2018

UNIVERSITY OF PENNSYLVANIA

Penn Engineering | GRASP Laboratory PRECISE

INDUSTRY SYMPOSIUM

Philadelphia, Pennsylvania
February 2nd & 3rd

WELCOME INDUSTRY

Aescape	Eric Litman
Amazon Robotics	Parris Wellman
Anki, Inc.	Bran Neuman
	Chris Starr
CCM Real Estate	Terence O'Connell
Children's Hospital of Philadelphia	Chris Bonafide
	Jorge Guerra
	Todd Lawrence
	Helen Loeb
	Vinay Nardkarni
Cognitive TPG	Jizhou Zhang
Comcast	Dagaen Golomb
	Prasad Rao
Draper	Gian Luca Mariottini
GlaxoSmithKline	Matt Burke
GM	Ramesh S
Greppo	Eza Koch
Humanistic Robotics, Inc.	Samuel Reeves
Intel Labs	Justin Gottschlich
Lehigh University	Liang Cheng
	Mooi Choo Chuah
LG	Anupam Kaul
Lutron Electronics Co., Inc.	Chaitanya Bhargava
	Peeral Malani

WELCOME INDUSTRY

MathWorks	Giampiero Campa
	Pulkit Kapur
Medtronic	Jaimeen Kapadia
Microsoft Research	Ashish Kapoor
MIT Lincoln Laboratory	Michael Chan
National Grid	Yoon Soo Lee
NBC Universal Media, LLC	Kevin Alcedo
NIST	Yan Lu
Nokia Bell Labs	Prasanth Ananth
	Bong Ho Kim
NVIDIA	Serena Cheng
	Ben Firner
	Urs Muller
	Nischal Prasad
OPEX	Ola Stahl
	Alex Stevens
	Nenad Vujovic
PECO	Aileen Gallagher
PowerInsight Inc.	Brian Zima
Qualcomm	Stephen Chaves
	Ross Kessler
	Alex Kushleyev
	Paul Martin
	Daniel Mellinger
	Matthew Turpin

WELCOME INDUSTRY

Robotic Research, LLC	Joseph Putney
	Rei Suzuki
RRE Ventures	Stuart Ellman
	Raju Rishi
SAP	Shwetha Shetty
Setvi	Raheem Ghouse
Siemens	Zhen Song
SK	Hyun Park
Synfluent Corporation	Jefferson Martin
Temple University	Li Bai
The Traffic Group, Inc.	Wes Guckert
	Renata Haberkam
Toyota	BaekGyu Kim
United Technologies Research	Edward Tunstel
Wabtec Corporation	Robert Bourg
Zoox	Andrew King

GRASP / PRECISE
INDUSTRY SYMPOSIUM

The GRASP/PRECISE Industry Symposium is a 1-1/2 day symposium of leading executives and engineering involved in cutting-edge robotics, cyber-physical systems and Internet of Things. Prominent speakers from industry and academia will be featured, along with ample networking opportunities with GRASP and PRECISE students, alumni and industry representatives.

Penn Engineering | GRASP Laboratory

The General Robotics, Automation, Sensing and Perception (GRASP) Lab is an inter-disciplinary research center at the University of Pennsylvania, consisting of students, faculty, and staff from the departments of Computer and Information Science, Electrical and Systems Engineering, and Mechanical Engineering and Applied Mechanics. Founded in 1979, GRASP has grown today to be one of the premier research centers focusing on fundamental research in robotics, vision, perception, control, automation, and machine learning.

PRECISE

PRECISE (Penn Research In Embedded Computing and Integrated Systems) was established in 2008 to bring together experts from the electrical systems engineering and computer science fields to study the way machines interact with the physical world through their computing systems, aka Cyber-Physical Systems (CPS) and the Internet of Things (IoT). Our research involves finding fundamental and practical solutions to problems of modeling, control, simulation, operation, formal design, and implementation of CPS and IoT. Such next generation systems are central to energy-efficient buildings and smart cities, industrial automation, advanced manufacturing, autonomous vehicles, and medical devices. Thus, CPS and IoT work has a direct, powerful impact on healthcare, energy, and transportation - all essential and important facets of modern society.

