# Curriculum Vitae – Timothy Hnat, Ph.D.


**Personal Information**

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**Education**

**University of Virginia** Ph.D., Computer Science *2012*
- Advisor: Professor Kamin Whitehouse

**University of Louisville** M.Eng., Computer Engineering and Computer Science *2006*
- Advisor: Professor Rammohan K. Ragade

B.S., Computer Engineering and Computer Science *2005*

**About Me**

I have 17 years of experience developing cutting-edge AI technology for wearables and smart devices. Prior to becoming full-time CTO for CuesHub, I was the Chief Software Architect for two NIH-funded national research centers in AI for wearables where I led the development of research-grade software for wearables, smartphones, and cloud that enabled cutting-edge scientific studies on sensor-triggered mobile interventions. Research groups in medicine, psychology, engineering, and computing across 11 states in the U.S. have collected hundreds of terabytes of wearable sensor data using this software to push the frontiers of research in a wide variety of health, wellness, and work performance domains. Previously, as a tenure-track Assistant Professor of Computer Science, my research resulted in new software platforms for smart homes and AI for wearables.

**Employment**

**Chief Technology Officer and Co-founder** CuesHub, PBC *2022–present*
CuesHub is a Delaware Public Benefit Corporation

**Chief Software Architect and Local Deputy Director** University of Memphis *2020–2023*
mHealth Center for Discovery, Optimization & Translation
of Temporally-Precise Interventions (mDOT)

**Projects:** **Total: $5.9 million**

1. pJITAI: Personalized Just-in-Time Adaptive Interventions (Web interface, API service, and Python library)
2. mResearch Toolkit: A collection of Jupyter Notebooks demonstrating numerous research contributions from the mDOT Center
3. mHEART: mHealth Ethics Awareness Research Toolkit

**Chief Software Architect** University of Memphis *2014–2023*
NIH Center of Excellence for Mobile Sensor Data-to-Knowledge (MD2K)

**Projects:** **Total: $39.8 million**

1. MD2K: Mobile Sensor Data-to-Knowledge
   NIH: 1U54EB020404 $10.8 million
2. mProv: Provence-Based Data Analytics Cyberinfrastructure for High-frequency Mobile Sensor Data
   NSF: 1640813 $4.0 million
3. Socioeconomic status, stress, and smoking cessation
   NIH: 1R01CA190329 $3.1 million
4. Eliminating Tobacco-Related Disparities among African American Smokers
   NIH: 5R01MD010362 $3.8 million
5. ROBAS: A Multimodal Sensor System for Remote Assessment of Oral Health Behaviors
   NIH: 5R01DE025244 $3.1 million
6. mPerf: A Theory-driven Approach to Model and Predict Everyday job Performance Using Mobile Sensors
   IARPA: $15.0 million

**Assistant Professor** University of Memphis *2011–2014*

Research focusing on indoor tracking and navigation systems, mobile health interventions, and body sensor networks.

**Graduate Student Researcher** University of Virginia *2006–2012*

Research focused on programming systems, languages, and data analysis for large scale wireless embedded networks with Professor Whitehouse.

- Guest Lecturer: Computer Networks (CS 457)

**Teaching Assistant** University of Virginia *2006–2008*

Courses:

- Computer Networks (CS 457)
- Program and Data Representation (CS 216)
- Computer Architecture (CS 333)

## Dissertation

***A System for Tracking People in Homes for Smart Home Applications***

People spend 62 percent of their time within the confines of their home. However, localization technologies such as GPS fail to accurately identify their indoor location. A key requirement of creating a smart home is both identifying each person and their current room location. This work addresses these challenges with a new hardware and software solution for indoor tracking.

