James Weimer
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BRIEF BIOGRAPHY

Dr. James Weimer is an Assistant Professor in the Department of Computer Science (primary) and Department of Biomedical Engineering (secondary) in the College of Connected Computing (CCC) at Vanderbilt University (since August 2022), where he directs the Internet of Medical Things (IoMT) Lab. He is affiliated faculty for the Institute for Software Integrated Systems (ISIS) and the Vanderbilt Institute of Surgery and Engineering (VISE). He serves as the executive director for the Vanderbilt Medical Makers and the Medical Device Club @ Vanderbilt. Dr. Weimer was previously (August 2016 to August 2022) an Assistant Research Professor of Computer and Information Science (CIS) at the University of Pennsylvania (Penn). Dr. Weimer earned a PhD in Electrical and Computer Engineering (ECE) from Carnegie Mellon University (CMU) in 2010, where he worked with Prof. Bruce Krogh and Prof. Bruno Sinopoli, and earlier earned an MSc in ECE at CMU in 2007 and a BSEE from Purdue University in 2005.

His research interests include the design and analysis of learning-enabled cyber-physical systems with application to the internet-of-medical things and safe autonomy. Specifically, he aims to develop tools and techniques to address challenges arising from real-world data constraints including unmodeled variability, dataset shifts, anomalies, and limited sensing. Dr. Weimer has over 90 publications and won best paper awards at ACM/IEEE ICCPS 2014, IEEE CPSNA 2016, ACM/IEEE MEMOCODE 2019, and ACM TECS 2022. In addition, Dr. Weimer's work has been designated as a BreakThrough Device by the FDA (2021) and earned a TIME Magazine Best Invention award (2022). Dr. Weimer's research has been and remains supported by DARPA, ONR, ARO, NSF, NIH, and Hillrom (now Baxter), totalling over $30 million in sponsored research projects (over $3.3M as PI). He serves as an associate editor of the ACM Transaction on Cyber-Physical Systems and ACM Transactions on Computing for Healthcare. He has co-founded two medical device startups: Neuralert Technologies and Vasowatch.

EDUCATION

2010 **Ph.D. in Electrical and Computer Engineering,** Carnegie Mellon University, Pittsburgh, PA
Dissertation: ``Large Scale Multi-Source Detection Using Wireless Sensor Networks"
Co-Advisors: Prof. Bruce H. Krogh and Prof. Bruno Sinopoli
Committee: Bruce H. Krogh, Bruno Sinopoli, Jose Moura, Raj Rajkumar, Mitchell Small

2007 **M.S. in Electrical and Computer Engineering ,** Carnegie Mellon University, Pittsburgh, PA
Dissertation: ``Modeling and Implementation of Mode Switching with Application to Failure Analysis in Steer-by-Wire Systems"
Advisor: Prof. Bruce H. Krogh

2005 B.S. in Electrical Engineering, Purdue University, West Lafayette, IN

ACADEMIC APPOINTMENTS

8/2022 - present **Assistant Professor,** Vanderbilt University, Nashville, TN 37235
Appointments: Computer Science (primary), Biomedical Engineering
Senior Research Scientist in the Institute for Software Integrated Systems (ISIS)
Faculty Affiliate, Vanderbilt Institute for Surgery and Engineering (VISE)
Director, Internet-of-medical-Things (IoMT) Lab
Director, Medical Device Club
Innovation Ambassador, Center for Technology Transfer and Commercialization

8/2018-8/2022 **Research Assistant Professor**, Children's Hospital of Philadelphia, Philadelphia, PA
Department of Biomedical and Health Informatics

8/2016 - 8/2022 **Research Assistant Professor**, University of Pennsylvania, Philadelphia, PA 19046
Computer and Information Science
Faculty Affiliate, PRECISE Center
Faculty Advisor, Penn Health-Tech
Director, Medical Device Club
Executive Advisory Board, Penn4C

11/2012 - 7/2016 **Postdoctoral Researcher**, University of Pennsylvania, Philadelphia PA, 19046
Department of Computer and Information Science
Mentor: Insup Lee

12/2010 - 11/2012 **Postdoctoral Researcher**, KTH Royal Institute of Technology, Stockholm, SE
Department of Automatic Control
Mentor: Karl Henrik Johansson

INDUSTRY POSITIONS

9/2022 - present **Founder**, Vasowatch Inc, Philadelphia, PA
- Research, development, commercialization, and consulting activities arising from our research on predicting maternal health outcomes.

5/2020 - present **Founder**, Neuralert Technologies Inc, Philadelphia, PA
- Research, development, commercialization, and consulting activities arising from our research on stroke detection.

TEACHING EXPERIENCE

Vanderbilt University

Fall 2025 **Introduction to Engineering, Computer Science Module (ES140x)**, Instructor
59 students total: about 20 first-year students each in 3 one credit hour modules taught over the semester.

Spring 2025 **Internet of Medical Things (CS 8395)**, Instructor. 40 students.

Fall 2024 **Introduction to Engineering, Computer Science Module (ES140x)**, Instructor
72 students total: about 25 first-year students each in 3 one credit hour modules taught over the semester.

Spring 2024 **Internet of Medical Things (CS 8395)**, Instructor. 42 students.

Fall 2023 **Introduction to Engineering, Computer Science Module (ES140x)**, Instructor
80 students total: about 25 first-year students each in 3 one credit hour modules taught over the semester.

Spring 2023 **Internet of Medical Things (CS 8395)**, Instructor. 19 students.

Fall 2022 **Introduction to Engineering, Computer Science Module (ES140x)**, Instructor
80 students total: about 25 first-year students each in 3 one credit hour modules taught over the semester.

HONORS & AWARDS

[Since joining Vanderbilt]

[H12] **Vanderbilt Innovation Investment Awardee.** Vanderbilt Innovation Investment Fund invested $300k to commercialize the VIBRANT postpartum hemmorage risk prediction algorithm licensed to Vasowatch, Inc. (See [C32] in Publications and [L4] in licenses)

[H11] **Best Paper Award Finalist.** *IEEE/EMBS International Conference on Body Sensor Networks (BSN '24) for the paper* "Raproto: An Open-Source Platform for Rapid Prototyping with Wearable Devices". (See [C31] in Publications)

[H10] **Best Paper Award Finalist.** *ACM/IEEE International Conference on Cyber Physical Systems (ICCPS '24) for the paper* "Curating Naturally Adversarial Datasets for Learning-Enabled Medical Cyber-Physical Systems". (See [C30] in Publications)

[H9] **NSF CAREER Award.** "Learning-enabled Medical Cyber-Physical Systems". National Science Foundation (NSF). Award number: 2339637.

[H8] **TIME Best Invention**. Stroke detection technology, licensed to Neuralert, named a 2022 Best Invention by TIME Magazine in medical care category (See [L2] in Licences)

[Prior to joining Vanderbilt]

[H7] **Best Paper Award**. *ACM Transactions on Embedded Computing Systems (TECS)' 22 for the paper "*Verifying the Safety of Autonomous Systems with Neural Network Controllers." See [J15] in Publications.

[H6] **Breakthrough Device.** US Food and Drug Administration designated stroke detector (license to Neuralert) as a breakthrough device (2022).

[H5] **Best Paper Award Finalist**. *IEEE/ACM Conference on Connected Health: Applications, Systems, and Engineering Technologies (CHASE '21) for the paper "*RT-ACL: Identification of High-Risk Youth Patients and their Most Significant Risk Factors to Reduce Anterior Cruciate Ligament Reinjury Risk." See [C27] in Publications.

[H4] **Best Paper Award**. *ACM-IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE'19) for the paper* "Detecting Security Leaks in Hybrid Systems with Information Flow Analysis." See [C18] in Publications.

[H3] **Best Paper Award**. I*EEE International Conference on Cyber-Physical Systems, Networks, and Applications (CPSNA'16) for the paper* "Adaptive Transient Fault Model for Sensor Attack Detection". See [OC13] in Publications.

[H2] **Best Paper Award Finalist**. 6th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS'15) for the paper "Early-Detection of Critical Pulmonary Shunts in Infants". See [C8] in Publications.

[H1] **Best Paper Award**. 4th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS'14) for the paper "Robustness of Attack-Resilient State Estimators". See [C6] in Publications.

PUBLICATIONS

Co-authors with a trailing * indicate thesis students formally advised or co-advised, with a trailing † are postdocs formally mentored, and co-authors with a trailing ° indicate students informally mentored (all at the time of publication).

Publication Summary: As of December 1, 2025, I have 118 total publications (59 in journals and highly selective conferences). Since joining Vanderbilt, I have 25 total publications (12 in journals and highly selective conferences). In the following, the distribution of publications are specified:

Publication category	Total publications	Publications since joining Vanderbilt
Journal publications	26	6
Refereed highly selective conference papers	33	6
Other refereed conference papers	21	4
Book chapters	2	0
Lightly refereed conference papers	8	4
Refereed workshop papers	8	1
Other workshop papers	3	0
Abstracts	4	0
Tutorials	3	0
Patents / patent submissions	6	2
Licenses optioned/executed	4	2

Citation metrics provided by Google Scholar (12/1/2025), with a total of 3632 citations, h-index of 28, and an i10-index of 63.

REFEREED JOURNAL ARTICLES

[Since joining Vanderbilt]

[J26] Sydney Pugh*, Ivan Ruchkin, **James Weimer**, and Insup Lee. "Evaluating Robustness of Learning-Enabled Medical Cyber-Physical Systems with Naturally Adversarial Datasets." *ACM Transactions on Cyber-Physical Systems* (2025). Vol 9. Issue 4. 1-39.
DOI: 10.1145/3734695
Impact Factor: 2.9
Summary: This paper presents an approach for evaluating the robustness of medical classifiers using adversarial examples rather than traditional epsilon measures.
Role: Mentor: originator of problem, advised on approach, edited paper.
Contribution: 25%

[J25] Sara B. DeMauro, Erik A. Jensen, Molly Passarella, Mary Catherine Gambacorta, Megan Dhawan, **James Weimer**, Sooyong Jang*, Howard Panitch, and Haresh Kirpalani. "Oxygen saturation targeting for infants with bronchopulmonary dysplasia: a pilot randomized trial." *Annals of the American Thoracic Society* 22, no. 4 (2025): 560-569.
DOI: 10.1513/AnnalsATS.202404-443OC
Impact Factor: 5.4
Summary: This paper compares the incidence of intermittent hypoxemia (IH), proportion of time with hypoxemia, and secondary clinical outcomes measured up to 6 months corrected age (CA) in infants with established BPD randomized to higher (≥96%) versus lower (90–94%) SpO2 target ranges.
Role: Mentor: designed clinical data collection system used in trial, edited paper.
Contribution: 10%

[J24] Kimberly K. Trout, Stefanie Modri, Harish M. Sehdev, and **James Weimer**. "Derivation and validation of an intrapartum algorithm to predict postpartum hemorrhage risk using photoplethysmography data." *American Journal of Obstetrics & Gynecology* 230, no. 1 (2024): S52.
DOI: 10.1016/j.ajog.2023.11.091
Impact Factor: 8.4
Summary: This paper presents the derivation and validation on an algorithm to predict postpartum hemorrhage risk using maternal heart beat timing information.
Role: Lead Technical Researcher: designed, implemented and validated algorithm, edited paper.
Contribution: 80%

[J23] Susan Kohl Malone, Austin M. Matus, Anneliese J. Flatt, Amy J. Peleckis, Laura Grunin, Gary Yu, Sooyong Jang*, **James Weimer**, Insup Lee, Michael R Rickels, and Namni Goel. "Prolonged Use of an Automated Insulin Delivery System Improves Sleep in Long-Standing Type 1 Diabetes Complicated by Impaired Awareness of Hypoglycemia." *Journal of diabetes science and technology* (2023): 19322968231182406.
DOI: 10.1177/1932296823118240
Impact Factor: 5.0
Summary: This paper presents a study that assessed changes in actigraphy-estimated sleep and glycemic outcomes after initiating automated insulin delivery.

Role: Mentor: advised on clinical decision support system used in study, edited paper.
Contribution: 10%

[J22] Amanda Watson[†], Claire Kendell[o], Anush Lingamoorthy[o], Insup Lee, and **James Weimer.** "Lumos: An Open-Source Device for Wearable Spectroscopy Research." *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 6, no. 4 (2023): 1-24.
DOI: 10.1145/3569502
Impact Factor: 4.96
Summary: This paper presents Lumos, an open-source device for wearable spectroscopy research. Lumos can facilitate on-body spectroscopy research in health monitoring, athletics, rehabilitation, and more. We developed an algorithm to determine the spectral response of a medium with a mean absolute error of 13nm. From this, researchers can determine the optimal spectrum and create customized sensors for their target application.
Role: Mentor: originator of problem, oversaw Lumos development/testing, edited paper.
Contribution: 20%

[J21] Steven R. Messé, Scott E. Kasner, Brett L. Cucchiara, Michael L. McGarvey, Stephanie Cummings, Michael A. Acker, Nimesh Desai, Pavan Atluri, Grace J Wang, Benjamin M Jackson, **James Weimer**. "Derivation and Validation of an Algorithm to Detect Stroke Using Arm Accelerometry Data." *Journal of the American Heart Association* 12, no. 3 (2023): e028819.
*DOI:*10.1161/JAHA.122.028819
Impact Factor: 6.106
Summary: This paper presents the derivation and validation of an algorithm for detecting in-hospital stroke in high-risk cardiovascular subjects.
Role: developed data collection platform, developed algorithm and results, co-wrote paper.
Contribution: 50%

[Prior to joining Vanderbilt]

[J20] Anneliese J. Flatt, Amy J. Peleckis, Cornelia Dalton-Bakes, Huong-Lan Nguyen, Sarah Ilany, Austin Matus, Susan K. Malone, Namni Goel, Sooyong Jang[*], **James Weimer**, Insup Lee, and Michael R. Rickels. "Automated insulin delivery for hypoglycemia avoidance and glucose counterregulation in long-standing type 1 diabetes with hypoglycemia unawareness." *Diabetes Technology & Therapeutics* 25, no. 5 (2023): 302-314.
DOI: 10.1089/dia.2022.0506
Impact Factor: 5.4
Summary: This paper presents a study to assess the effect of 18 months of automated insulin delivery on hypoglycemia avoidance and glucose counterregulatory responses to insulin-induced hypoglycemia in long-standing type 1 diabetes complicated by impaired awareness of hypoglycemia.
Role: Mentor: advised on clinical decision support system used in study, edited paper.
Contribution: 10%

[J19] Sydney Pugh*, Ivan Ruchkin, Christopher Bonafide, Sara Demauro, Oleg Sokolsky, Insup Lee, and **James Weimer**. "Evaluating alarm classifiers with high-confidence data programming." *ACM Transactions on Computing for Healthcare* 3, no. 4 (2022): 1-24.
DOI: 10.1145/3549942
Impact Factor: 8.0
Summary: This paper presents a new technique for evaluating alarm performance without labeled data. A weakly supervised approach was developed leveraging data programming tools and results were demonstrated on an actionable alarm dataset.
Role: Mentor: originator of the problem definition and approach, co-wrote paper.
Contribution: 30%

[J18] Herrick, Heidi M., Molly Passarella, **James Weimer**, Christopher P. Bonafide, and Sara B. DeMauro. "Alarm Burden in Infants With Bronchopulmonary Dysplasia Monitored With Pulse Oximetry at Home." *JAMA Network Open* 5, no. 6 (2022): e2218367-e2218367.
DOI: 10.1001/jamanetworkopen.2022.18367
Impact Factor: 13.37
Summary: This paper presents a study to evaluate the association of low oxygen saturation (SpO2) limits, alarm delays, and averaging times with alarm incidence by simulating threshold adjustments using data from a clinical trial of continuous home SpO2 monitoring among infants with Bronchopulmonary Dysplasia.
Role: developed home monitoring system used in study, edited paper.
Contribution: 15%

[J17] Cummings, Stephanie, Scott E. Kasner, Michael Mullen, Andrew Olsen, Michael McGarvey, **James Weimer**, Ben Jackson, Nimesh Desai, Michael Acker, and Steven R. Messé. "Delays in the identification and assessment of in-hospital stroke patients." *Journal of Stroke and Cerebrovascular Diseases* 31, no. 4 (2022): 106327.
DOI: 10.1016/j.jstrokecerebrovasdis.2022.106327
Impact Factor: 2.4
Summary: This paper presents an analysis on the effects of delays, interventions, and the presence of large vessel occlusion in stroke patients.
Role: contributed to problem description and potential solutions, edited paper.
Contribution: 10%

[J16] Susan Kohl Malone, Amy J. Peleckis, Laura Grunin, Gary Yu, Sooyong Jang*, **James Weimer**, Insup Lee, Michael R. Rickels, and Namni Goel. "Characterizing Glycemic Control and Sleep in Adults with Long-Standing Type 1 Diabetes and Hypoglycemia Unawareness Initiating Hybrid Closed Loop Insulin Delivery." *Journal of Diabetes Research* 2021 (2021).
DOI: 10.1155/2021/6611064
Impact Factor: 4.3
Summary: This paper presents study results on the relationships between diabetes therapeutic technologies and sleep health.