AGENDA

FRIDAY, FEBRUARY 2nd

8:15 - 9:00	Breakfast & Registration
9:00 - 9:05	Welcome Message Kathleen Stebe Deputy Dean for Research & Innovation, SEAS
9:05 - 10:00	GRASP Lab Research Presentations
10:00 - 10:50	PRECISE Center Research Presentations
10:50 - 11:50	Morning Keynote Speaker Parris Wellman (Amazon Robotics) *"The Future is Humans and Robots Working Together"*
11:50 - 12:00	SEAS Outreach Programs Daniel Miller-Uueda Associate Director of Education and Outreach, SEAS
12:00 - 13:30	Lunch / Student Poster Session & Demos

AGENDA

FRIDAY, FEBRUARY 2nd *(cont'd)*

13:30 - 14:20 Industry Presentations
(Theme: Transportation)
Session Chair: Rahul Mangharam

BaekGyu Kim (Toyota)
"Design Challenge of Open Software Platform for Connected Vehicles"

Andrew King (Zoox)
"Autonomous Mobility for the Future"

Robert Bourg (Wabtec Freight)
"Positive Train Control"

Ashish Kapoor (Microsoft Research)
"What's new in AirSim?"

Justin Gottschlich (Intel)
"Deep Learning for Autonomous Driving"

14:20 - 14:30 Break

14:30 - 15:20 Afternoon Keynote Speaker
Ben Firner (Nvidia)
"Accelerating Autonomous Vehicles with Deep Learning"

15:20 - 15:30 Break

AGENDA

FRIDAY, FEBRUARY 2nd *(cont'd)*

15:30 - 16:20 **Industry Presentations (Theme: AI / IOT / CPS)**
Session Chair: Joe Devietti

Gian Luca (Draper)
"Autonomous Perception and Localization at Draper"

Bongho Kim (Nokia)
"Wireless Communications for IoT"

Yoonsoo Lee (National Grid)
"Modeling Our Future: The Energy Path Forward"

Shwetha Shetty (SAP)
"Getting Enterprises to the Cutting 'Edge'"

16:20 - 16:30 **Break**

16:30 - 17:20 **Industry Presentations (Theme: Robotics)**
Session Chair: Daniel Koditschek

Pulkit Kapur (MathWorks)
"Advanced Robotics with MATLAB and Simulink"

Brad Neuman (Anki)
"Creating Robotics with Character"

Alex Kushleyev (Qualcomm)
"Robotics @ Qualcomm Research Philadelphia"

Edward Tunstel (UTRC)
"Robotics at UTRC"

17:20 - 17:30 **Closing Remarks**
Daniel Lee & Insup Lee
Directors, GRASP Lab & Precise Center (respectively)

17:30 - 18:30 **Reception & Industry Networking**

KEYNOTE SPEAKER

FRIDAY, FEBRUARY 2nd - MORNING

PARRIS S. WELLMAN, PhD

Amazon Robotics

"The Future is Humans and Robots Working Together"

Amazon Robotics systems are transforming fulfillment at the core of many of Amazon's fulfillment centers. The unprecedented scale and efficiency that have been achieved in these facilities are the result of some key system design decisions that were made during development. In this talk, we will address how these choices influenced the development of the massively parallel human-robot collaborative system and its components. We will show how these choices allow the associates perform their tasks safely, quickly and efficiently in order to deliver smiles to Amazon customers worldwide.

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Parris has been at Amazon Robotics since September 2013. He first started building robots more than 20 years ago in the GRASP laboratory at the University of Pennsylvania and earned his doctorate at the Harvard Robotics Laboratory. He has delivered robotics and automated instrumentation solutions world-wide in the material handling, medical device, life sciences and in-vitro diagnostics sectors. He enjoys the challenge of solving customer needs by commercializing products that are built at the intersection of many disciplines. He is excited to be at Amazon Robotics where he gets to work with robots every day and where he leads Hardware Engineering and Advanced Robotics. His teams design and engineer the robots, firmware and other equipment used in the Amazon robotic fulfillment solution to support the rapidly scaling business.

KEYNOTE SPEAKER

FRIDAY, FEBRUARY 2nd -AFTERNOON

BEN FIRNER, PhD

NVIDIA

"Accelerating Autonomous Vehicles with Deep Learning"

At NVIDIA's lab in Holmdel, New Jersey we are training deep convolutional neural networks to emulate human drivers. Using only annotated recordings of human drivers we can train these networks learn important driving maneuvers, including lane keeping, changing lanes, and turning. Furthermore, we can show that these networks have learned to react strongly to consistent and reasonable features, such as lane markers and other vehicles, without any explicitly human intervention or labeling. As part of NVIDIA's efforts to create hardware and software platforms for autonomous vehicles we have also developed testing and simulation tools to validate our trained models. Integrating this approach to autonomous driving with more traditional approaches creates the opportunity to create redundancy and improve safety for future autonomous vehicles.