## Selected Projects

*MOODS (University of Memphis)* *2020–2023*

- The Mobile Open Observation of Daily Stressors (MOODS) study is about discovering key stress events from sensor data in our day-to-day lives. Results from this study may help society better understand stress and stressor detection through the exploration of complex interactions between stress, daily behaviors, and environmental factors.
- https://moods.md2k.org

*mContain (University of Memphis)* *2020*

- Researchers at the MD2K Center of Excellence, headquartered at the University of Memphis, announce the launch of a free mobile app called mContain to help track social distancing during the COVID-19 outbreak with a goal to reduce community transmission. mContain uses location and Bluetooth technologies in smartphones to detect proximity encounters (within 6 feet for several minutes) with other app users. Similar to a step count, the app counts and displays the number of daily proximity encounters with other app users. To reduce the chances of entering crowded places, the app displays the level of crowding at busy places on a map.
- https://mcontain.md2k.org

*mCerebrum (University of Memphis)* *2014–2021*

- mCerebrum is a configurable software platform for mobile and wearable sensors. It provides support for reliable data collection from mobile and wearable sensors, and real-time processing of these data for sensor triggered just-in-time adaptive interventions.
- http://github.com/MD2Korg/

*Cerebral Cortex (University of Memphis)* *2014–Present*

- Cerebral Cortex is a flexible layered big-data architecture designed around different functional layers so that each component can be adapted and extended without adversely affecting the other components. A Kernel links the layers to provide security controls between modules and a unified data interface to abstract implementation specifics.
- http://github.com/MD2Korg/

*Smart home tracking (University of Virginia)* *2009–2012*

- Developed a hardware and software system that mounted at the top of doorways to track people in their homes
- Does not require cameras or for individuals to carry anything special
- Resulted in 90+% tracking accuracy
- This deployment and software I developed resulted in over 2TB of data being produced and logged in a reliable manner
- Demo: https://www.youtube.com/watch?v=wAluI_uniK8

*MacroLab (University of Virginia)* *2007–2009*

- Developed a complete tool chain for running Matlab-like code on a distributed wireless sensor network.
- Deployed and tested the system on a 50-node testbed
- Resulting developed code size was reduced by a factor of 100
- Additionally, developed a debugging environment to support the new programming abstraction

*K-Sense (University of Memphis)* *2013–2015*
- Advised and employed a graduate student to develop a wearable sensor platform for determining the kinematics of a human body
- Designed to monitor and estimate calories in obese populations and during light-intensity activities
- Future applications include various medical diagnostic systems

*SlamDroid (University of Memphis)* *2013*
- Advised an undergraduate student (now at Amazon) to develop an indoor localization and mapping (SLAM) technique for Android devices
- This system has the potential to bring Google map style technology to indoor environments

*Lifesense (University of Memphis)* *2013*
- Advised and employed an undergraduate student to develop a complete sensor logging platform for Android devices
- Designed to validate a user's identify on a smartphone based on weak-biometrics
- Future applications include personel physical security, multi-factor computer authentication, or remote-validation of identity for banking.

*Traffic Optimizer (University of Memphis)* *2012*
- Advised and employed an undergraduate student (now at Wayfair) to develop a simulation framework to test theories about real-time control of vehicle route planning and traffic light control

## Advisory Board

**University of Memphis**, Memphis, Tennessee
- Center for Information Assurance *2012–2015*

## Awards and Honors

**University of Memphis**, Memphis, Tennessee
- NCURS demonstration presenter to 3,500 undergraduates with Santosh Kumar's keynote *2017*
- mHealth Scholar *2013*
- Ralph E. Powe Junior Faculty Enhancement Nomination *2013*

**University of Virginia**, Charlottesville, Virginia
- Frank Anger Memorial ACM SIGBED/SIGSOFT Student Award, *2009*
- SenSys Student Travel and Conference Funding Award, *2009*
- SenSys Student Conference Funding Award, *2008*
- IPSN Student Travel and Conference Funding Award, *2008*
- UVA Fellowship, *2006–2011*

**University of Louisville**, Louisville, Kentucky
- Fischer Family Scholarship, University of Louisville, *2001–2006*
- ACM Distinguished Student Award, *2005*
- Speed School Alumni (Scholarship), *2001–2002*

## Professional Organizations

**The Association of Computing Machinery (ACM)** *2005–present*
- Local Arrangement Chair: SenSys *2014*

**Service**
- Panelist: IEEE Wireless Health *2016*
- Program Committee: DCOSS *2013–2015*
- Poster and Demo Chair: EWSN *2014*
- Program Committee: IEEE Wireless Health *2014*
- Program Committee: IEEE MASS *2013*