Role: Mentor: advised on clinical decision support system used in study, edited paper.
Contribution: 10%

[J15] Radoslav Ivanov°, Taylor J. Carpenter*, **James Weimer**, Rajeev Alur, George J. Pappas, and Insup Lee. "Verifying the Safety of Autonomous Systems with Neural Network Controllers." *ACM Transactions on Embedded Computing Systems (TECS)* 20, no. 1 (2020): 1-26.
Best Paper Award
DOI: 10.1145/3419742
Impact Factor: 1.886
Summary: This paper presents the application of a formal verification tool on an autonomous driving system to assure safety.
Role: Mentor: advised on research direction and solution, co-wrote paper.
Contribution: 20%

[J14] Emily K. Presseller, Megan N. Parker, Mandy Lin, **James Weimer**, and Adrienne S. Juarascio. "The application of continuous glucose monitoring technology to eating disorders research: An idea worth researching." *International Journal of Eating Disorders* 53, no. 12 (2020): 1901-1905.
DOI: 10.1002/eat.23404
Impact Factor: 4.861
Summary: This paper presents preliminary results and future research directions for using continuous glucose monitoring technology to aid in eating disorder research.
Role: developed meal detection algorithm used in study, co-wrote paper.
Contribution: 33%

[J13] Esen Yel, Taylor J. Carpenter*, Carmelo Di Franco, Radoslav Ivanov°, Yiannis Kantaros°, Insup Lee, **James Weimer**, and Nicola Bezzo. "Assured runtime monitoring and planning: toward verification of neural networks for safe autonomous operations." *IEEE Robotics & Automation Magazine* 27, no. 2 (2020): 102-116.
DOI: 10.1109/MRA.2020.2981114
Impact Factor: 5.7
Summary: This paper presents an approach for verifying safety of autonomous systems operating in uncertain environments under the effects of disturbances. The main goal was to reduce the complexity of reachability analysis (RA) by training feedforward neural networks to replicate RA and verify the resulting networks using emerging verification tools.
Role: Mentor: originator of the problem and solution, edited paper.
Contribution: 20%

[J12] Ivan Ruchkin°, Oleg Sokolsky, **James Weimer**, Tushar Hedaoo, and Insup Lee. "Compositional probabilistic analysis of temporal properties over stochastic detectors." *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* 39, no. 11 (2020): 3288-3299.
DOI: 10.1109/TCAD.2020.3012643
Impact Factor: 2.9

Summary: This paper presents a compositional framework for modeling and analysis of noisy monitoring systems. A 3-value detector model uses probability spaces to represent atomic (noncomposite) detectors, and it composes them into a temporal logic-based monitor. The goal is to enable accurate evaluation of logical monitors in early design stages before deploying them.
Role: Mentor: advised on probabilistic representation and detector model, edited paper.
Contribution: 15%

[J11] Radoslav Ivanov[*], Nikolay Atanasov, Miroslav Pajic, **James Weimer**, George J. Pappas, and Insup Lee. "Continuous estimation using context-dependent discrete measurements." *IEEE Transactions on Automatic Control* 64, no. 1 (2018): 238-253.
DOI: 10.1109/TAC.2018.2797839
Impact Factor: 6.8
Summary: This paper considers the problem of continuous state estimation from discrete context-based measurements. Context measurements provide binary information as obtained from the system's environment, e.g., a medical alarm indicating that a vital sign is above a certain threshold. We developed a recursive context-aware filter by approximating the posterior distribution with a Gaussian distribution with the same first two moments as the true posterior.
Role: Mentor: advised on problem formulation and solution, edited paper.
Contribution: 20%

[J10] Lorenzo Fernandez Maimo, Alberto Huertas Celdran[†], Angel L. Perales Gomez, Felix J. Garcia Clemente, **James Weimer**, and Insup Lee. "Intelligent and dynamic ransomware spread detection and mitigation in integrated clinical environments." *Sensors* 19, no. 5 (2019): 1114.
DOI: 10.3390/s19051114
Impact Factor: 3.847
Summary: This paper presents an automatic, intelligent and real-time system to detect, classify, and mitigate ransomware in integrated clinical environments (ICE). The proposed solution is fully integrated with the ICE++ architecture and makes use of machine learning techniques to detect and classify the spreading phase of ransomware attacks affecting ICE.
Role: Mentor: advised on problem space, ensured practicality of solution, edited paper.
Contribution: 15%

[J9] Hung Nguyen[°], Sooyong Jang[*], Radoslav Ivanov[*], Christopher P. Bonafide, **James Weimer**, and Insup Lee. "Reducing pulse oximetry false alarms without missing life‐threatening events." *Smart Health* 9 (2018): 287-296.
DOI: 10.1016/j.smhl.2018.07.002
Impact Factor: 4.9
Summary: This paper presents a robust classification procedure based on the AdaBoost algorithm with a reject option that can identify and silence false alarms, while ensuring zero misclassified clinically significant alarms. We propose a variant of AdaBoost with a reject option by allowing a third decision (i.e., reject) expressing doubt. We evaluate the proposed classifier using a dataset collected from 100 hospitalized children .

Role: Mentor: advised on problem space, co-developed solution concept, edited result generating code, co-wrote paper.
Contribution: 25%

[J8] **James Weimer**, Radoslav Ivanov*, Sanjian Chen°, Alexander Roederer°, Oleg Sokolsky, and Insup lee. "Parameter-Invariant Monitor Design for Cyber-Physical Systems." in *Proceedings of the IEEE*, vol. 106, no. 1, pp. 71-92, Jan. 2018.
DOI: 10.1109/JPROC.2017.2723847
Impact Factor: 20.6
Summary: This paper presents an overview on the design of parameter-invariant (PAIN) monitors for cyber-physical systems (CPS). PAIN monitors are designed such that unknown events and system variability minimally affect the monitor performance. This work describes how PAIN designs can achieve a constant false alarm rate (CFAR) in the presence of data sparsity and intra/inter system variance in real-world CPS. To demonstrate the design of PAIN monitors for safety monitoring in CPS with different types of dynamics, we consider systems with networked dynamics, linear-time invariant dynamics, and hybrid dynamics that are discussed through case studies for building actuator fault detection, meal detection in type I diabetes, and detecting hypoxia caused by pulmonary shunts in infants.
Role: Originator of parameter-invariant approach, developed all results, primary author.
Contribution: 75%

[J7] Junkil Park°, Radoslav Ivanov*, **James Weimer**, Miroslav Pajic, Sang Hyuk Son, and Insup Lee. "Security of cyber-physical systems in the presence of transient sensor faults." *ACM Transactions on Cyber-Physical Systems* 1, no. 3 (2017): 1-23.
DOI: 10.1145/3064809
Impact Factor: 2.3
Summary: This paper aims to distinguish between faults and attacks and develop an attack detection algorithm for the latter only. We provide a framework for developing such a model if it is not provided by manufacturers. Attacks can manifest as either transient or permanent faults depending on the attacker's goal. We provide a real-data case study on an unmanned ground vehicle to evaluate the various aspects of this article.
Role: Originator of problem statement and approach, oversaw experiments, co-wrote paper.
Contribution: 25%

[J6] Miroslav Pajic, **James Weimer**, Nicola Bezzo, Oleg Sokolsky, George J. Pappas, and Insup Lee. "Design and implementation of attack-resilient cyberphysical systems: With a focus on attack-resilient state estimators." *IEEE Control Systems Magazine* 37, no. 2 (2017): 66-81.
DOI: 10.1109/MCS.2016.2643239
Impact Factor: 5.7
Summary: This paper aims to describe efforts on the development of an attack-resilient cyber-physical systems (CPS). Specifically, a case study is considered, the design of a resilient cruise controller for an autonomous ground vehicle, focusing on one component of the system,

namely an attack-resilient state estimator and the performance guarantees in the presence of attacks.
Role: Developed resilient state estimator code, co-executed experiments, co-wrote paper.
Contribution: 25%

[J5] **James Weimer**, Sanjian Chen°, Amy Peleckis, Michael R. Rickels, and Insup Lee. "Physiology-invariant meal detection for type 1 diabetes." *Diabetes technology & therapeutics* 18, no. 10 (2016): 616-624.
DOI: 10.1089/dia.2015.0266
Impact Factor: 5.4
Summary: This paper developed a novel meal detector based on a minimal glucose–insulin metabolism model and shows that the detector is, by design, invariant to patient-specific physiological parameters in the minimal model. Our physiological parameter-invariant (PAIN) detector achieves a near-constant false alarm rate across all individuals and is evaluated against three other major existing meal detectors on a clinical type 1 diabetes data set.
Role: Originator of meal-detection approach, developed all results, primary author.
Contribution: 70%

[J4] Sanjian Chen°, Oleg Sokolsky, **James Weimer**, and Insup Lee. "Data-driven adaptive safety monitoring using virtual subjects in medical cyber-physical systems: a glucose control case study." *Journal of Computer Science and Engineering* 10, no. 3 (2016): 75.
DOI: 10.5626/JCSE.2016.10.3.75
Impact Factor: 0.903
Summary: This paper presents a run-time predictive safety monitoring technique for surgical diabetes that leverages a maximal model coupled with online training of a computational virtual subject (CVS) set. The proposed monitor predicts safety-critical events at run-time using only clinically available measurements. We apply the technique to a surgical glucose control case study.
Role: Mentor: Advised on detection technique for monitor, edited paper.
Contribution: 15%

[J3] Radoslav Ivanov°, **James Weimer**, Allan F. Simpao, Mohamed A. Rehman, and Insup Lee. "Prediction of critical pulmonary shunts in infants." *IEEE Transactions on Control Systems Technology* 24, no. 6 (2016): 1936-1952.
DOI: 10.1109/TCST.2016.2538207
Impact Factor: 4.8
Summary: This paper presents a technique to predict sharp drops in blood oxygen concentration in infants undergoing pulmonary shunting. We employed available noninvasive respiratory measurements and built a parameterized physiological model of the circulation of these gasses through the cardiopulmonary system. Since the model parameters (e.g., metabolic rate) are unknown and vary greatly across patients, we utilize a parameter-invariant detector designed to provide a constant false alarm rate for different patients regardless of the values of the

parameters and robust to missing measurements. Finally, we evaluate the performance of the detector on real patient data collected during surgeries.
Role: Originator of parameter-invariant monitor, co-developed results, co-primary author.
Contribution: 40%

[J2] **James Weimer**, Radoslav Ivanov[o], Alexander Roederer[o], Sanjian Chen[o], and Insup Lee. "Parameter-invariant design of medical alarms." *IEEE Design & Test* 32, no. 5 (2015): 9-16.
DOI: 10.1109/MDAT.2015.2451083
Impact Factor: 2.0
Summary: This tutorial paper presents a design methodology for medical parameter-invariant monitors. We begin by providing a motivational review of currently employed medical alarm techniques, followed by the introduction of the parameter-invariant design approach. Finally, we present a case study example to demonstrate the design of a parameter-invariant alarm for critical shunt detection in infants during surgical procedures
Role: Originator of parameter-invariant technique, developed tutorial, primary author.
Contribution: 60%

[J1] **James Weimer**, Bruce H. Krogh, Mitchel J. Small, and Bruno Sinopoli. "An approach to leak detection using wireless sensor networks at carbon sequestration sites." *International Journal of Greenhouse Gas Control* 9 (2012): 243-253.
DOI: 10.1016/j.ijggc.2012.04.001
Impact Factor: 3.9
Summary: This paper concerns the problem of detecting leaks at carbon sequestration sites through the monitoring of CO_2 levels using a wireless sensor network (WSN). By applying a basic linear dynamic model for an advection–diffusion process, a model-based detection strategy called the Iterative Partial Sequential Probability Ratio Test (IPSPRT) can be employed to detect and localize multiple leaks.
Role: Originator of leak detection technique, developed experiments, primary author.
Contribution: 75%

REFEREED HIGHLY-SELECTIVE CONFERENCE PAPERS

[Acceptance based on peer review of full papers.]

