, Jacob S. Brenner
   CHASE'22: Proceedings of the 6th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2022

8. *Impact of Vibration on Tremor in Older Adults with Parkinson's disease*
   Ingrid A. Pretzer-Aboff, R.K.Elswick, Jr., **Amanda Watson**, Minglong Sun, Woosub Jung, Kenneth Koltermann, Gang Zhou, Leslie J. Cloud
   Gerontological Society of America, Indianapolis IN,2022

9. *Pediatric ACL Reinjury Risk Model: Clinician informed machine learning can identify High-Risk athletes and modifiable individual Risk Factors to reduce Risk*
   Elliot Greenberg, **Amanda Watson**, Pengyuan Lu, Insup Lee, J. Todd Lawrence, James Weimer, Theodore Ganley
   ACL Research Retreat, High Point, NC, 2022

10. *Raproto: An Open Source Platform for Rapid Prototyping of Wearable Medical Devices*
    Amanda Watson, Hyonyoung Choi, Insup Lee, James Weimer
    MCPS'21: Medical Cyber Physical Systems and Internet of Medical Things Workshop, Nashville, Tennessee, 2021

11. *FRED: Fall Risk Evaluation Database Based on Electronic Health Record Data*
    Pengyuan Lu, Xian Li, Sooyong Jang, Alexander Lee, Sydney Pugh, **Amanda Watson**, Ragnhildur I. Bjarnadottir, Robert Lucero, George Demiris, Ani Nenkova, James Weimer, Insup Lee
    CHASE'21: Proceedings of the 6th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies, Washington, D. C., 2021

12. *Microsleep Prediction Using an EKG Capable Heart Rate Monitor*
    Amanda Watson, Gang Zhou
    CHASE'16: Proceedings of the 1st IEEE Conference on Connected Health: Applications, Systems and Engineering Technologies, (Poster), pages 328-329, Washington DC, 2016

TECHNICAL REPORTS AND DISSERTATION

1. *Wearable Technology for Healthcare and Athletic Performance*
   Amanda Watson
   Dissertation, 2020

2. *Wearable Technology*
   Amanda Watson
   NTRS: NASA Technical Reports Server, Houston, TX, 2013

PATENTS

1. *Magnetic-Based Motion Monitoring for Two Objects Sharing a Common Joint*
   Amanda Watson, Andrew Lyubovsky, Gang Zhou
   US Patent 11,169,001, Issued November 9, 2021

HONORS AND AWARDS

CHASE Outstanding Service Award *November 2022*
for service as Poster Chair at CHASE 2021 and 2022

CPS Rising Stars Workshop *May 2022*
Presented Wearable Technology for Healthcare and Athletic Performance

Best Paper Award Finalist *December 2021*
IEEE/ACM Conference on Connected Health: Applications, Systems, and Engineering Technologies (CHASE '21)
Paper: *RT-ACL: Identification of High-Risk Youth Patients and their Most Significant Risk Factors to Reduce Anterior Cruciate Ligament Reinjury Risk*

MIT EECS Rising Stars Workshop *October 2021*
Presented Wearable Technology for Healthcare and Athletic Performance

Society of 1918 Scholarship Recipient *March 2020*
$4,000 scholarship awarded for membership in the society.

William & Mary 3 Minute Thesis (3MT) Winner *September 2019*
$500 Prize awarded of for 1^{st} place in the competition.
Competed at the Council of Southern Graduate Schools (CSGS) Regional 3MT Competition.

National Science Foundation Student Travel Award for CHASE'19 *September 2019*
Award of $600 to cover travel expenses to present at CHASE'19 in Washington D.C.

Mylan Hack Summit *April 2016*
$4,000 Prize awarded of for 1^{st} place in the competition.
Presented *Stroke Detection with IoT*

Central Plains Student Poster Competition *April 2014*
Prize awarded of for 3rd place in the competition.
Presented *E-SEWT Monitoring Interface*
Advisors: Dr. Scott Sigman and Cory Simon.

Panther Pride Award *May 2011*
Awarded for an outstanding academic record, a positive role model, an unsung hero, and the embodiment of the team player.

Drury University Undergraduate Research Fellowship *Summer 2013*
Stipend Award of $4000 to research wearable technology at NASA Johnson Space Center
Advisor: Cory Simon

Drury University Mathematics Scholarship *August 2012-May 2013*
Awarded one year scholarship based on excellence in Mathematics.

Drury University Presidential Scholarship *August 2010-May 2014*
Awarded four year scholarship based on academic merit.

Varsity Athletic Scholarship *August 2010-May 2014*
Awarded four year athletic scholarship for excellence in volleyball.
Four year letterman and GLVC Academic All Conference.
GLVC conference and team record holder for attack percentage.