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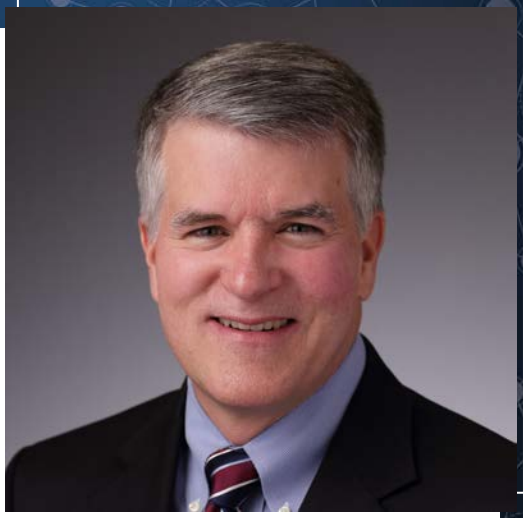
In 2015 Ben Firner joined a new research group at NVIDIA whose goal was to explore novel solutions for autonomous vehicles, starting with end-to-end deep learning. In the past few years this small group has demonstrated the viability of their approach on real roads and in variable weather conditions across the United States and in live demonstrations, such as at the annual consumer electronics show in Las Vegas.

Ben earned a PhD from Rutgers University where he worked on small wireless sensors with many-year lifetimes. Before joining NVIDIA, Ben applied his thesis work at a startup creating and deploying next generation wireless monitoring systems for the laboratory animal care market. Ben also taught several undergraduate and graduate courses in the Rutgers ECE and CS departments.

SPEAKER



ROBERT BOURG

Wabtec Freight
"Positive Train Control"

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Bob Bourg is the Vice President for Strategy & Growth at Wabtec Corporation. Wabtec is a leading supplier of value-added, technology-based products and services for rail, transit and other global industries. Bob is responsible for strategy and business development particularly as it relates to electronic technology and systems.

Prior to his current position, Bob led Wabtec's efforts for the design and implementation of Positive Train Control systems called for by the Rail Safety Improvement Act of 2008. Before joining Wabtec, Bob worked in the instrumentation and controls industry, and he began his career in the US Navy where he helped develop microprocessor based equipment used in naval nuclear instrumentation and control applications.

Bob holds a BSE degree in Electrical Engineering from Duke University and an MS degree in Computer Science from George Washington University.

SPEAKER

GIAN LUCA

Draper

"Autonomous Perception and Localization at Draper"

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Gian-Luca Mariottini is Group Leader in Perception and Localization at Draper Lab in Cambridge MA. He has more than 12 years of experience in robotics and machine perception and reasoning, with specific focus on computer vision, sensor fusion, robot navigation, and machine learning with applications to swarming, medicine, healthcare, and assistive robotics. Gian Luca received his Ph.D. degree in Electrical Engineering from the University of Siena, Italy, in 2006. In 2005 and 2007 he was a Visiting Scholar at the GRASP Lab (CIS Department, UPENN, USA) and he held postdoctoral positions at the Georgia Institute of Technology (2007-2008) and the University of Minnesota (2008-2010). From September 2010 to December 2015 he held an Assistant Professor position at the University of Texas at Arlington (Dept. of Computer Science and Engineering), where he directed the ASTRA Robotics and Vision Lab. Dr. Mariottini was the organizer of several international workshops (International Workshop of Surgical Vision, the Robotics in Assistive Environment Workshop, the Computer-Assisted Robotics and Endoscopy workshop), and has been working in collaboration with other universities, research institutes, hospitals, and companies (e.g., UT Southwestern Medical Center, Vanderbilt University, and UNT Health Science Center). Over the years he received support from government agencies (NSF, DARPA, DoE) as well as by industry partners.

SPEAKER

JUSTIN GOTTSCHLICH

Intel

"Deep Learning for Autonomous Driving"

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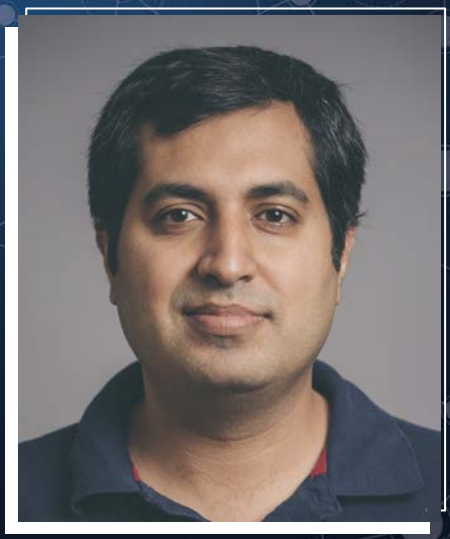
Justin Gottschlich is a senior staff research scientist at Intel Labs. He is the Intel principal investigator and co-founder of the joint Intel-NSF CAPA research center for programmability of heterogeneous systems. His current research interests focus on machine learning with an emphasis on software generation, anomaly detection, and autonomous systems. Justin currently oversees academic collaborations at Brown and Stanford Universities and an industrial collaboration between Intel and BMW for anomaly detection on autonomous vehicles.