[Since joining Vanderbilt]

[C33] Kimberly Trout, Stefanie Modri, Amanda Watson[†], Insup Lee, Harish Sehdev, and **James Weimer**. "VIBRANT: Early Prediction of Life-Threatening Uterine Atony Using Maternal Heart Rate." In *Proceedings of the ACM/IEEE International Conference on Connected Health: Applications, Systems and Engineering Technologies*, pp. 117-128. 2025.
DOI: 10.1145/3721201.3721379
Acceptance Rate: 25% (24 out of 96)

Summary: This paper presents VIBRANT an algorithm for predicting uterine atony that leads to postpartum hemorrhage using only maternal heart rate that out-performs existing standard of care.
Role: Lead Researcher: Developed system to collect data, developed algorithm and approach, performed validation, primary paper writer.
Contribution: 90%

[C32] Tarek Hamid[o], Kimberly Helm, Hyonyoung Choi, Jean Park, Claire Kendell, Stephanie Cummings, Steve Messe, Stefanie Modri, Insup Lee, Amanda Watson[†], **James Weimer**. "Raproto: An Open-Source Platform for Rapid Prototyping with Wearable Devices" In *2024 IEEE/EMBS Conference on Body Sensor Networks (BSN)*, pp. 56-67. IEEE, 2024.
Best Paper Award Finalist
DOI: 10.1145/3580252.3586973
Acceptance Rate: 21% (37 out of 180 – oral presentations)
Summary: This paper presents Raproto, an open-source easy-to-use rapid prototyping platform that does not require the time, effort, and expertise needed for custom development. The Raproto platform consists of three components, the wearable device(s), communication protocol, and remote storage. These components support the collection, transmission, storage, analysis, and visualization of large-scale data with applications from smaller-scale research studies to large clinical trials. Raproto was demonstrated to be effective in multiple prospective clinical pilots.
Role: Developed initial version of Raproto and oversaw clinical pilots. Mentor: led code reviews, advised on future work, edited paper.
Contribution: 30%

[C31] Sydney Pugh[*], Ivan Ruchkin, **James Weimer**, Insup Lee. "Curating naturally adversarial datasets for learning-enabled medical cyber-physical systems." In *2024 ACM/IEEE International Conference on Cyber Physical Systems (ICCPS)* , pp. 212-223. IEEE, 2024.
Best Paper Award Finalist
DOI: 10.1109/ICCPS61052.2024.00026
Acceptance Rate: 28% (24 out of 85)
Summary: This paper presents the a technique for curating datasets for assessing robustness using only real-world data. Unlike other adversarial robustness techniques, this work utilizes real-world data (not synthetically altered data) to build datasets that any robust classifier should demonstrate decreasing performance. The approach was validated on multiple real-world datasets.
Role: Mentor: guided approach for curitating natural adversarial datasets.
Contribution: 30%

[C30] Anush Lingamoorthy[o], Amanda Watson[†], Korey Henderson, Ayan Mandal, David Gordon, Xiaonan Ma, **James Weimer**, Nagarajan Kandasamy, and Jacob S. Brenner. "Dove: shoulder-based opioid overdose detection and reversal device." In *2023 IEEE/ACM Conference*

on Connected Health: Applications, Systems and Engineering Technologies (CHASE), pp. 56-67. IEEE, 2023.
DOI: 10.1145/3580252.3586973
Acceptance Rate: 35% (36 out of 103)
Summary: This paper presents the DOVE, a shoulder-based opioid overdose detection and reversal device. It noninvasively measures the subject's motion state and changes in blood oxygen levels (SpO_2) along with the respiration state. These biomarkers are measured from the shoulder using an optical sensor and accelerometer to determine if a fatal overdose occurred.
Role: Mentor: guided SpO2 analysis, advised on form factor, edited paper.
Contribution: 10%

[C29] Souradeep Dutta[o], Kaustubh Sridhar[o], Osbert Bastani, Edgar Dobriban, **James Weimer**, Insup Lee, and Julia Parish-Morris. "Exploring with sticky mittens: Reinforcement learning with expert interventions via option templates." In *Conference on Robot Learning*, pp. 1499-1509. PMLR, 2023.
Acceptance Rate: 39% (197 out of 505)
Summary: This paper presents a framework for leveraging expert intervention to solve long-horizon reinforcement learning tasks. We consider “option templates”, which are specifications encoding a potential option that can be trained using reinforcement learning. We formulate expert intervention as allowing the agent to execute option templates before learning an implementation.
Role: Mentor: originator of extending sticky mittens to machine learning, edited paper
Contribution: 20%

[C28] Yahan Yang, Sunghye Cho, Maxine Covello, Azia Knox, Osbert Bastani, **James Weimer**, Edgar Dobriban, Robert Schultz, Insup Lee, and Julia Parish-Morris. "Automatically predicting perceived conversation quality in a pediatric sample enriched for autism." In *Interspeech*, vol. 2023, p. 4603. 2023.
DOI: 10.21437/interspeech.2023-2251
Acceptance Rate: 50% (1097 out of 2293)
Summary: This paper presents an approach for predicting conversation quality between pediatric subjects with autism and adults. The study suggests that automatically predicting conversation quality could be an inexpensive and objective way to monitor intervention progress in children with communication challenges, and could be used to identify intervention targets for improving conversational success

[Prior to joining Vanderbilt]

[C27] Amanda Watson[†], Pengyuan Lu[o], Elliot Greenberg, J. Todd R. Lawrence, Theodore J. Ganley, Insup Lee, and **James Weimer**. "Rt-acl: Identification of high-risk youth patients and their most significant risk factors to reduce anterior cruciate ligament reinjury risk." In *2021 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 35-45. IEEE, 2021.

Best Paper Award Finalist
DOI: 10.1109/CHASE52844.2021.00012
Acceptance Rate: 41% (24 out of 58)
Summary: This paper presents RT-ACL, a system that enhances patient outcomes by reducing their risk of an ACL re-tear by providing personalized recommendations of modifiable risk factors that can be altered during the patient's recovery process. Our system leverages the RT-ACL model that uses labeling functions designed by clinicians to classify the risk level of an ACL re-tear. Further, it identifies modifiable risk factors and suggests interventions to minimize adverse outcomes and complications.
Role: Mentor: Originator of problem, advised on solution, edited paper.
Contribution: 20%

[C26] Sydney Pugh[*], Ivan Ruchkin[o], Christopher P. Bonafide, Sara B. DeMauro, Oleg Sokolsky, Insup Lee, and **James Weimer**. "High-confidence data programming for evaluating suppression of physiological alarms." In *2021 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 70-81. IEEE, 2021.
DOI: 10.1109/CHASE52844.2021.00015
Acceptance Rate: 41% (24 out of 58)
Summary: This paper presents a lightweight method for evaluating alarm suppression without access to the true alarm labels. The method is based on the data programming paradigm, which combines noisy and cheap-to-obtain labeling heuristics into probabilistic labels. Based on these labels, the method estimates the sensitivity/specificity of a suppression mechanism and describes the likely outcomes of an observational study in the form of confidence bounds.
Role: Mentor: Originator of problem, advised on solution, edited paper.
Contribution: 20%

[C25] Hyonyoung Choi, Amanda Lor, Mike Megonegal, Xiayan Ji, Amanda Watson[†], **James Weimer**, and Insup Lee. "Vitalcore: Analytics and support dashboard for medical device integration." In *2021 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 82-86. IEEE, 2021.
DOI: 10.1109/CHASE52844.2021.00016
Acceptance Rate: 41% (24 out of 58)
Summary: This paper presents presents VitalCore, a medical device integration platform that supports access to medical device data in real-time. We deploy VitalCore in three applications at Penn Medicine: Medical Device Dashboard, Ventilation Alert, and Anomaly Detector.
Role: Mentor: advised on technical solution and integration efforts, edited paper.
Contribution: 15%

[C24] Radoslav Ivanov[o], Taylor Carpenter[*], **James Weimer**, Rajeev Alur, George Pappas, and Insup Lee. "Verisig 2.0: Verification of neural network controllers using taylor model preconditioning." In *International Conference on Computer Aided Verification*, pp. 249-262. Cham: Springer International Publishing, 2021.
DOI: 10.1007/978-3-030-81685-8_11

Acceptance Rate: 27% (79 out of 290)
Summary: This paper presents Verisig 2.0, a verification tool for closed-loop systems with neural network (NN) controllers. We focus on NNs with tanh/sigmoid activations and develop a Taylor-model-based reachability algorithm through Taylor model preconditioning and shrink wrapping. Furthermore, we provide a parallelized implementation that allows Verisig 2.0 to efficiently handle larger NNs than existing tools.
Role: Mentor: Originator of problem, advised on solution, edited paper.
Contribution: 20%

[C23] Yinjun Wu[o], **James Weimer**, and Susan B. Davidson. "CHEF: a cheap and fast pipeline for iteratively cleaning label uncertainties." *Proceedings of the VLDB Endowment*, Vol. 14, No. 11 ISSN 2150-8097. pp. 2410-2418. 2021.
*DOI:*10.14778/3476249.3476290
Acceptance Rate: 19% (128 out of 677)
Summary: This paper aims to lower the overall cost and computational overhead labeling data by proposing a solution called CHEF (CHEap and Fast label cleaning), which consists of the following three advancements: (i) reducing human annotators by prioritizing the most influential training samples for cleaning; (ii) to accelerate the sample selector phase and the model constructor phase, we use Increm-INFL to *incrementally* produce influential samples, and DeltaGrad-L to *incrementally* update the model; (iii) we redesign the typical label cleaning pipeline so that human annotators iteratively clean smaller batch of samples rather than one big batch of samples.
Role: Mentor: advised on weak supervision, guided overall research, edited paper.
Contribution: 25%

[C22] Yiannis Kantaros[o], Taylor Carpenter[*], Kaustubh Sridhar[o], Yahan Yang[o], Insup Lee, and **James Weimer**. "Real-time detectors for digital and physical adversarial inputs to perception systems." In *Proceedings of the ACM/IEEE 12th International Conference on Cyber-Physical Systems*, pp. 67-76. 2021.
DOI: 10.1145/3450267.3450535
Acceptance Rate: 26% (20 out of 77)
Summary: This paper presents a novel attack- and dataset-agnostic and real-time detector for both types of adversarial inputs to DNN-based perception systems. In particular, the proposed detector relies on the observation that adversarial images are sensitive to certain label-invariant transformations.
Role: Mentor: originated problem, guided research, edited paper.
Contribution: 20%

[C21] Sooyong Jang[*], Insup Lee, and **James Weimer**. "Improving classifier confidence using lossy label-invariant transformations." In *International Conference on Artificial Intelligence and Statistics*, pp. 4051-4059. PMLR, 2021.
Acceptance Rate: 30% (455 out of 1527)

Summary: This paper presents the recursive lossy label-invariant calibration (ReCal) technique that leverages label-invariant transformations of the input that induce a loss of discriminatory information to recursively group (and calibrate) inputs in machine learning models – without requiring model retraining.
Role: Mentor: originated problem, guided research, co-wrote paper.
Contribution: 40%

[C20] Sangdon Park[o], Osbert Bastani, **James Weimer**, and Insup Lee. "Calibrated prediction with covariate shift via unsupervised domain adaptation." In *International Conference on Artificial Intelligence and Statistics*, pp. 3219-3229. PMLR, 2020.
Acceptance Rate: 31% (423 out of 1359)
Summary: This paper presents an algorithm for calibrating predictions that accounts for the possibility of covariate shift, given labeled examples from the training distribution and unlabeled examples from the real-world distribution. Our algorithm uses importance weighting to correct for the shift from the training to the real-world distribution.
Role: Mentor: advised on problem formulation and research direction. Edited paper
Contribution: 10%

[C19] Radoslav Ivanov, Taylor J. Carpenter, **James Weimer**, Rajeev Alur, George J. Pappas, and Insup Lee. "Case study: verifying the safety of an autonomous racing car with a neural network controller." In *Proceedings of the 23rd International Conference on Hybrid Systems: Computation and Control*, pp. 1-7. 2020.
DOI: 10.1145/3365365.3382216
Acceptance Rate: 39% (29 out of 75)
Summary: This paper describes a verification case study on an autonomous racing car with a neural network (NN) controller. Although several verification approaches have been recently proposed, they have only been evaluated on low-dimensional systems or systems with constrained environments. To explore the limits of existing approaches, we present a challenging benchmark in which the NN takes raw LiDAR measurements as input and outputs steering for the car.
Role: Mentor: guided case study development, wrote simulator code, edited paper.
Contribution: 30%

[C18] Luan Viet Nguyen, Gautam Mohan, **James Weimer**, Oleg Sokolsky, Insup Lee, and Rajeev Alur. "Detecting security leaks in hybrid systems with information flow analysis." In *Proceedings of the 17th ACM-IEEE International Conference on Formal Methods and Models for System Design*, pp. 1-11. 2019.
Best paper Award
DOI: 10.1145/3359986.3361212
Acceptance Rate: 35% (12 out of 34)
Summary: This paper presents an algorithm that generates security constraints between each sub-component of hybrid automata, and then transforms these constraints into a directed dependency graph to search for non-interference violations. The proposed algorithm can be

applied directly to parallel compositions of automata without resorting to model-flattening techniques. Our static checker works on hybrid systems modeled in Simulink/Stateflow format and decides whether or not the model satisfies non-interference given a user-provided security annotation for each variable.
Role: Mentor: advised on hybrid systems modeling in Simlink/Stateflow, edited paper.
Contribution: 15%

[C17] Radoslav Ivanov[o], **James Weimer**, Rajeev Alur, George J. Pappas, and Insup Lee. "Verisig: verifying safety properties of hybrid systems with neural network controllers." In *Proceedings of the 22nd ACM International Conference on Hybrid Systems: Computation and Control*, pp. 169-178. 2019.
DOI: 10.1145/3302504.3311806
Acceptance Rate: 30% (27 out of 89)
Summary: This paper presents Verisig, a hybrid system approach to verifying safety properties of closed-loop systems using neural networks as controllers. We focus on sigmoid-based networks and exploit the fact that the sigmoid is the solution to a quadratic differential equation, which allows us to transform the neural network into an equivalent hybrid system. By composing the network's hybrid system with the plant's, we transform the problem into a hybrid system verification problem which can be solved using state-of-the-art reachability tools.
Role: Mentor: Originator of approach, guided its development, co-wrote paper.
Contribution: 40%

[C16] Kuk Jin Jang[o], Yash Vardhan Pant, Bo Zhang, **James Weimer**, and Rahul Mangharam. "Robustness evaluation of computer-aided clinical trials for medical devices." In *Proceedings of the 10th ACM/IEEE International Conference on Cyber-Physical Systems*, pp. 163-173. 2019.
DOI: 10.1145/3302509.3311058
Acceptance Rate: 23% (28 out of 123)
Summary: This paper presents the Computer-Aided Clinical Trial (CACT) within a Bayesian statistical framework allowing explicit modeling of assumptions and utilization of simulation results at all stages of a clinical trial. To quantify the robustness of the CACT outcome with respect to a simulation assumption, we define δ-robustness as the minimum perturbation of the base prior distribution resulting in a change of the CACT outcome and provide a method to estimate the δ-robustness.
Role: Mentor: advised on clinical trial testing and statistics, edited paper.
Contribution: 20%

[C15] Hung Nguyen[o], Radoslav Ivanov[*], Linh TX Phan, Oleg Sokolsky, **James Weimer**, and Insup Lee. "LogSafe: Secure and scalable data logger for IoT devices." In *2018 IEEE/ACM Third International Conference on Internet-of-Things Design and Implementation (IoTDI)*, pp. 141-152. IEEE, 2018.
DOI: 10.1109/IoTDI.2018.00023
Acceptance Rate: 24% (21 out of 89)

Summary: This paper presents LogSafe, a scalable, fault-tolerant logger that leverages the use of Intel Software Guard Extensions (SGX) to store logs from IoT devices efficiently and securely. Using the security guarantees of SGX, LogSafe is designed to run on an untrusted cloud infrastructure and satisfies Confidentiality, Integrity, and Availability (CIA) security properties.
Role: Mentor: advised on problem space, guided solution design choices, edited paper.
Contribution: 15%