INVITED TALKS (EXCLUDES CONFERENCE PRESENTATIONS)

Wearable Technology for Healthcare and Athletic Performance *April 2023*
Georgia Institute of Technology

Wearable Technology for Healthcare and Athletic Performance *March 2023*
University of Virginia

Wearable Technology for Healthcare and Athletic Performance *March 2023*
University of Tennessee at Knoxville

Wearable Technology for Healthcare and Athletic Performance *March 2023*
University of Alabama at Birmingham

Medical Cyber-Physical Systems: IoMT Applications and Challenges *October 2022*
Asilomar Conference on Signals, Systems, and Computers

Wearable Technology for Healthcare and Athletic Performance *April 2020*
University of Pennsylvania

Wearables: Background, Strategy, and Practical Experience *June 2016*
Microsoft/Avanade Tech Summit

Wearables Technology: Implementation and Practical Experience *August 2015*
NTT Innovation Institute Inc

Wearable Technology for Human Spaceflight *June 2013*
NASA Johnson Space Center

FUNDING AND PROPOSAL WRITING

Foundation for Physical Therapy Research: An Individualized Pediatric ACL Reinjury Risk Model and Clinical Implementation Pending 2022. Published *RT-ACL: Identification of High-Risk Youth Patients and their Most Significant Risk Factors to Reduce Anterior Cruciate Ligament Reinjury Risk* and *Pediatric ACL Reinjury Risk Model: Clinician informed machine learning can identify High-Risk athletes and modifiable individual Risk Factors to reduce Risk.* I am continuing research on this topic.

CSR: EAGER: A Wearable Body Motion Sensing Platform Using Conductive Stretchable Fabric Assisted Dr. Gang Zhou in writing this proposal based of my research into stretchable fabric sensors. Granted 2018. Published TracKnee: Knee Angle Measurements Using Stretchable Conductive Fabric Sensors and am continuing research on this topic.

TEACHING EXPERIENCE

Co-Instructor *Spring 2022*
CIS 441/541: Embedded Software for Life-Critical IoT/CPS Applications
Department of Computer and Information Science, University of Pennsylvania

Instructor *Spring 2020*
CSCI 243: Discrete Structures of Computer Science
Department of Computer Science, William & Mary

Teaching Assistant *Fall 2014 - Spring 2016*
CSCI 141: Computational Problem Solving Lab
Department of Computer Science, William & Mary

STUDENT MENTORING

Anush Lingamoorthy, PhD Research on Development of Wearable Optical Sensors *2022-present*

Kimberly Helm, Masters Research on Machine Learning for ACL-Retear Prevention *2023-present*

Tarek Hamid, Masters Research on a Wearable Optical Spectroscopy *2023-present*

Kimberly Helm, Masters Research on a Wearable Data Collection Platform *2022-2023*

Tarek Hamid, Masters Research on a Wearable Data Collection Platform *2022-2023*

Jean Park, Masters and PhD Research on Applying Explainable AI to Medical Data *2020-2023*

Eric Lu, PhD Research on Scalable Semi-Supervised Continual Learning *2021-2023*

Claire Kendell, PhD Research on Development of Wearable Optical Sensors *2021-2023*

Chakradi Paladi, Masters Research on Explainable AI *2021-2022*

Jayadev Chevireddi, Masters Research on Explainable AI *2021-2022*

Andrew Lyubovsky, Undergraduate Research on Wearable Magnetic Sensors *2019-2021*

Sanju Peddagorla, Undergraduate Research on Wearable Optical Spectroscopy *2020-2020*

Jay Ford, Undergraduate Research on Sensing and Feedback on Rowing Skills *2020-2021*

Philip Ignatoff, Undergraduate Research on Computation of High Performance Athletics *2020-2021*

Samhita Pendyal, Undergraduate Research on Soft Wearable Technology *2018-2019*

SOFTWARE ARTIFACTS

1. SpectraVue - rapid data visualization and analysis for Lumos
   https://github.com/tarek-hamid/SpectraVue
2. Lumos: An Open-Source Device for Wearable Spectroscopy Research
   https://github.com/LumosIMWUT/Lumos
3. *Raproto: An Open-Source Platform for Rapid Prototyping of Wearable Medical Devices*
   https://github.com/weimerj/Raproto-WearOS
   https://github.com/weimerj/Raproto-Arduino
4. *BreathEZ: Smartwatches Application for Choking First Aid*
   https://github.com/aawatson22/BreathEZ
5. *Project Stressful Shirt: Stress Detection via an ECG Capable SoftWear Shirt*
   https://github.com/aawatson22/Proj_Stressful_Shirt