## Teaching Experience

**University of Memphis**, Memphis, Tennessee

*mHealth Training Institute* — *2019*

- Open Source mHealth Software: mCerebrum and Cerebral Cortex

*Undergraduate Courses* — *2011–2014*

- COMP 3825 - Computer Networking and Information Assurance
- COMP 3410 - Computer Organization
- COMP 4310 - Wireless Mobile Computing

*Graduate Courses* — *2011–2014*

- COMP 6310 - Wireless Mobile Computing
- COMP 7212 - Operating Systems

**University of Virginia**, Charlottesville, Virginia

*Ballroom Dance Technique Instructor* — *2008–2010*

- Augmented basic instruction for beginning dancers with technical details of the dances.

## Community Service

*Computer Science Research Day* — *2012–2014*

- Judged and/or organized this event.

*ACM 3D Printer Workshop* — *2013*

- Helped guide the student ACM group to apply for funding to build a 3d printer
- Taught the basics of 3d modeling to grades 9-12.

*Computer Science Day* — *2007–2014*

- Demonstrated wireless sensor network technology to the general public.

*Google-Rise Camp* — *2009–2010*

- Presentation and demonstration of Wireless Sensor Networks to 7th and 8th graders.

*Engineering Day* — *2005–2006*

- Demonstration of current research to the general public.

*Computing Workshop for Kids* — *2004*

- Designed and taught a half-day workshop that introduced kids to programming and web design.

## Publications

1. Neupane S., Saha M., ALi N., **Hnat, T.**, Samiei S.A., Nandugudi A., Almeida D.M., Kumar S. *Momentary Stressor Logging and Reflective Visualizations: Implications for Stress Management with Wearables.* arXiv preprint arXiv:2401.16307, 2024
2. Hojjatinia S., Daly E.R., **Hnat, T.**, Hossain S.M., Kumar S., Lagoa C.M., Nahum-Shani I., Samiei S.A., Spring B., Conroy D.E. *Dynamic System Modeling to Identify Moments of Vulnerability Based on Stress-Smoking Responses in Daily Smokers.* Annals of Behavioral Medicine. 56, 2022
3. Hojjatinia S., Daly E.R., **Hnat, T.**, Hossain S.M., Kumar S., Lagoa C.M., Nahum-Shani I., Samiei S.A., Spring B., Conroy D.E. *Dynamic models of stress-smoking responses based on high-frequency sensor data.* npj Digital Medicine. 4, 162 2021
4. Shetty V, Morrison D, Delin T, **Hnat T**, Kumar S, *A Scalable System for Passively Monitoring Oral Health Behaviors Using Electronic Toothbrushes in the Home Setting: Development and Feasibility Study*, JMIR Mhealth Uhealth, 2020
5. Yli-Piipari S, Zaman K, Fish J, **Hnat T**, *Validation of K-Sense against Indirect Calorimetry and Accelerometry*, Human Movement, pp. –, 2018
6. Hossain SM, **Hnat T**, Saleheen N, Nasrin NJ, Noor J, Ho B-J, Condie T, Srivastava M and Kumar S, *mCerebrum: An mHealth Software Platform for Development and Validation of Digital Biomarkers and Interventions*, Proceedings of the 15th ACM Conference on Embedded Network Sensor Systems (SenSys), Delft, Netherlands, pp. –, November 2017
7. **Hnat T**, Hossain S, Ali N, Carini S, Condie T, Sim I, Srivastava M and Kumar S, *mCerebrum and Cerebral Cortex: A Real-time Collection, Analytic, and Intervention Platform for High-frequency Mobile Sensor Data*, In AMIA (American Medical Informatics Association) 2017 Annual Symposium., November 2017.