[C14] Nima Roohi[o], Ramneet Kaur, **James Weimer**, Oleg Sokolsky, and Insup Lee. "Parameter invariant monitoring for signal temporal logic." In *Proceedings of the 21st International Conference on Hybrid Systems: Computation and Control (part of CPS Week)*, pp. 187-196. 2018.
DOI: 10.1145/3178126.3178140
Acceptance Rate: 45% (24 out of 53)
Summary: This paper presents a method to extend any parameter invariant test procedure for single points in time to a parameter invariant test procedure for efficiently monitoring continuous time executions of a system against STL properties. We also show how to extend probabilistic error guarantee of the input test procedure to a probabilistic error guarantee for the constructed test procedure.
Role: Mentor: advised on parameter-invariant extension, experimentation, and edited paper.
Contribution: 15%

[C13] Fanxin Kong[o], Meng Xu, **James Weimer**, Oleg Sokolsky, and Insup Lee. "Cyber-physical system checkpointing and recovery." In *2018 ACM/IEEE 9th International Conference on Cyber-Physical Systems (ICCPS)*, pp. 22-31. IEEE, 2018.
DOI: 10.1109/ICCPS.2018.00011
Acceptance Rate: 32% (30 out of 94)
Summary: This paper presents a new concept of physical-state recovery. The essential operation is defined as rolling the system forward starting from a consistent historical system state. We designed a checkpointing protocol that defines how to record system states for the recovery and the protocol introduces a sliding window that accommodates attack-detection delay to improve the correctness of stored states.
Role: Mentor: collaborated on defining CPS checkpointing, edited paper.
Contribution: 15%

[C12] Radoslav Ivanov[*], **James Weimer**, and Insup Lee. "Context-aware detection in medical cyber-physical systems." In *2018 ACM/IEEE 9th International Conference on Cyber-Physical Systems (ICCPS)*, pp. 232-241. IEEE, 2018.
DOI: 10.1109/ICCPS.2018.00030
Acceptance Rate: 32% (30 out of 94)
Summary: This paper presents the context-aware parameter-invariant (CA-PAIN) detector; the CA-PAIN detector improves upon the original PAIN detector by recognizing events with noisy

measurements and not raising unnecessary false alarms. We evaluate the CA-PAIN detector both in simulation and on real-patient data.
Role: Mentor: Advised on PAIN formulation, assisted with experimentation, edited paper.
Contribution: 30%

[C11] Alberto Huertas Celdrán[o], Félix J. García Clemente, **James Weimer**, and Insup Lee. "ICE++: improving security, QoS, and high availability of medical cyber-physical systems through mobile edge computing." In *2018 IEEE 20th International Conference on e-Health Networking, Applications and Services (Healthcom)*, pp. 1-8. IEEE, 2018.
DOI: 10.1109/HealthCom.2018.8531185
Acceptance Rate: 49% (108 out of 220)
Summary: This paper presents the ICE++ architecture, which is oriented to the Mobile Edge Computing paradigm and combines SDN and NFV techniques to manage efficiently and automatically the MCPS elements taking into account its security, QoS, and high availability.
Role: Advised on the features of ICE++ suitable for the medical domain, edited paper.
Contribution: 15%

[C10] Sangdon Park[o], **James Weimer**, and Insup Lee. "Resilient linear classification: an approach to deal with attacks on training data." In *Proceedings of the 8th International Conference on Cyber-Physical Systems*, pp. 155-164. 2017.
DOI: 10.1145/3055004.3055006
Acceptance Rate:
Summary: This paper analyzes the resilience of classification algorithms to training data attacks. Specifically, a generic metric is proposed that is tailored to measure resilience of classification algorithms with respect to worst-case tampering of the training data. Using the metric, we show that traditional linear classification algorithms are resilient under restricted conditions and present alternative methods.
Role: Mentor: originator of problem statement, guided research/experiments, co-wrote paper
Contribution: 40%

[C9] Radoslav Ivanov[o], Nikolay Atanasov, **James Weimer**, Miroslav Pajic, Allan Simpao, Mohamed Rehman, George Pappas, and Insup Lee. "Estimation of blood oxygen content using context-aware filtering." In *2016 ACM/IEEE 7th International Conference on Cyber-Physical Systems (ICCPS)*, pp. 1-10. IEEE, 2016.
DOI: 10.1109/ICCPS.2016.7479102
Acceptance Rate: 28% (27 out of 97)
Summary: This paper addresses the problem of estimating the blood oxygen concentration in children during surgery. Currently, the oxygen content can only be measured through invasive means such as drawing blood from the patient. In this work, we perform estimation by only using other non-invasive measurements (e.g., fraction of oxygen in inspired air, volume of inspired air) collected during surgery.
Role: Mentor: collaborated with senior graduate students, shaped approach, edited paper.
Contribution: 30%

[C8] Radoslav Ivanov[o], **James Weimer**, Allan Simpao, Mohamed Rehman, and Insup Lee. "Early detection of critical pulmonary shunts in infants." In *Proceedings of the ACM/IEEE Sixth International Conference on Cyber-Physical Systems*, pp. 110-119. 2015.
Best Paper Award Finalist
DOI: 10.1145/2735960.2735962
Acceptance Rate: 27% (25 out of 91)
Summary: This paper aims to detect steep drops in blood oxygen content before SpO2 is affected. We present a formal model of the circulation of oxygen and carbon dioxide in the body, characterized by unknown patient-unique parameters. Employing the model, we design a matched subspace detector to provide a near constant false alarm rate invariant to these parameters and modeling uncertainties. Finally, we validate our approach on real-patient data from lung lobectomy surgeries.
Role: Co-primary author, led detector development, oversaw experiments, co-wrote paper.
Contribution: 45%

[C7] Junkil Park[o], Radoslav Ivanov[o], **James Weimer**, Miroslav Pajic, and Insup Lee. "Sensor attack detection in the presence of transient faults." In *Proceedings of the ACM/IEEE Sixth International Conference on Cyber-Physical Systems*, pp. 1-10. 2015.
DOI: 10.1145/2735960.2735984
Acceptance Rate: 27% (25 out of 91)
Summary: This paper presents a transient fault model for each sensor and an algorithm designed to detect and identify attacks in the presence of transient faults. The fault model consists of three aspects: the size of the sensor's interval (1) and an upper bound on the number of errors (2) allowed in a given window size (3). Given such a model for each sensor, the algorithm uses pairwise inconsistencies between sensors to detect and identify attacks.
Role: led problem definition, oversaw solution development and experiments, co-wrote paper.
Contribution: 25%

[C6] Miroslav Pajic, **James Weimer**, Nicola Bezzo, Paulo Tabuada, Oleg Sokolsky, Insup Lee, and George J. Pappas. "Robustness of attack-resilient state estimators." In *2014 ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, pp. 163-174. IEEE, 2014.
Best Paper Award.
DOI: 10.1109/ICCPS.2014.6843720
Acceptance Rate: 24% (18 out of 76)
Summary: This paper presents a method for state estimation in presence of attacks, for systems with noise and modeling errors. When the estimated states are used by a state-based feedback controller, we show that the attacker cannot destabilize the system by exploiting the difference between the model used for the state estimation and the real physical dynamics of the system. Furthermore, we provide a bound on the state-estimation error caused by modeling errors.
Role: Developed resilient state estimator code and implementation, co-wrote paper.
Contribution: 30%

[C5] Nicola Bezzo, **James Weimer**, Miroslav Pajic, Oleg Sokolsky, George J. Pappas, and Insup Lee. "Attack resilient state estimation for autonomous robotic systems." In *2014 IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp. 3692-3698. IEEE, 2014.
DOI: 10.1109/IROS.2014.6943080
Acceptance Rate: 47% (750 out of 1600)
Summary: This paper presents a methodology to control ground robots under malicious attack on sensors. In order to guarantee resilience against attacks, we use a control-level technique implemented within a recursive algorithm that takes advantage of redundancy in the information received by the controller.
Role: Co-developed problem and solution, developed theoretical results, co-wrote paper
Contribution: 45%

[C4] **James Weimer**, Oleg Sokolsky, Nicola Bezzo, and Insup Lee. "Towards assurance cases for resilient control systems." In *2014 IEEE International Conference on Cyber-Physical Systems, Networks, and Applications*, pp. 1-6. IEEE, 2014.
DOI: 10.1109/CPSNA.2014.19
Acceptance Rate: 39% (9 out of 23)
Summary: This paper presents the case study of a resilient speed estimator for an autonomous ground vehicle and takes the reader through a detailed assurance case arguing that the estimator computes speed estimates with bounded error.
Role: primary author, co-developed assurance case, developed system models and resutls.
Contribution: 60%

[C3] **James Weimer**, Damiano Varagnolo, and Karl Henrik Johansson. "Distributed model-invariant detection of unknown inputs in networked systems." In *Proceedings of the 2nd ACM international conference on High confidence networked systems*, pp. 127-134. 2013.
DOI: 10.1145/2461446.2461464
Acceptance Rate: 49% (18 out of 37)
Summary: This paper presents a distributed testing implementation of our previous work on centralized Uniformly Most Powerful Invariant (UMPI) approach to testing unknown inputs in unknown Linear Time Invariant (LTI) networked dynamics subject to unknown Gaussian noise.
Role: led development of problem and solution, developed experimental results, primary author
Contribution: 75%

[C2] **James Weimer**, Bruno Sinopoli, and Bruce Krogh. "Multiple source detection and localization in advection-diffusion processes using wireless sensor networks." In *2009 30th IEEE Real-Time Systems Symposium*, pp. 333-342. IEEE, 2009.
DOI: 10.1109/RTSS.2009.43
Acceptance Rate: 22% (44 out of 197)
Summary: This paper presents an approach to use large-scale wireless sensor networks to detect and locate leaks of specified gases in the presence of time-varying advection (air currents) and diffusion. We show that when leaks are rare but constant for long periods, Kalman filtering

combined with binary hypothesis testing provides an effective alternative to full-scale hypothesis testing covering all possible combinations of leaks and leak intensities.
Role: primary author. Developed approach, experiments, and led paper writing.
Contribution: 75%

[C1] Sumit K. Jha, Bruce H. Krogh, **James E. Weimer**, and Edmund M. Clarke. "Reachability for linear hybrid automata using iterative relaxation abstraction." In *International Workshop on Hybrid Systems: Computation and Control*, pp. 287-300. Berlin, Heidelberg: Springer Berlin Heidelberg, 2007.
DOI: 10.1007/978-3-540-71493-4_24
Acceptance Rate: 49% (83 out of 167)
Summary: This paper introduces *iterative relaxation abstraction* (IRA), a new method for reachability analysis of LHA that aims to improve scalability by combining the capabilities of current tools for analysis of low-dimensional LHA with the power of linear programming (LP) for large numbers of constraints and variables. IRA is inspired by the success of counterexample guided abstraction refinement (CEGAR) techniques in verification of discrete systems.
Role: junior author: developed experimental results, co-wrote paper
Contribution: 25%

OTHER FULLY REFEREED CONFERENCE PAPERS

[Acceptance based on peer review of full papers.]

[Since joining Vanderbilt]

[OC21] Chi Phuong Ngoc Huynh*, and **James Weimer**. "Estimating Data Requirements for Learning-Enabled Systems Using Metadata." In the *International Conference on Assured Autonomy.* IEEE. 2024.
DOI: 10.1109/ICAA64256.2024.00015
Acceptance Rate: 60% (9 out of 15)
Summary: This paper presents a method to estimate dataset difficulty as a surrogate for identifying dataset requirements for accurate machine learning. Leveraging published datasets and corresponding performance information it was demonstrated that task difficulty could be effectively estimated without access to the underlying datasets.
Role: Mentor: guided research direction, edited paper.
Contribution: 40%

[OC20] Matthew Chan, Luis Garcia, Nathaniel Snyder, Marcus Lucas, Aolin Ding, Amin Hass, Oleg Sokolsky, **James Weimer**, Paulo Tabuada, Saman Zonouz, Mani Srivastava. "Leaking Through the Physics: Covert Cyber-Physical Data Exfiltration Through Unobserved Physics." In *International Conference on Security and Privacy in Cyber-Physical Systems and Smart Vehicles*, pp. 3-25. Cham: Springer Nature Switzerland, 2024.
DOI: 10.1007/978-3-031-93354-7_1

Acceptance Rate: 72% (16 out of 22)
Summary: This paper presents a technique to covertly extract data through unobserved physics in cyber-physical systems.
Role: Advisor: recommended research directions, edited paper.
Contribution: 5%

[OC19] Sridhar, Kaustubh°, Souradeep Dutta, **James Weimer**, and Insup Lee. "Guaranteed Conformance of Neurosymbolic Models to Natural Constraints." In *Learning for Dynamics and Control Conference*, pp. 76-89. PMLR, 2023.
Acceptance Rate: 67% (113 out of 167)
Summary: This paper presents a method to guarantee conformance of neurosymbolic models to real-world physical constraints. Leveraging representative samples, called memories, we partition the state space into disjoint subsets and compute bounds that should be respected by the neural network in each subset. This serves as a symbolic wrapper for guaranteed conformance. We experimentally show performance on three case studies (Car Model, Drones, and Artificial Pancreas).
Role: Mentor: guided research applications, edited paper.
Contribution: 15%

[OC18] Kuk Jin Jang†, Souradeep Dutta, Jean Park, **James Weimer**, and Insup Lee. "Memory Classifiers for Robust ECG Classification against Physiological Noise." In *2023 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, pp. 1-5. IEEE, 2023.
DOI: 10.1109/EMBC40787.2023.10339980
Summary: This paper presents a memory classifier approach that attains a boost in robustness using expert-informed features. Memory classifiers combine standard deep neural network training with a domain knowledge-guided similarity metric to boost the robustness of classifiers. We evaluate the performance of the models against naturally occurring physiological perturbations, specifically electrode movement, muscle artifact, and baseline wander noise
Role: Mentor: Advised on the application of memory classifiers to physiology, edited paper.
Contribution: 20%

[Prior to joining Vanderbilt]

[OC17] Vivian Lin, Radoslav Ivanov°, **James Weimer**, Oleg Sokolsky, and Insup Lee. "T4V: Exploring Neural Network Architectures that Improve the Scalability of Neural Network Verification." In *Principles of Systems Design: Essays Dedicated to Thomas A. Henzinger on the Occasion of His 60th Birthday*, pp. 585-603. Cham: Springer Nature Switzerland, 2022.
DOI: 10.1007/978-3-031-22337-2_28
Summary: This paper presents a general framework for incorporating verification scalability in the training process by identifying neural network properties that improve verification and incentivizing these properties through a verification loss.
Role: Advised on technical approach and potential applications, edited paper.