PROFESSIONAL SERVICE AND AFFILIATIONS

Workshop/Conference Organization

1. *Elsevier Smart Health Associate Editor (SmartHealth 2023)*
2. *45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society Biomedical Sensors and Wearable Systems Associate Editor (EMBC 2023)*
3. *IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies Demo and Poster Chair (CHASE 2021,2022,2023)*
4. *IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies TPC Chair (CHASE 2023)*
5. *IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies Session Chair (CHASE 2021)*

Journal and Conference Reviews

1. *IEEE Engineering in Medicine and Biology Society Biomedical Sensors and Wearable Systems Associate Editor [EMBC]* *2023*

2. *Elsevier Smart Health [SmartHealth]* *2018,2021,2023*
3. *Transactions on Cyber-Physical Systems [TCPS]* *2022*
4. *ACM Transactions on Computing for Healthcare [HEALTH]* *2020,2021*
5. *ACM International Joint Conference on Pervasive and Ubiquitous Computing [Ubicomp]* *2020*
6. *IEEE Transactions on Mobile Computing [TMC]* *2020*
7. *ACM Transaction on Sensor Networks [TOSN]* *2019*
8. *IEEE/ACM International Conference on Connected Health: Application, Systems and Engineering Technologies [CHASE]* *2018*
9. *International Conference on Body Sensor Networks [BSN]* *2018*

Professional Affiliations

1. *William & Mary Society of 1918* *2020-present*
2. *Kappa Mu Epsilon* *2014-present*
3. *IEEE* *2020-present*
4. *ACM* *2020-present*

Community Outreach

1. William & Mary K-12 STEM Hackathon Field Trip *February 2019*
2. Kansas City Big Brothers Big Sisters Fundraiser raised $1000 *Summer 2014*

INDUSTRY EXPERIENCE

NTT Innovation Institute, Inc Summer 2017
Research and Development Intern *Palo Alto, CA*

Developed proof of concept for Artificial Intelligence Operations for industrial IoT. Cut downtime loses by up to 85% by predicting downtime an hour before it occurred. Advised and mentored a Google science fair winner on how to move forward with and publish her work.

Avanade, Inc Summer 2016
CTIO Showcase and Innovation Intern *Seattle, WA*

Monitored Williams Martini Racing pit crew members to gain insight on what causes delays in a pit stop. Formulated and developed a system that will optimize pit stop times using the Zephyr Bioharness. Researched what causes time delays, what biometrics show these delays, and how to fix them in a Formula 1 pit stop. Traveled to London, England and presented the system and implementation to Williams Martini Racing.

NTT Innovation Institute, Inc May 2015-May 2016
Invention Magician Intern *Palo Alto, CA*

Developed an application that monitors stress levels in the body, helps you to learn what you stressors are, and gives you advice on how to handle them. Continuing research on the NTT Docomo Hitoe shirt to create a system that can accurately detect and predict microsleep. Won Mylan Hack Summit with a Stroke Detection IoT solution.

Perceptive Software Summer 2014
Research and Development Intern *Lenexa, KS*

Developed the user interface for the Perceptive Software mapping system for obsolete e-forms.

NASA Wearable Technology Research August 2013 - May 2014
Undergraduate Researcher *Springfield, MO*

Developed a monitoring application for the Electronic-Textile System for the Evaluation of Wearable Technology, E-SEWT. Worked with NASA customers such as the WEAR Lab and the HOLODECK to integrate this system. Built a test environment and created my own swatches for the test sequences. Analyzed, problem-solved, and supported work in circuit assembly, networking, software and hardware demos, and configuration of Arduino electronics.

NASA Wearable Technology Internship Summer 2013
Intern *Houston, TX*

Developed electronic textiles and corresponding demo interfaces by designing, analyzing, and testing circuits to be integrated into garments. Interfaced with internal NASA customers as well as external contractors to integrate WEAR Lab hardware into the Flight Deck of the Future. Analyzed, problem-solved, and supported work in circuit assembly, networking, software and hardware demos, and configuration of Arduino electronics. Extended summer research into Senior Research

Drury University Technology Services January 2011 - May 2014
Network Assistant *Springfield, MO*

Analyzed, troubleshooted, and supported problems with the network, campus and faculty computers. Oversaw the Computer Science and Mathematics computer lab.

NASA HUNCH Program August 2007 - May 2009
Machine Operator *League City, TX*

Fabricated training hardware via sheet metal fabrication, welding, drafting, machining, electronics, programming and painting. Used the computerized CNC mill and lathe to create precise and accurate pieces of astronaut training hardware. Helped to produce the mock ups of the ISS wardroom table flight hardware, the MERLIN fridge and a can crusher.