Justin is a founding member of the Machine Learning and Programming Languages (MAPL) workshop. He has been the general and program chairs for MAPL and TRANSACT and the vice-chair of the C++ Standards Transactional Memory Working Group (SG5). Justin has over two dozen publications and holds a dozen patents with over forty pending. He completed his PhD at the University of Colorado – Boulder and is the CEO of Nodeka, LLC, an online gaming company that he has run for 20 years.

SPEAKER



ASHISH KAPOOR

Microsoft Research

"What's new in AirSim?"

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Ashish Kapoor leads the Aerial Informatics and Robotics group at Microsoft Research, Redmond. Currently, his research focuses on building intelligent and autonomous flying agents that are safe and enable applications that can positively influence our society. The research builds upon cutting edge research in machine intelligence, robotics and human-centered computation in order to enable an entire fleet of flying robots that range from micro-UAVs to commercial jetliners. Various applications scenarios include Weather Sensing, Monitoring for Precision Agriculture, Safe Cyber-Physical Systems etc. Ashish received his PhD from MIT Media Laboratory in 2006. He also holds FAA Commercial Pilot certificate (SEL), FAA Flight Instructor certificate (Airplane Single Engine and Instrument Airplane) and is an avid amateur aircraft builder.

SPEAKER

PULKIT KAPUR

MathWorks

"Advanced Robotics with MATLAB and Simulink"

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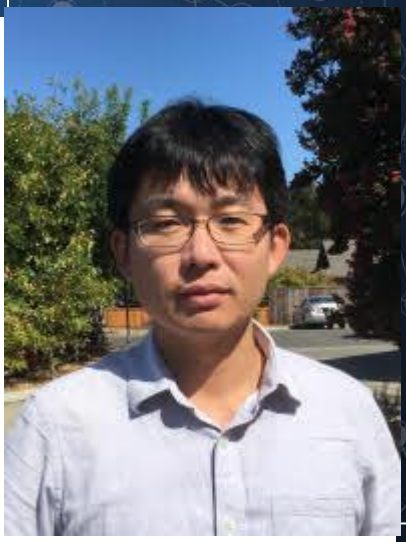
Pulkit Kapur is a Senior Industry Manager for Robotics and Autonomous Systems at MathWorks. Prior to MathWorks, Pulkit worked at iRobot as a product manager launching several commercial vacuum cleaning robots globally. Pulkit has also worked in the areas of haptics and manipulation, developing and launching desktop-based haptic robotic devices. Pulkit has a bachelor's in Mechanical Engineering and a Master's in Mechanical Engineering with a specialization in Robotics from the GRASP Lab at University of Pennsylvania in Philadelphia. Pulkit has over 10 years of research and industry experience in the field of robotics and autonomous systems.

SPEAKER



BAEKGYU KIM

Toyota

"Design Challenge of Open Software Platform for Connected Vehicles"

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Dr. BaekGyu Kim earned B.S. and M.S. in computer science from Kyungpook National University in South Korea in 2007 and 2009, and earned Ph.D in computer science from University of Pennsylvania in 2015 under Prof. Insup Lee and Prof. Oleg Sokolsky. He has been working as a researcher in Toyota InfoTechnology Center., U.S.A since 2015. His research interest is to apply formal verification, analysis and simulation techniques to guarantee correctness of safety critical systems. In particular, he is currently working on software platform technologies to guarantee safety for connected vehicles. He is actively supporting academic activity via university research collaboration and publishing papers in academic conferences, and he received a top inventor award from Toyota ITC in 2017.