Contribution: 15%

[OC16] Amanda Watson[†], Jean Park, Sydney Pugh[*], Oleg Sokolsky, **James Weimer**, and Insup Lee. "Medical Cyber-Physical Systems: IoMT Applications and Challenges." In *2022 56th Asilomar Conference on Signals, Systems, and Computers*, pp. 998-1004. IEEE, 2022.
DOI: 10.1109/IEEECONF56349.2022.10052004
Summary: This paper presents the challenges in developing medical cyber-physical systems and the internet of medical things (IoMT), some of our work in addressing them, and several open research issues.
Role: identified open challenges, provided description of recent work, edited paper
Contribution: 30%

[OC15] Kaustubh Sridhar[o], Oleg Sokolsky, Insup Lee, and **James Weimer**. "Improving neural network robustness via persistency of excitation." In *2022 American Control Conference (ACC)*, pp. 1521-1526. IEEE, 2022.
DOI: 10.23919/ACC53348.2022.9867880
Acceptance Rate: 64% (837 out of 1322)
Summary: This paper presents parameter estimation with gradient descent (i.e., machine learning) can be modeled as a sampling of an adaptive linear time-varying continuous system. Leveraging this model, and with inspiration from Model-Reference Adaptive Control (MRAC), we prove a sufficient condition to constrain gradient descent updates to reference persistently excited trajectories converging to the true parameters.
Role: Mentor: problem and solution concept originator, co-developed theory, co-wrote paper.
Contribution: 40%

[OC14] Kuk Jang[o], **James Weimer**, Houssam Abbas, Zhihao Jiang, Jackson Liang, Sanjay Dixit, and Rahul Mangharam. "Computer aided clinical trials for implantable cardiac devices." In *2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pp. 1-4. IEEE, 2018.
DOI: 10.1109/EMBC.2018.8513284
Summary: This paper presents a method for formulating computer-aided clinical trials using a Bayesian statistical framework. We define a hierarchical model of the virtual cohort generated from a physiological model which captures the uncertainty in the parameters and allow for the systematic incorporation of information available at the design of the trial.
Role: Co-developed technical approach, co-wrote paper.
Contribution: 35%

[OC13] Minsu Jo, Junkil Park[o], Youngmi Baek, Radoslav Ivanov[*], **James Weimer**, Sang Hyuk Son, and Insup Lee. "Adaptive transient fault model for sensor attack detection." In *2016 IEEE 4th International Conference on Cyber-Physical Systems, Networks, and Applications (CPSNA)*, pp. 59-65. IEEE, 2016.
Best Paper Award.
DOI: 10.1109/CPSNA.2016.21

Summary: This paper presents an adaptive transient fault model for sensor attack detection to use the appropriate parameter values in accordance with the change of the operating mode of the system. The benefit of our proposed system is demonstrated using real measurement data obtained from an unmanned ground vehicle.
Role: Mentor: Advised on integration of technical approach with application, edited paper.
Contribution: 15%

[OC12] Nicola Bezzo, **James Weimer**, Yanwei Du, Oleg Sokolsky, Sang H. Son, and Insup Lee. "A stochastic approach for attack resilient uav motion planning." In *2016 American Control Conference (ACC)*, pp. 1366-1372. IEEE, 2016.
DOI: 10.1109/ACC.2016.7525108
Acceptance Rate: 68% (1258 out of 1840)
Summary: This paper presents a stochastic strategy for motion planning of unmanned aerial vehicles (UAVs) subject to malicious cyber attacks. By injecting erroneous information and compromising sensor data, an attacker can hijack a system driving it to unsafe states. In this work we bear on the problem of choosing optimal actions while one or more sensors are not reliable.
Role: collaborated on the problem and technical solution, edited paper.
Contribution: 20%

[OC11] Sanjian Chen[o], Matthew O'Kelly, **James Weimer**, Oleg Sokolsky, and Insup Lee. "An intraoperative glucose control benchmark for formal verification."*5th IFAC conference on Analysis and Design of Hybrid Systems (ADHS), IFAC-PapersOnLine* 48, no. 27 (2015): 211-217.
DOI: 10.1016/j.ifacol.2015.11.177
Summary: This paper presents a hybrid system model, as a verification benchmark, of a closed-loop physiological system that includes an existing FDA-accepted high-fidelity physiological model tailored to intraoperative settings and a validated improvement to a clinical glucose control protocol for diabetic cardiac surgery patients.
Role: Originator of problem formulation and solution concept, edited code, co-wrote paper.
Contribution: 35%

[OC10] Alexander Roederer[o], **James Weimer**, Joseph DiMartino, Jacob Gutsche, and Insup Lee. "Robust monitoring of hypovolemia in intensive care patients using photoplethysmogram signals." In *2015 37th Annual International Conference of the Ieee Engineering in Medicine and Biology Society (Embc)*, pp. 1504-1507. IEEE, 2015.
DOI: 10.1109/EMBC.2015.7318656
Summary: This paper presents a fingertip photoplethysmography based technique to assess patient fluid status that is robust to waveform artifacts and health variability in the underlying patient population. The technique is intended for use in intensive care units, where patients are at risk for hypovolemia, and signal artifacts and inter-patient variations in health are common.
Role: co-developed problem and solution, developed detection code, co-wrote paper
Contribution: 45%

[OC9] **James Weimer**, Nicola Bezzo, Miroslav Pajic, Oleg Sokolsky, and Insup Lee. "Attack-resilient minimum mean-squared error estimation." In *2014 American Control Conference*, pp. 1114-1119. IEEE, 2014.
DOI: 10.1109/ACC.2014.6859478
Acceptance Rate: 67% (931 out of 1400)
Summary: This paper presents the design of resilient estimators for stochastic systems. To this end, we introduce a minimum mean-squared error resilient (MMSE-R) estimator whose conditional mean squared error from the state remains finitely bounded and is independent of additive measurement attacks. An implementation of the MMSE-R estimator is presented and is shown as the solution of a semidefinite programming problem, which can be implemented efficiently using convex optimization techniques.
Role: led development of problem and solution, primary author.
Contribution: 75%

[OC8] **James Weimer**, Damiano Varagnolo, Miloš S. Stanković, and Karl Henrik Johansson. "Parameter-invariant detection of unknown inputs in networked systems." In *52nd IEEE Conference on Decision and Control*, pp. 4379-4384. IEEE, 2013.
DOI: 10.1109/CDC.2013.6760563
Summary: This paper presents the problem of detecting unknown inputs in networked systems whose dynamics are governed by time-varying unknown parameters. We propose a strategy that employs test statistics that are invariant to the unknown parameters and do not rely on parameter estimation.
Role: Led problem and solution development, primary author
Contribution: 75%

[OC7] **James Weimer**, Yuzhe Xu, Carlo Fischione, Karl Henrik Johansson, Per Ljungberg, Craig Donovan, Ariane Sutor, and Lennart E. Fahlén. "A virtual laboratory for micro-grid information and communication infrastructures." In *2012 3rd IEEE PES Innovative Smart Grid Technologies Europe (ISGT Europe)*, pp. 1-6. IEEE, 2012.
DOI: 10.1109/ISGTEurope.2012.6465836
Summary: To evaluate various information and communication infrastructures for micro-grid deployment, this work introduces the Virtual Micro-Grid Laboratory (VMGL) and provides a preliminary analysis of Long-Term Evolution (LTE) as a micro-grid communication infrastructure.
Role: led the development of the virtual micro-grid laboratory, primary author.
Contribution: 60%

[OC6] **James Weimer**, José Araújo, and Karl Henrik Johansson. "Distributed event-triggered estimation in networked systems." *4th IFAC conference on Analysis and Design of Hybrid Systems (ADHS). IFAC Proceedings Volumes* 45, no. 9 (2012): 178-185.
DOI: 10.3182/20120606-3-NL-3011.00099
Acceptance Rate: 72% (72 out of 100)

Summary: This paper presents a global event-triggered communication policy for state estimation that minimizes a weighted function of the network energy consumption and the number of transmissions subject to constraints on the estimator performance.
Role: led the problem and solution development, primary author.
Contribution: 75%

[OC5] **James Weimer**, Soummya Kar, and Karl Henrik Johansson. "Distributed detection and isolation of topology attacks in power networks." In *Proceedings of the 1st international conference on High Confidence Networked Systems*, pp. 65-72. 2012.
DOI: 10.1145/2185505.2185516
Summary: This paper addresses the issue of detecting and isolating topology attacks in power networks. A topology attack, unlike a data attack and power injection attack, alters the physical dynamics of the power network by removing bus interconnections. To detect topology attacks, a stochastic hypothesis testing problem is considered assuming noisy measurements are obtained by periodically sampling a dynamic process described by the networked swing equation dynamics, modified to assume stochastic power injections.
Role: led problem development and solution, primary author
Contribution: 65%

[OC4] **James Weimer**, José Araújo, Aitor Hernandez, and Karl Henrik Johansson. "Periodic constraint-based control using dynamic wireless sensor scheduling." In *2011 50th IEEE Conference on Decision and Control and European Control Conference*, pp. 4789-4796. IEEE, 2011.
DOI: 10.1109/CDC.2011.6161330
Summary: This paper introduces and experimentally evaluates a new receding-horizon approach for performing constraint-based control using a WSN. By leveraging the system controllability, the receding-horizon controller is formulated as a mixed-integer programming problem which, at each time step, simultaneously generates a control sequence and sensor selection schedule such that the desired performance is achieved while minimizing the energy required to perform data acquisition and control.
Role: led problem development and solution, primary author
Contribution: 65%

[OC3] Kin Cheong Sou, **James Weimer**, Henrik Sandberg, and Karl Henrik Johansson. "Scheduling smart home appliances using mixed integer linear programming." In *2011 50th IEEE conference on decision and control and European control conference*, pp. 5144-5149. IEEE, 2011.
DOI: 10.1109/CDC.2011.6161081
Summary: This paper presents an approach to minimize electricity cost through a scheduling problem of smart home appliances. Operation characteristics, such as expected duration and peak power consumption of the smart appliances, can be adjusted through a power profile signal. The optimal power profile signal minimizes cost, while satisfying technical operation constraints and consumer preferences.

Role: co-developed problem and technical solution, co-wrote paper
Contribution: 40%

[OC2] **James E. Weimer**, Bruno Sinopoli, and Bruce H. Krogh. "Large-scale source localization with a wireless sensor network application." *IFAC Proceedings Volumes* 44, no. 1 (2011):4278-4283.
DOI: 10.3182/20110828-6-IT-1002.03232
Acceptance Rate:
Summary: This paper concerns the problem of large-scale source localization arising when many potential sources must be classified as either active or inactive such that the probability of missing an active source is bounded. A new iterative heuristic called the Iterative Source Localization Procedure (ISLoP) is introduced that reduces the complexity of a source localization problem with J potential sources from 2^J to J per iteration, while also providing a local bounds on the maximum probability of a missed source.
Role: led problem development and solution, primary author
Contribution: 75%

[OC1] **James E. Weimer**, and Bruce H. Krogh. "Hierarchical modeling of mode-switching systems." In *Proceedings of the 2007 Summer Computer Simulation Conference*, pp. 567-574. 2007.
DOI: 10.5555/1357910.1357999
Summary: This paper presents a set of input-output blocks to build intuitive models of dynamic systems with mode switching due to changes in operating conditions, sensor failure, model reconfiguration, and model-order reduction. These blocks make it possible to construct hierarchical component models of mode-switching systems.
Role: led problem development and solution, primary author
Contribution: 75%

BOOK CHAPTERS

[Acceptance based on peer review of full papers.]

[Prior to joining Vanderbilt]

[B2] Insup Lee, Oleg Sokolsky, and James Weimer. "Medical cyber-physical systems: Challenges and future directions." In *Encyclopedia of Systems and Control*, pp. 1213-1220. Cham: Springer International Publishing, 2021.
DOI: 10.1007/978-3-030-44184-5_100115
Summary: This entry considers the area of medical cyber-physical systems, which recently has enjoyed much research and development efforts. We present a brief summary of recent developments, followed by a discussion of remaining challenges and directions for further development.
Role: co-wrote the entry, curated background information.
Contribution: 33%

[B1] Mauricio Novelo, Nalaka Gooneratne, **James Weimer**. “Digital Health: Software and a Medical Device” as part of *Academic Entrepreneurship for Medical and Health Scientists.* 2019.
DOI: 10.21428/b2e239dc.82cee59e
Summary: This paper presents challenges and opportunities for working in digital health, focusing on the interplay between software development and validation and regulatory oversight. These topics are discussed in this chapter; while the primary focus is on smartphone app software, many of the core issues are relevant to other domains in digital health.
Role: wrote the portion on software as a medical device, edited other sections.
Contribution: 25%

LIGHTLY REFEREED CONFERENCE PROCEEDINGS PAPERS

[Acceptance based on peer review of abstracts or short papers.]

[Since joining Vanderbilt]

[LC8] Xiayan Ji, Ahhyun Yuh, Viktor Erdélyi, Teruhiro Mizumoto, Hyonyoung Choi, Sean Lee Harrison, Emma Cho, **James Weimer**, Hajime Nagahara, Teruo Higashino, George Demiris, Oleg Sokolsky, Insup Lee. "Exploring effective sensing indicators of loneliness for elderly community in US and Japan." In *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*, pp. 1-9. 2024.
DOI: 10.1145/3613905.3637123
Summary: This paper presents an approach for sensor placement and corresponding evaluation for monitoring indicators of loneliness in elderly communities in US and Japan. The results demonstrate high correlation between passive sensing systems and gold-standard indicators of loneliness.
Role: Advised on system architecture and sensor selection. Edited paper.
Contribution: 5%

[LC7] Xiayan Ji, Ahhyun Yuh, Hyonyoung Choi, Amanda Watson[†], Claire Kendell[o], Xian Li, **James Weimer**, Hajime Nagahara, Teruo Higashino, Teruhiro Mizumoto, Viktor Erdeelyi, George Demiris, Oleg Sokolsky, and Insup Lee. "iCareLoop: Closed-Loop Sensing and Intervention for Gerontological Social Isolation and Loneliness." In *Proceedings of the ACM/IEEE 14th International Conference on Cyber-Physical Systems (with CPS-IoT Week 2023)*, pp. 272-273. 2023.
DOI: 10.1145/3576841.3589632
Summary: This paper presents *iCareLoop*, a closed-loop decision support system with clinician-in-the-loop actuation to mitigate gerontological social isolation and loneliness. By implementing targeted interventions, this system can help maintain the mental well-being of elderly individuals, which is particularly crucial given the social disruptions caused by the COVID-19 pandemic.
Role: Advised on implementation of iCareLoop. Edited paper.
Contribution: 5%

[LC6] Xiayan Ji, Xian Li, Ahhyun Yuh, Amanda Watson†, Claire Kendell°, **James Weimer**, Hajime Nagahara et al. "Short: Integrated Sensing Platform for Detecting Social Isolation and Loneliness In the Elderly Community." In *2023 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 148-152. IEEE, 2023.
DOI: 10.1145/3580252.3586983
Summary: This paper presents an integrated design for technology usage to tackle the aforementioned mental healthcare concerns involving the elderly community. The technology infrastructure is an Internet-of-Things (IoT) monitoring system aiming to detect social isolation and promptly predict the risk of loneliness.
Role: Advised on implementation of sensing platform in elderly communities. Edited paper.
Contribution: 5%