8. Kumar S, Abowd G, Abraham WT, al'Absi M, Chau DH, Ertin E, Estrin D, Ganesan D, **Hnat T**, Hossain SM, Ives Z, Kerr J, Marlin BM, Murphy S, Rehg JM, Nahum-Shani I, Shetty V, Sim I, Spring B, Srivastava M and Wetter D, *Center of Excellence for Mobile Sensor Data-to-Knowledge (MD2K)*, IEEE Pervasive Computing., Vol. 16(2), pp. 18-22., April 2017
9. Kazi I. Zaman, Anthony White, Sami Yli-Piipari, **Timothy W. Hnat** *K-Sense: A Kinematic Approach to Measuring Human Energy Expenditure for Daily Living Activities.* Proceedings of The 11th European Conference on Wireless Sensor Networks (EWSN), Oxford, United Kingdom, pp. –, February 2014
10. **Timothy W. Hnat**, Erin Griffiths, Raymond Dawson, Kamin Whitehouse. *Doorjamb: Unobtrusive Room-level Tracking of People in Homes using Doorway Sensors.* Proceedings of the 10th ACM Conference on Embedded Network Sensor Systems (SenSys), Toronto, Canada, pp. –, November 2012
11. **Timothy W. Hnat**, Vijay Srinivasan, Jiakang Lu, Tamim Sookoor, Raymond Dawson, John Stankovic, Kamin Whitehouse. *The Hitchhiker's Guide to Successful Residential Sensing Deployments.* Proceedings of the 9th ACM Conference on Embedded Network Sensor Systems (SenSys), Seattle, WA, pp. –, November 2011
12. **Timothy W. Hnat**, Kamin Whitehouse. *A Relaxed Synchronization Primitive for Macroprogramming Systems.* Proceedings of the 7th International IEEE Conference on Networked Sensing Systems (INSS), Kassel, Germany, pp. 219–226, June 2010
13. **Timothy W. Hnat**, Tamim I. Sookoor, Pieter Hoomimeijer, Westley Weimer, Kamin Whitehouse. *A Modular and Extensible Macroprogramming Compiler.* Proceedings of the 1th Workshop on Software Engineering for Sensor Network Applications (SESENA) in Conjunction With ACM/IEEE International Conference on Software Engineering (ICSE), Cape Town, South Africa, pp. 49–54, May 2010
14. Tamim I. Sookoor, **Timothy W. Hnat**, Pieter Hoomimeijer, Westley Weimer, Kamin Whitehouse. *Macrodebugging: Providing Abstract Views of System State.* Proceedings of the 7th ACM Conference on Embedded Network Sensor Systems (SenSys), Berkeley, CA, pp. 141–154, November 2009
15. **Timothy W. Hnat**, Tamim I. Sookoor, Pieter Hoomimeijer, Westley Weimer, Kamin Whitehouse. *MacroLab: A Vector-based Macroprogramming Framework for Cyber-Physical Systems.* Proceedings of the 6th ACM Conference on Embedded Network Sensor Systems (SenSys), Raleigh, NC, pp. 225–238, November 2008
16. S. Braun, W. P. Hnat, **T. W. Hnat**, H. L. Legan, *Taking the guesswork out of mandibular symphyseal distraction osteogenesis.* American Journal of Orthodontics and Dentofacial Orthopedics, Volume 119, Number 2, pp. 121–126, February 2001
17. S. Braun, W. P. Hnat, B. Kusnoto, **T. W. Hnat**, *A new accurate approach to the anterior ratio with clinical applications. Part 1: A computer program.* American Journal of Orthodontics and Dentofacial Orthopedics, Volume 115, Number 4, pp. 368–372, April 1999

## Conference Demos

1. R. Dickerson, **T. Hnat**, E. Hoque, J. Stankovic. *Demonstration of Sleep Monitoring and Caregiver Displays for Depression Monitoring* . Wireless Health, San Diego, CA, October 2011
2. **Timothy W. Hnat**, Tamim I. Sookoor, Kamin Whitehouse. *Macrodebugging with MDB Framework for Cyber-Physical Systems.* The 7th ACM Conference on Embedded Network Sensor Systems (SenSys), Berkeley, CA, November 2009
3. Tamim I. Sookoor, **Timothy W. Hnat**, Kamin Whitehouse. *Demo Abstract: Programming Cyber-Physical Systems with MacroLab.* The 6th ACM Conference on Embedded Network Sensor Systems (SenSys), Raleigh, NC, November 2008
4. R. Dickerson, J. Lu, B. Chantree, **Timothy W. Hnat**, J. Lu, J. Stankovic, K. Whitehouse, *MetroNet: Case Study for Collaborative Data Sharing on the World Wide Web.* Information Processing and Sensor Networks, April 2008