[LC5] Anush Lingamoorthy°, Amanda Watson†, Ethan Donlon, **James Weimer**, and Jacob S. Brenner. "DOVE: Noninvasive Shoulder-based Opioid Overdose Detection Device." In *2022 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 182-183. IEEE, 2022.
DOI: 10.1145/3551455.3564751
Summary: This paper presents DOVE, a device capable of noninvasively measuring changes in blood oxygenation levels and heart rate on the shoulder in real-time using optical sensors to detect an overdose.
Role: advised on SpO2 monitoring, edited paper.
Contribution: 10%

[Prior to joining Vanderbilt]

[LC4] Jean Park, Amanda Watson†, Xiayan Ji, Kyle C. Quinn, **James Weimer**, and Insup Lee. "Autowean: Extubation failure risk estimation for critically ill patients." In *2022 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 99-110. IEEE, 2022.
DOI: 10.1145/3551455.3559601
Summary: This paper presents AutoWean, a system that improves the prediction of extubation outcomes in ICU patients by displaying risk levels via a feedback system provided to clinicians. Our system uses an ensemble method that combines the output of labeling functions leveraging domain knowledge from clinicians to distinguish high and low-risk patients for each risk factor.
Role: developed problem, advised on solution, edited paper.
Contribution: 25%

[LC3] Claire Kendell°, Amanda Watson†, Insup Lee, and **James Weimer**. "GlucoScan: Noninvasive Glucose Monitoring Device." In *2022 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 158-159. IEEE, 2022.
DOI: 10.1145/3551455.3559160

Summary: This paper presents a new device for non-invasive measurement of change in blood glucose through a wearable finger clamp system using optical spectroscopy with visible wavelengths.
Role: developed problem, advised on solution, edited paper.
Contribution: 25%

[LC2] Pengyuan Lu[o], Xian Li, Sooyong Jang[*], Alexander Lee, Sydney Pugh[*], Amanda Watson[†], Ragnhildur I. Bjarnadóttir, Robert Lucero, George Demiris, Ani Nenkova, **James Weimer**, Insup Lee. "FRED: Fall Risk Evaluation Database Based on Electronic Health Record Data." In *2021 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, pp. 130-131. IEEE, 2021.
DOI: 10.1109/CHASE52844.2021.00030
Summary: This paper presents a four-part database, FRED, for fall risk evaluation based on electronic health record data from MIMIC-III.
Role: Originated problem, advised on technical solution, edited paper.
Contribution: 20%

[LC1] Radoslav Ivanov[*], Hung Nguyen[o], **James Weimer**, Oleg Sokolsky, and Insup Lee. "Openice-lite: Towards a connectivity platform for the internet of medical things." In *2018 IEEE 21st International Symposium on Real-Time Distributed Computing (ISORC)*, pp. 103-106. IEEE, 2018.
*DOI:*10.1109/ISORC.2018.00022
Acceptance Rate: 54% (28 out of 51)
Summary: This paper presents OpenICE-lite, a middleware for medical device interoperability that also provides security guarantees and allows other internet-of-medical-things (IoMT) applications to view/analyze the data in real time.
Role: Originator of research concept and solution direction, guided solution, edited paper.
Contribution: 30%

REFEREED WORKSHOP PROCEEDINGS PAPERS

[Acceptance based on peer review of full papers.]

[Since joining Vanderbilt]

[W8] Evan Krueger[†], Taylor Carpenter[†], Kevin Leach, and **James Weimer**. "Towards a LLM-Based System for Generating and Validating Product Requirements." In *Proceedings of the 33rd ACM International Conference on the Foundations of Software Engineering*, pp. 1538-1539. 2025.
DOI: 10.1145/3696630.3731673
Summary: This paper presents a framework for a LLM-Based system to generate software product requirements and validate software satisfies the requirements.
Role: Originator of the problem and solution outline, edited paper.
Contribution: 30%

[Prior to joining Vanderbilt]

[W7] Amanda Watson[†], Hyonyoung Choi, Insup Lee, and **James Weimer**. "Raproto: an open source platform for rapid prototyping of wearable medical devices." In *Proceedings of the Workshop on Medical Cyber Physical Systems and Internet of Medical Things*, pp. 1-6. 2021.
DOI: 10.1145/3446913.3460315
Summary: This paper presents Raproto, an open-source, easy-to-use rapid prototyping platform that facilitates data collection and visualization from sensors on commercially available, off-the-shelf smartwatches.
Role: Originator of problem and solution, developed Raproto, edited paper.
Contribution: 70%

[W6] Fanxin Kong, Oleg Sokolsky, **James Weimer**, and Insup Lee. "State consistencies for cyber-physical system recovery." In *Workshop on Cyber-Physical Systems Security and Resilience (CPS-SR)*. 2019.
Summary: While the feasibility of CPS recovery is well demonstrated, one issue not fully addressed is that what kind of states should be used for the recovery. In this paper, we address this issue and claim to use consistent states.
Role: co-developed technical solution, edited paper.
Contribution: 20%

[W5] Hung Nguyen, Radoslav Ivanov[*], Sara B. DeMauro, and **James Weimer**. "Repulmo: A remote pulmonary monitoring system." *ACM SIGBED Review* 16, no. 2 (2019): 46-50.
DOI: 10.1145/3357495.3357501
Summary: This paper presents RePulmo, an open-source platform for secure and accurate remote pulmonary data monitoring. RePulmo satisfies both robustness and security requirements by utilizing hospital-grade pulse oximeter devices with multiple layers of security enforcement.
Role: Mentor: originator of problem, advised on technical solution, edited paper.
Contribution: 30%

[W4] **James Weimer**, Jose Araujo, Mani Amoozadeh, Seyed Alireza Ahmadi, Henrik Sandberg, and Karl Henrik Johansson. "Parameter-Invariant Actuator Fault Diagnostics in Cyber-Physical Systems with Application to Building Automation." *Control of Cyber Physical Systems*. 2013.
DOI: https://doi.org/10.1007/978-3-319-01159-2_10
Summary: This paper presents a robust method for performing active actuator fault detection and diagnostics (FDD) in heating ventilation and air conditioning (HVAC) systems. The proposed actuator FDD strategy, for testing whether an actuator is stuck in a given position, is designed on using an invariant hypothesis testing approach and is an improvement of a previous strategy that employed an adaptive detection strategy.
Role: Primary author. Originated problem, developed solution, wrote paper.
Contribution: 75%

[W3] **James Weimer**, Nicola Bezzo, Miroslav Pajic, George J. Pappas, Oleg Sokolsky, and Insup lee. "Resilient Parameter-Invariant Control with Application to Vehicular Cruise Control." *Control of Cyber Physical Systems*. 2013.
DOI: https://doi.org/10.1007/978-3-319-01159-2_11
Summary: This paper addresses the general problem of resilient control of unknown stochastic linear time-invariant (LTI) systems in the presence of sensor attacks. Motivated by a vehicle cruise control application, this work considers a first order system with multiple measurements, of which a bounded subset may be corrupted.
Role: Primary author. Originated problem, developed solution, wrote paper.
Contribution: 75%

[W2] **James Weimer**, Seyed Alireza Ahmadi[*], José Araujo, Francesca Madia Mele[*], Dario Papale[*], Iman Shames, Henrik Sandberg, and Karl Henrik Johansson. "Active actuator fault detection and diagnostics in hvac systems." In *Proceedings of the fourth ACM workshop on embedded sensing systems for energy-efficiency in buildings*, pp. 107-114. 2012.
DOI: 10.1145/2422531.2422551
Summary: This paper presents a new method for performing actuator fault detection and diagnostics (FDD) in heating ventilation and air conditioning (HVAC) systems. The proposed actuator FDD strategy, for testing whether an actuator is stuck in a single position, uses a two-tier approach that includes a dynamic model-based detector and a fast-deciding steady-state detector.
Role: primary author, developed problem, technical solution, and implementation.
Contribution: 70%

[W1] **James E. Weimer**, Bruno Sinopoli, and Bruce H. Krogh. "A relaxation approach to dynamic sensor selection in large-scale wireless networks." In *2008 The 28th International Conference on Distributed Computing Systems Workshops*, pp. 501-506. IEEE, 2008.
DOI: 10.1109/ICDCS.Workshops.2008.82
Summary: This paper introduces and empirically evaluates a dynamic sensor selection strategy. We propose a relaxation approach to solve the non-convex combinatorial optimization problem and demonstrate its applicability to large-scale sensor networks.
Role: primary author, developed problem, technical solution, and implementation.
Contribution: 75%

OTHER WORKSHOP PROCEEDINGS PAPERS

[Other workshop proceedings papers, not fully refereed, such as competition reports.]

[Prior to joining Vanderbilt]

[OW3] Taylor T. Johnson, Diego Manzanas Lopez, Luis Benet, Marcelo Forets, Sebastián Guadalupe, Christian Schilling, Radoslav Ivanov[o], Taylor J. Carpenter[*], **James Weimer**, and Insup Lee.

"ARCH-COMP21 category report: artificial intelligence and neural network control systems (AINNCS) for continuous and hybrid systems plants." *EPiC Series in Computing* 80 (2021).
DOI: 10.29007/kfk9
Summary: This paper presents the results of a friendly competition for formal verification of continuous and hybrid systems with artificial intelligence (AI) components.
Role: competitor (Verisig)
Contribution: 10%

[OW2] Sanjian Chen[o], **James Weimer**, Michael R. Rickels, Amy Peleckis, and Insup Lee. "Towards a Model-Based Meal Detector for Type I Diabetics." *6th Medical Cyber-Physical Systems Workshop (MedicalCPS)*, 2015.
Summary: This paper presents a novel meal-time detector that leverages a linearized physiological model to realize a (nearly) constant false alarm rate (CFAR) performance despite unknown model parameters and uncertain meal inputs.
Role: Originator of problem, developed CFAR detector, co-wrote paper
Contribution: 40%

[OW1] Alexander Roederer[o], **James Weimer**, Joseph Dimartino, Jacob Gutsche, and Insup Lee. "Towards Non-Invasive Monitoring of Hypovolemia in Intensive Care Patients." *6th Medical Cyber-Physical Systems Workshop (MedicalCPS)*, 2015.
Summary: This paper presents a photoplethsymgraphy-based monitor designed to be robust to waveform artifacts and health variability in the underlying patient population.
Role: Originator of problem, developed CFAR detector, co-wrote paper
Contribution: 40%

REFEREED ABSTRACTS

[Acceptance based on peer review of abstracts]

[Prior to joining Vanderbilt]

[A4] Rajeev Alur, Insup Lee, Rahul Mangharam, Mayur Naik, Oleg Sokolsky, **James Weimer**, Houssam Abbas. “Towards Scenario-Based Design and Verification of Resilient Cyber-Physical Systems - Extended Abstract.” *1st Workshop on Cyber-Physical System Security and Resilience (CPS-SR*), 2018.
Summary: This extended abstract outlines the concept of scenario-based design and verification of resilient cyber-physical systems.
Role: co-wrote extended abstract, co-developed concept.
Contribution: 20%

[A3] Shivani Agarwal, **James Weimer**, Jack Eiel, Insup Lee, Amy Peleckis, Michael Rickels. "Use of a Novel Algorithm to Measure Differences in Adherence by Age." *American Diabetes Association: 77th Scientific Sessions*, 2017
Summary: This paper presents a recently developed algorithm to measure adherence to insulin pump treatment and explore its utility as a new objective measure of adherence to predict glycemic control in adults with type 1 diabetes.
Role: algorithm developer, co-wrote abstract
Contribution: 50%

[A2] Miroslav Pajic, Nicola Bezzo, **James Weimer**, Rajeev Alur, Rahul Mangharam, Nathan Michael, George J. Pappas et al. "Towards synthesis of platform-aware attack-resilient control systems." In *Proceedings of the 2nd ACM international conference on High confidence networked systems*, pp. 75-76. 2013.
DOI: 10.1145/2461446.2461457
Summary: This extended abstract presents a conceptual solution to synthesizing a platform-aware attack-resilient controller.
Role: co-developed conceptual solution, edited abstract.
Contribution: 20%

[A1] Miroslav Pajic, Nicola Bezzo, **James Weimer**, Oleg Sokolsky, Nathan Michael, George J. Pappas, Paulo Tabuada, and Insup Lee. "Demo abstract: Synthesis of platform-aware attack-resilient vehicular systems." In *2013 ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, pp. 251-251. IEEE, 2013.
Summary: introduced a design framework for development of high-confidence vehicular control systems that can be used in adversarial environments. The framework employs control system design techniques (control-level defenses) that guarantee that the vehicle will maintain control, possibly at a reduced efficiency, under a variety of externally-originating attacks on sensors, actuators, and communication and computation resources.
Role: developed code for demo, edited paper
Contribution: 20%

TUTORIAL PRESENTATIONS

[Acceptance based on peer review of abstracts or short papers]

[Prior to joining Vanderbilt]

[T3] James Weimer, Oleg Sokolsky, and Insup Lee. "Tutorial Abstract: Parameter-Invariant Monitor Design for Cyber-Physical Systems." *Cyber Physical Systems Week (CPSweek)*, 2016.
Summary: This tutorial presents how to design parameter-invariant monitors for cyber-physical systems.
Role: developed tutorial material, presented two of three modules, wrote abstract.
Contribution: 75%

[T2] James Weimer, Oleg Sokolsky, and Insup Lee. "Tutorial Abstract: Robust Medical Monitor Design." *International Conference on Healthcare Informatics (ICHI)*, 2015.
Summary: This tutorial presents how to design parameter-invariant monitors for medical monitors.
Role: developed tutorial material, presented two of three modules, wrote abstract.
Contribution: 75%

[T1] James Weimer, Oleg Sokolsky, and Insup Lee. "Tutorial Abstract: Parameter-Invariant Monitor Design for Cyber-Physical Systems." *Embedded Systems Week (ESweek)*, 2015.
Summary: This tutorial presents how to design parameter-invariant monitors for cyber-physical systems.
Role: developed tutorial material, presented two of three modules, wrote abstract.
Contribution: 75%

PATENTS AND PATENT APPLICATIONS

[Since joining Vanderbilt]

[P6] **James Weimer**. VU25108 (222230-8791) METHODS, SYSTEMS, AND DEVICES FOR EARLY PREDICTION OF LIFE-THREATENING UTERINE ATONY USING MATERNAL HEART RATE – Provisional Patent

[P5] **James Weimer**, Amanda Watson†, Stefanie Modri, and Insup Lee. VU23168 (222230-8571) Provisional Application for SYSTEMS AND METHODS FOR POSTPARTUM HEMORRHAGE RISK PREDICTION USING MATERNAL HEART RATE – Provisional Patent

[Prior to joining Vanderbilt]

[P4] Amanda Watson†, Claire Kendell°, **James Weimer**, Insup Lee. “A method for determining levels of a biomarker of a user by a mobile device” – Provisional Patent Filed.

[P3] **James Erich Weimer**, and Steven Russell Messé. "Monitoring of upper limb movements to detect stroke." U.S. Patent Application 18/563,707, filed July 11, 2024.

[P2] Jason Van Batavia, Stephen A. Zderic, **James Weimer**, Brett Garberman, Qizhi Li, Xin Liu, Igor Shamis, Yuriy M. Mirochnik, Alexander Gutsol. “UROFLOW MONITORING SYSTEM AND METHOD”, US17/636,950. Submitted.

[P1] Sanjian Chen[o], **James Erich Weimer**, and Insup Lee. "Methods, systems, and computer readable media for physiology parameter-invariant meal detection." U.S. Patent 10,792,423, issued October 6, 2020.

Licenses Optioned/Executed

[Since joining Vanderbilt]

[L4] License [P6] to Vasowatch.

[L3] Licensed [P5] to Vasowatch.

[Prior to joining Vanderbilt]

[L2] Licensed [P4] to Luminosity.

[L1] Licensed [P3] to Neuralert.

Invited Talks [excludes conference presentations]

[T35] *Connecting Care: Innovations in the Internet of Medical Things.* Emerging Trends in Health Technologies. Philadelphia. October 2025.

[T34] *CPS in the Age of AI.* National Science Foundation Cyber-Physical Systems PI meeting. March 2025.

[T33] *Internet of Medical Things: Research to Impact.* World Bonzai Forum. Sendai Japan. March 2025.

[T32] *Internet of Medical Things at Vanderbilt.* Vanderbilt University Medical Center Ophthalmology Symposium. November 2024.

[T31] *Internet of Medical Things at Vanderbilt.* University of Leeds industrial collaboration symposium, Nashville. October 2024.

[T30] *Internet of Medical Things: Medical Device Security.* DARPA CASTLE site visit, Nashville. July 2024.

[T29] *Internet of Medical Things: From Ideas to Products.* Workshop on Future Technologies for Emergency Response and Public Safety. June 2024.

[T28] *Securing Learning-Enabled Systems: Being More than Data Subscribers.* Vanderbilt Workshop on Biosecurity, AI, and Modern Conflict. April 2024.

[T27] *Internet of Medical Things: Learning-Enabled Medical Cyber-Physical Systems on the Edge.* Presented at Vanderbilt Electrical and Computer Engineering Day. April 2024.

[T26] *Commercializing Learning-Enabled Medical Cyber Physical Systems.* Presented at NSF Cyber-Physical Systems PI meeting. March 2024.

[T25] *Internet of Medical Things: Medical Cyber-Physical Systems on the Edge.* Presented at Vanderbilt Department of Computer Science Industrial Advisory Committee Meeting. December 2023.

[T24] *Internet of Medical Things: Medical Cyber-Physical Systems on the Edge.* Presented at Vanderbilt Institute for Software Integrated Systems. September 2023.

[T24] *Internet of Medical Things: Medical Cyber-Physical Systems on the Edge.* Presented at Vanderbilt Institute for Software Integrated Systems. September 2023.

[T23] *Market-Informed Design for Safe Autonomous Medical Systems.* Presented at Vanderbilt Institute for Surgery and Engineering. May 2023.

[T22] *Monitors for Learning-Enabled Components: ReCal and ModelGuard.* Presented at DARPA Assured Autonomy Site Visit, Philadelphia. December 2022.

[T21] *Personalizing Medicine in an Impersonal World: Design and Analysis of Safe Autonomous Medical Systems.* Presented at Vanderbilt University Biomedical Engineering Seminar, November 2022.

[Prior to joining Vanderbilt]

[T20] *Personalizing Medicine in an Impersonal World: Opportunities and Challenges in the Internet of Medical Things.* Presented at University of Pennsylvania Medicine, April 2022.

[T20] *Personalizing Medicine in an Impersonal World: Design and Analysis of Safe Autonomous Medical Systems.* Presented at Vanderbilt University, January 2022.

[T19] *Sensing, Learning, and Adaptation: Design and Analysis of Learning-Enabled Medical Systems.* Presented at NSF Smart and Connected Health PI Meeting, March 2021.

[T18] *Anomaly Detection for Safe Autonomy: Confidence Calibration using Context.* Presented at Semiconductor Research Corporation, November 2020.

[T17] *Verification and Monitoring of Learning.* ARO MURI Kickoff Meeting, June 2020.

[T16] *Personalizing Health in an Impersonal World: Design and Analysis for Safe Autonomous Medical Systems.* Presented at Washington University, March 2020.

[T15] *Personalizing Health in an Impersonal World: Design and Analysis for Safe Autonomous Medical Systems.* Presented at Washington University, February 2020.

[T14] A*utonomous Medical Systems: the Future of Personalized Health.* Presented at Penn-India Technology Innovation Forum, Mumbai India, January 2020.

[T13] *Medical Cyber-Physical Systems and Autonomy: Beyond Pacemakers and Pancreases.* Presented at NSF/NIH Smart and Connected Health PI Meeting, January 2020.

[T12] *Personalizing Health in an Impersonal World: Design and Analysis for Safe Learning-Enabled Medical Systems.* Presented at University of Illinois Urbana-Champaign (UIUC), November 2019.

[T11] *Personalizing Health in an Impersonal World: Design and Analysis for Safe Learning-Enabled Medical Systems.* Presented at Vanderbilt University, October 2019.

[T10] *Personalizing Health in an Impersonal World: Design and Analysis for Safe Learning-Enabled Medical Systems.* Presented at Washington University, October 2019.

[T9] *Resilience in Medical Cyber-Physical Systems.* Presented at NSF Workshop on Grand Challenges in Resilience, Purdue University. March 2019.

[T8] *The Internet of Medical Things: Personalizing Medicine in an Impersonal World.* Presented at NSF ASSIST Workshop, March 2019.

[T7] *The Internet of Medical Things: Personalizing Medicine in an Impersonal World.* Presented at Carnegie Mellon University, May 2018.

[T6] *The Internet of Medical Things: Personalizing Medicine in an Impersonal World.* Presented at Carnegie Mellon University, May 2018.

[T5] *Towards Composition of Cyber-Physical Security Techniques.* Presented at ONR RHIMES PI Meeting, March 2018.

[T4] *Challenges in (Medical) Cyber-Physical System Security.* Presented at the workshop on Cyber-Physical Systems Security, NSF CPS PI meeting, November 2017.

[T3] *The Internet of Medical Things: Personalizing Medicine in an Impersonal World.* Presented at Intel Corporation, August 2017.

[T2] *Personalizing Medicine in an Impersonal World: Parameter-Invariant Design for Cyber-Physical Systems*. Presented at Children's Hospital of Philadelphia, May 2016.

[T1] *Personalizing Medicine in an Impersonal World: Parameter-Invariant Design for Cyber-Physical Systems*. Presented at University of Pennsylvania, May 2016.

ARTIFACTS AND IMPLEMENTATIONS

- Medical devices and systems:
  [Developed or Maintained by Vanderbilt]

  - VIBRANT: a non-invasive predictor of life-threatening uterine atony (2025-present)
  - VasowatchAI: a non-invasive predictor for postpartum hemorrhage. (2022-present)
  - StrokeDetectAI: a non-invasive monitor for in-hospital stroke (2019-present)
    https://weimerj.github.io/StrokeDetectAI/
  - PPHdetection: a wearable optical postpartum hemorrhage detection system (2020-present)
    https://weimerj.github.io/PPHdetection/
  - Raproto: An Open Source Platform for Rapid Prototyping of Wearable Medical Devices (2020-present)
    https://github.com/weimerj/Raproto-Tizen
  - RePulmo: remote pulmonary monitoring for infants (2017-present);

  [Developed or Completed prior to joining Vanderbilt]

  - Meal Detection for Type 1 Diabetes (2016-2022). US Patent 10,792,423.
  - SenseSupport: Monitoring Bulimia Nervosa using blood glucose (2018-2021);
  - Improving gating of proton therapy machines (2017-2021);
  - Uroflow: at-home monitoring of urinary flow patterns in children (2017-2021);
  - Smart alarms for the intensive care unit (2015-2020);
  - HypoCount: a clinical decision support system for analyzing overnight hypoglycemia (2015 -2022).
- Software packages and platforms:
  [Developed or Maintained by Vanderbilt]

  - Raproto: An Open Source Platform for Rapid Prototyping of Wearable Medical Devices (2020-present)
    https://github.com/weimerj/Raproto-Tizen

[Developed or Completed prior to joining Vanderbilt]

- Verisig: an open-source tool for verification of neural networks in-the-loop (2019-2022): https://github.com/verisig
- OpenICE-lite: an open-source medical device interoperability platform for connecting and securing the internet of medical things (2015-2020); https://github.com/samdware/openice-lite
- DataWiz: a clinician-facing parser for the internet-of-medical-things (2016-2021).

- Environmental monitoring *[Developed or Completed prior to joining Vanderbilt]*:
  - CO2 Sequestration Testbed: a hardware-in-the-loop testbed for simulating CO2 advection and diffusion from subterranean carbon sequestration sites (2007-2011).
- Smart buildings *[Developed or Completed prior to joining Vanderbilt]*:
  - KTH HVAC Testbed, an open-source testbed for automatic control of heating, ventilation, and air conditioning systems (2011-2018).
- Autonomous systems and robotics *[Developed or Completed prior to joining Vanderbilt]*:
  - Deployment of resilient speed estimation for automotive cruise control in an american built car (2013-2017)

RESEARCH MENTORING (CURRENT)

Postdoctoral Fellows / Research Engineers / Research Scientists

[RS4] Michael Laurenzano. Senior Research Scientist. Vanderbilt University. 2026-present.

[RS3] Chad Ice. Senior Research Engineer. Vanderbilt University. 2025-present.

[RS2] Evan Krueger. Senior Research Engineer. Vanderbilt University. 2025-present.

[RS1] Taylor Carpenter. System Architect. Vanderbilt University. 2024-present.

Current Ph.D. Students

[CS3] Yue Zhao. “Data Requirement Constrained Learning in Time-Series Data”. Vanderbilt University. 2nd year.

[CS2] Zhiting Zhou. “Data Repair for Learning-Enabled Medical Systems”. Vanderbilt University. 2nd year.

[CS1] Chi Phuong Ngoc Huynh. “Data Design for Cyber-Physical Systems”. Vanderbilt University. 3rd year.

RESEARCH MENTORING (PAST / GRADUATED ALUMNI)

Postdoctoral Fellows / Research Engineers / Research Scientists:

[PDA2] Amanda Watson (2020 - 2022): Internet-of-Medical Things. University of Pennsylvania. (co-advised w/ Insup Lee). Next/current position: Assistant professor, Department of Electrical and Computer Engineering, University of Virginia.

[PDA1] Shawn Li (2019 - 2022): Internet-of-Medical Things. University of Pennsylvania. (co-advised w/ Insup Lee). Next/current position: postdoctoral researcher, Department of Mechanical Engineering, University of Virginia.

Graduated Ph.D. Students:

[DA2] Sydney Pugh. *"*Weak Supervision for Autonomous Medical Systems*"*. University of Pennsylvania. 2024 (co-Advised w/ Insup Lee). Next/current position: Post-doc, Department of Computer and Information Science, University of Pennsylvania (primary mentor: Kevin Johnson)

[DA1] Radoslav Ivanov. *"Context-Aware Sensor Fusion for Securing Cyber-Physical Systems"*. University of Pennsylvania. 2017 (co-Advised w/ Insup Lee). Next/current position: Assistant professor, Department of Computer Science, Rensselaer Polytechnic University

OUTREACH/EDUCATION ACTIVITIES

[O13] **College of Connected Computing / Computer Science faculty search committee**. Vanderbilt University. 2026

[O12] **College of Connected Computing / Computer Science faculty search committee**. Vanderbilt University. 2025

[O11] **Electrical and Computer Engineering faculty search committee**. Vanderbilt University. 2024

[O10] **Innovation Catalyst Review Committee**. Vanderbilt University. 2023 - present.

[O9] **Dare to Grow campaign kick-off participant.** Vanderbilt University. April 2023.

[O8] **Innovation Ambassador**. Vanderbilt University. 2022 - present.

[O7] **Penn Community Collaboratory for Co-Creation**. Executive Committee member. University of Pennsylvania, 2021 - 2022.

[O6] **Penn Health Tech**. Technical Advisor. University of Pennsylvania, 2020-2022.

[O5] **Penn-Trilogy Bootcamps**. Faculty advisor for Data Science and Cyber-Security Bootcamps. University of Pennsylvania, 2019 - 2022.

[O4] **Women's Society of Cyberjitsu**. Guest teacher. Taught a biomedical signal processing outreach workshop called "Music-from-the-heart", 2019.

[O3] **Women in Computer Science High School Day**. Medical Device Lab tour and demos. University of Pennsylvania, 2018 & 2019.

[O2] **Medical Device Club**. Executive Director. Vanderbilt University, 2022-present. University of Pennsylvania, 2017 - 2022.

[O1] **Penn Health Tech**. Education committee member. University of Pennsylvania, 2017-2019.

PROFESSIONAL EXPERIENCE

- **Research Assistant**
  ECE Department, Carnegie Mellon University, Pittsburgh, PA
  Research on large-scale multi-source detection using wireless sensor networks.
  June 2007 - May 2010

- **Research Assistant**
  ECE Department, Carnegie Mellon University, Pittsburgh, PA
  Research on modeling and implementation of mode-switching with application to ilure analysis in steer-by-wire systems.
  August 2005 - May 2007

- **Electrical Engineer**
  Delphi Electronics and Safety, Delphi Automotive, Kokomo, IN
  System monitoring - designed a multi-channel SPI-bus monitoring tool.
  June 2005 - August 2005

- **Electrical Engineer**
  Delphi Electronics and Safety, Delphi Automotive, Kokomo, IN
  System validation - designed and verified component models.
  June 2004 - August 2004

PROFESSIONAL SERVICE

Editorial Boards

- ACM Transactions on Computing for Healthcare (ACM HEALTH)
  Associate Editor 2019 - present
- ACM Transactions on Cyber-Physical Systems (ACM TCPS)
  Associate Editor 2018 - present

Workshop / Conference Organization

- IEEE/ACM Conference on Conference on Connected Health: Applications Systems and Engineering – Finance Chair (**CHASE 2026**)
- NSF Cyber-Physical Systems Rising Stars Workshop – General Chair (**CPS-RS 2025**)
- IEEE/ACM Conference on Conference on Connected Health: Applications Systems and Engineering – Poster Chair (**CHASE 2025**)
- International Conference on Assured Autonomy – Finance Chair **(ICAA 2025)**
- International Conference on Assured Autonomy – Program Chair **(ICAA 2024)**
- International Conference on Cyber-Physical Systems -- General Chair
  (ICCPS 2021)
- International Conference on Cyber-Physical Systems -- Program Chair
  (ICCPS 2020)
- IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies Workshops Chair **(CHASE 2019),** Special Session Chair **(CHASE 2020)**
- International Conference on Cyber-Physical Systems -- Demo/Poster Chair
  (ICCPS 2019)
- ACM/IEEE Workshop on Medical Cyber-Physical Systems
  (**MCPS 2018-2019, 2021**)
- Smart Grid Summer School (2012)

Technical Program Committees

- ACM/IEEE International Conference on Cyber Physical Systems
  (ICCPS 2016-present)
- IEEE ACM Conference on Connected Health: Applications Systems and Engineering
  (CHASE 2017-present)
- IEEE Workshop on the Internet of Safe Things (Co-located with Oakland 2021)
- Workshop on Hybrid Systems Biology
  (HSB 2018-2020)
- International Conference on Communications Systems and Networks
  (COMSNETS 2017)
- International Conference on Advances in Computing, Communications, and Informatics
  (ICACCI 2017)
- International Symposium on Signal Processing Applications in Buildings

(GlobalSIP 2015)

- EIT ICT Labs Workshop on Smart Grid Security
  (SmartGridSec 2012)

Journal Reviewer

- ACM Transactions on Computing for Healthcare (HEALTH)
- ACM Transactions on Cyber Physical Systems (TCPS)
- IEEE Transactions on Automatic Control (TAC)
- Automatica
- IEEE Transactions on Control System Technology (CST)
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- ACM Transactions on Sensor Networks (TOSN)
- IEEE Internet of Things Journal (IoTJ)

Conference Reviewer

ACM/IEEE International Conference on Cyber-Physical Systems **(ICCPS 2014 - present)**; IEEE/ACM Connected Health: Applications, Systems, and Engineering Technologies (**CHASE 2017-present**); IEEE Conference on Decision and Control **(CDC 2009 - 2018)**; American Control Conference **(ACC 2009 - 2018)**; ACM International Conference on Hybrid Systems: Computation and Control **(HSCC 2016-2018)**; International Conference on Runtime Verification **(RV 2013 - 2014)**; Conference on High Confidence Networked Systems **(HiCoNS 2012 - 2014);** Spring Simulation Conference **SpringSim (2020);** SafeThings **(2020 - 2021)**

Government Activities

- *Panelist, NSF Cyber Physical Systems PI meeting 2025.*
- *NSF Panelist CISE, CNS 2025 (2 times)*
- *Panelist, NSF Cyber Physical Systems PI meeting 2024.*
- *NSF Panelist CISE, CNS 2024 (3 times)*
- *NSF Panelist CISE 2023 (4 times)*
- *NSF Panelist CISE 2022*
- *NSF Panelist CISE 2021*
- *Panelist, NSF Smart and Connected Health PI Meeting, 2020*
- *NITRD Federal Listening Session on Interoperability of Medical Devices, Data, and Platforms to Enhance Patient Care, panelist, 2019*
- *NSF Grand Challenges in Resilience Workshop, panelist, 2019*
- *NSF Workshop on Reconfigurable Sensor Systems Integrated with Artificial Intelligence and Data Harnessing to Enable Personalized Medicine Workshop, panelist, 2019*
- NSF CPS PI meeting Panelist: Workshop on CPS Security & Privacy: From Theory to Practice A Decade-Long Research Plan, 2017
- NIST Panelist: CPS Framework Open Source Workshop, 2017
- NSF Panelist: 2015 1x

FUNDING

2016 – present: Funded Research Grants, Contracts, and Fellowships.

Total Research Funding (PI + Co-PI, active and completed projects): ~ $30.2M
Research Funding as PI: $3.3M ($1.2M since joining Vanderbilt).
Research Funding as Co-PI: $26.9M ($7M since joining Vanderbilt).

Pending Grants

[all at Vanderbilt]

[PG2] Bennet Landman (PI), James Weimer (Co-PI - Sensing Lead), et. al. "Multi-Modal AI for Early Lung Cancer Detection", Marcus Foundation, $18M.

[PG1] James Weimer (PI), Kevin Leach (Co-PI) "SCH: IoMT-SIM: Software Instrumentation, Emulation, and Repair of Internet of Medical Things", NSF, $1M.

Awarded Grants

[Since joining Vanderbilt]

[G28] Himanshu Neema (PI), James Weimer (Co-PI - TA 2 lead), Sandeep Neema, Kevin Leach. "ARMOR-H: Advanced Risk Management and Operational Resilience for Hospitals", ARPA-H, $5M. 10/1/2025 - 9/30/2026.

[G27] James Weimer (Founder Vasowatch, Inc.) "Investment in Vasowatch, Inc." Vanderbilt Innovation Investment fund, $300k (one time investment)

[G26] James Weimer (PI), Meiyi Ma. "Advanced Resuscitation and Medical-Skills for Operational Readiness - ARMOR", US Army, $114k. 9/1/2025-8/31/2026.

[G25] Kevin Leach (PI), James Weimer (Co-PI), Barish James Weimer (PI). "ARPA-H: BALAM-D: Binary Assurance Lodestar for Advancing Medical Devices", ARPA-H, $2M. 5/1/2024 - 4/30/2026.

[G24] James Weimer (PI). "Medical Realities of Large-Scale Combat Operations", US Army, $150k. 5/10/2024-2/5/2025.

[G23] *CAREER: Learning-Enabled Medical Cyber-Physical Systems*. National Science Foundation, Award ID: 2339637, $575K, 4/1/2024 - 3/31/2029. James Weimer (PI).

[G22] *Medical Device Club.* Analog Devices International, $10k, 6/1/2022. James Weimer (PI) (gift)

[G21] *Internet of Medical Things Lab.* Vanderbilt Institute of Surgery and Engineering (VISE), $10k, 5/1/2022. James Weimer (PI). (seed grant)

[G20] *Momitor: Wearable technology for detecting postpartum hemorrhage. National Institute of Health (NIH), 1R41HL164191-01 (subcontract from Vasowatch),* $40K, *12/1/2022 - 9/30/2023.* James Weimer (PI).

[Prior to joining Vanderbilt]

[G19] *Wearable Device for Early Postpartum Hemorrhage Detection.* Penn Health Tech, $45K, 9/1/2021 - 8/31/2022. James Weimer (PI), Stefanie Modri (Co-PI), Kimberly Trout (Co-PI).

[G18] *SCC-IRG JST: Active sensing and personalized interventions for pandemic-induced social isolation.* National Science Foundation, Award ID: 2125561. $770K, 10/1/2021 - 9/30/2024. Insup Lee (PI), George Demiris, Oleg Sokolsky, James Weimer.

[G17] *CPS: AutoWean: Foundations of Autonomous Medical CPS for Mechanical Ventilation Weaning.* National Institute of Health, R01EB029767, $1.1M, 9/01/2019 - 7/31/2022. James Weimer (PI-lead), Insup Lee (PI), Barry Fuchs (Co-I), Oleg Sokolsky (Co-I).

[G16] *SCH: Monitoring safety and adherence of pain management through remote opioid sensing and analysis.* National Institute of Health, R01EB029363, $905K, 9/30/2019 - 6/30/2023. James Weimer (PI-lead), Insup Lee (PI), Ping Wang (PI), Shu Yang (PI).

[G15] *Using Continuous Glucose Monitoring to Detect and Intervene on Maintenance Factors for Transdiagnostic Binge Eating Pathology,* National Institutes of Health STTR R43 (subcontract from Promptworks), $30K, 09/2019-08/2021. James Weimer (PI).

[G14] *Robust Concept Learning and Lifelong adaptation against adversarial attacks.* ARO MURI, $6.26M, 5/2020-4/2025. Insup Lee (PI), Osbert Bastani, Kostas Daniilidis, Eric Eaton, Dan Roth, James Weimer, Julia Parish-Morris.

[G13] *SCH: INT: Collaborative Research: Smart Alarms 2.0: Foundations for Caregiver-in-the-loop Suppression of Non-Informative Alarms.* National Science Foundation, $1.2M, 9/01/2019 - 08/31/2023. Insup Lee (PI), Christopher Bonafide, Sara DeMauro, James Weimer, James Won.

[G12] *Anomaly Detection for Safe Autonomy.* Semiconductor Research Corp, $100K, 07/2019-06/2022. Insup Lee (PI), Oleg Sokolsky, James Weimer.

[G11] *Pitch Plus: A Device to Reduce Overuse Injuries and Improve Rehabilitation in Youth Baseball Players.* Dennis Drummond Interdisciplinary Research Grant, $7.4K, 12/2018-12/2019. Elliot Greenberg (PI), James Weimer, J. Todd Lawrence.

[G10] *Pediatric patient safety learning laboratory to re-engineer continuous physiologic monitoring systems.* NIH R18, $2.5M, 10/2018-10-2022. Christopher Bonafide (PI), James Won, Sara DeMauro, Insup Lee, Sarah Rottenburgh, James Weimer.

[G9] *The DOVE Device.* Penn Medical Device Accelerator, $10K, 11/2018 - 11/2019. Jake Brenner (PI), Cynthia Dahl, James Weimer.

[G8] *Proton Target and Collimator Scanning on the SARRP.* Penn Radiation Oncology Grant, $20K, 11/2018 - 11/2019. Eric Diffenderfer (PI), Michelle Kim, James Weimer.

[G7] T*owards Improving Glycemic Control through Behavioral Feedback in Type 1 Diabetes.* Pennsylvania Tobacco Fund, $200K, 9/2018 - 8/2022. Insup Lee (PI), Shivani Agarwal, Michael Rickels, James Weimer.

[G6] *Synergy: Collaborative Research: Security and Privacy-Aware Cyber-Physical Systems.* NSF-Intel Partnership, $190K, 7/2018 – 6/2020. Insup Lee (PI) and James Weimer.

[G5] *Using Continuous Glucose Monitoring to Detect Eating Disorder Symptoms in Bulimia Nervosa.* Hilda and Preston Davis Foundation, $200K, 5/2018 - 5/2020. Adrienne Juarascio (PI), Evan Forman, Stephanie Manasse, James Weimer, Zoe Zhang.

[G4] *Integrated Static and Dynamic Approaches to High-Assurance for Learning-Enabled Cyber-Physical Systems.* DARPA Assured Autonomy (AA), $4.8 M, 4/2018 - 3/2022. Insup Lee (PI), Rajeev Alur, Daniel Lee, Manfred Morari, George Pappas, Oleg Sokolsky, James Weimer, Nicola Bezzo.

[G3] *AFFIRM: Scenario-Based Design and Verification of Resilient Cyber-Physical Systems.* DARPA Cyber-Assured Systems Engineering (CASE), $3.0M, 2/2018 - 2/2022. Rajeev Alur (PI), Insup Lee, Rahul Mangharam, Mayur Naik, Oleg Sokolsky, James Weimer.

[G2] *Development of Control-Aware Cyber Techniques for Attack-Resilient Industrial & Combat Systems,* Office of Naval Research, $2.7M, 10/2016 - 9/2019. Insup Lee (PI), George J. Pappas, Oleg Sokolsky, James Weimer, Miroslav Pajic, Nicola Bezzo.

[G1] *Prehabilitation to Improve Postoperative Outcomes and Limit Complications.* Penn Center for Precision Medicine, $100K, 12/2016 - 5/2018. Carsten C. Starke, Nalaka Gooneratne, Junxin Li, Greg Grant, Jason H. Moore, Garret A. FitzGerald, Elizabeth Mahanna, Gwo-Chin Lee, Yvette Sheline, James Weimer.

Declined Grants

[Since joining Vanderbilt]

[DG10] CARECOM: Care Delivery Platform Mission Orchestration Middleware. ARPA-H. $6M, James Weimer (PI). 10/1/2024 - 9/30/2028

[Prior to joining Vanderbilt]

[DG9] *Foundations for Scalable Learning-Enabled Co-Design of Cyber-Physical Systems.* DARPA Symbiotic Design, $6M, 5/1/2020 - 4/30/2024. Oleg Sokolsky (PI), Osbert Bastani, Insup Lee, Lyle Ungar, James Weimer.

[DG8] *SCH: INT: Collaborative Research: Development and assessment of a photonic healthcare technology for early detection of respiratory syncytial virus.* National Science Foundation, $1.1M, 11/1/2019 - 10/31/2023. Lan Yang (PI), Gaya Amarasinghe, Abraham Qavi , James Weimer.

[DG7] *SCC: Facilitating Social Inclusion Through Cyber-Physical Interactions*. National Science Foundation, $1M, 5/1/2018-4/30/2022. Insup Lee (PI), George Demiri, Zack Ives, Ani Nenkova, Therese Richmond, Oleg Sokolsky, James Weimer.

[DG6] *STICHES: Secure and Trustworthy Intelligent Composable Heterogeneous Systems for IoBT*. W911NF-17-S-0005 Internet of Battlefield Things (IoBT) Collaborative Research Alliance (CRA), $21M, 3/1/2018-2/28/2023. Insup Lee (PI), Rajeev Alur, George J. Pappas, Oleg Sokolsky, James Weimer, John A. Stankovic, John Lach, Kamin Whitehouse, Lu Feng, Miroslav Pajic, Mary Cummings, Cynthia Rudin, Ali Jadbabaie, Tamara Broderick, Patrick Jaillet, Asuman Ozdaglar, Suvrit Sra.

[DG5] *CPS: Frontier: Collaborative Research: Rigorous Design and Analysis of Closed-Loop Medical CPS*. National Science Foundation, $5M, 11/1/2017-10/31/2022. Insup Lee (PI), Bill Hanson, Oleg Sokolsky, James Weimer, Andrea Gabrielli, Maurizio Cereda, Jin-Oh Hahn, Mary Cummings, Miroslav Pajic, Lu Feng

[DG4] *CPS: Medium: Collaborative Research: SPMS: Secure Personalized Medical Systems: From Theory to Practice*. National Science Foundation, $1M, 11/1/2017-10/31/2021. Saswati Sarkar (PI), James Weimer, Ioannis Paschalidis.

[DG3] *SCH: INT: Improving Safety and Adherence of Pain Management Through Predictive Monitoring and Analysis*. National Science Foundation, $900K, 3/1/2017-2/28/2020. Insup Lee (PI), Oleg Sokolsky, James Weimer, Andrea Gabrielli, Maurizio Cereda, Michael Ashburn, Eric VanEpps

[DG2] *QuBBD: Developing Robust Classification Techniques for Polysomnography Data to Diagnose Depression*. National Science Foundation, $640K, 3/1/2017-2/28/2020. James Weimer (PI), Nalaka Gooneratne, Michael Thase.

[DG1] *CPS: Frontier: Collaborative Research: Rigorous Design and Analysis of Closed-Loop Medical CPS*. National Science Foundation, $6M, 11/1/2016-10/31/2021. Insup Lee (PI), Bill Hanson, George Pappas, Rita Powell, Oleg Sokolsky, James Weimer, Andrea Gabrielli, Maurizio Cereda, Jin-Oh Hahn, Mary Cummings, Miroslav Pajic, Lu Feng

ENTREPRENEURIAL ACTIVITIES

- **Co-Founder of Neuralert Technologies, LLC**
  Robust wearable monitors to rapidly identify critically important neurological events such as stroke. Co-founder and developer of physiological signal processing algorithms.
  https://neuralert.co/

- **Co-Founder of Vasowatch LLC**
  Robust wearable monitors to provide early detection of postpartum hemorrhage. Co-founder and developer of physiological signal processing algorithms.
  https://www.vasowatch.com/