SPEAKER

BONG HO KIM

Nokia

"Wireless Communications for IoT"

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Bong Ho Kim is a senior research engineer at Nokia Bell Labs' End-to-End Mobile Networks Solutions group in Murray Hill, New Jersey. He has a full cycle of technology experience from a new technology innovation, standardization, research, systems engineering, customer field trial, and technical marketing. His current research includes 5G wireless technology innovations, LTE, IoT, cross-protocol layer performance optimization, multidimensional advanced schedulers over wireless networks, and SDN/NFV. He has received a number of awards including the Proud Eagle Award from Lucent Technologies (2002) and the WiMAX Forum individual contribution award (2008). He received his B.S. degree with honors in Computer and Information Science from The Ohio State University and received M.S. and a Ph.D. degree in Computer Science and Engineering from the University of Pennsylvania.

SPEAKER

ANDREW KING

Zoox

"Autonomous Mobility for the Future"

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Andrew King is the lead compute systems architect and a software engineer at autonomous mobility company Zoox. As a compute systems architect, Andrew designs the compute architecture for Zoox's current and future robotic vehicles. As a software engineer, he helps design and implement Zoox's AI software stack. In particular, Andrew ensures that time-critical software components meet their specified timing requirements. Previously Andrew was a graduate student in the PRECISE Center at the University of Pennsylvania where he studied the application of formal methods and real-time scheduling techniques to safety critical medical devices. He earned a PhD in computer science from the University of Pennsylvania in 2016.

SPEAKER

ALEX KUSHLEYEV

Qualcomm Research Philadelphia

"Robotics @ Qualcomm Research Philadelphia"

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Alex graduated from University of Pennsylvania with MS in Electrical Engineering in 2009 with focus on hardware and software for ground and aerial robots. As co-founder of KMel Robotics (with Daniel Mellinger) between 2012 and 2015, Alex has helped lead the start-up company from working on research projects to successful commercialization of motor control, flight, navigation and image stabilization software for hobby drone applications. He then joined Qualcomm in February 2015 during Qualcomm's acquisition of KMel Robotics LLC and has been part of the group developing Snapdragon Flight hardware platform and Snapdragon Navigator flight stack for drones. Since 2017, Alex has been also working in the field of autonomous driving, returning to the research area since the 2007 DARPA Urban Challenge.

SPEAKER

YOONSOO LEE

National Grid

"Modeling Our Future: The Energy Path Forward"

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Yoon Soo Lee is part of the Advanced Data & Analytics Team at Nation Grid, which is a multinational electricity and gas utility company servicing customers in the Northeastern United States. His main focus has been developing a reverse-engineered building simulation platform that offers capabilities to simulate millions of customer load uses. He is proficient in using sophisticated web-crawling technology to collect data that informs future forecasts of energy consumption, behavior making decisions, and DER adoption that ultimately impact the energy grid. Prior to joining National Grid, he was an adjunct faculty at CUNY College of Technology teaching classes on Building Performance. He received his Ph.D. in Building Technology from University of Pennsylvania with a dissertation on "Modeling Multiple Occupant Behaviors in Buildings for Increased Simulation Accuracy: An Agent-Based Modeling Approach."

SPEAKER

BRAD NEUMAN

Anki

"Creating robots with character"

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Brad received his BS in Computer Science and MS in robotics from Carnegie Mellon, where he worked on mobile robot perception, navigation, and planning under uncertainty. Since 2012 he has been at Anki leading AI development for the Overdrive and Cozmo product lines, currently focusing on how to express an autonomous robot's unique personality through interactions with people and the robot's environment.

SPEAKER

SHWETHA SHETTY

Corporate Strategy Group

"What is one tough technical challenge or problem your company faces that we can help with?"

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Shwetha is a Sr. Director in SAP's Corporate Strategy Group where she drives long term innovation initiatives that have big social impact. She drives SAP's strategy for Blockchain Smart cities and robotics, while driving thought leadership on topics such as impact of automation in the workplace. She is the lead for driving startup engagement for SAP.iO (SAP's early stage fund and accelerator) which includes actively mentoring startups at the accelerator.

Prior to joining SAP, Shwetha spent over 5 years at McKinsey & Company where she worked primarily in healthcare technology and operations. Shwetha has an MBA from the Wharton Business School and a Bachelor in Engineering from Mumbai University.

SPEAKER

EDWARD TUNSTEL

UTRC

"Robotics at UTRC"

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Dr. Edward Tunstel holds a Ph.D. in electrical engineering from the University of New Mexico focused on intelligent robot control systems, and prior mechanical engineering degrees from Howard University, with a concentration in robotics. He is an Associate Director of Robotics at United Technologies Research Center involved in incubating a research group to study, develop, and transition relevant technologies for human-collaborative robotics in the context of United Technologies Corporation's business units spanning the aerospace and building industries. For the past decade, he was a Senior Roboticist at Johns Hopkins APL actively researching robotic intelligence, autonomous control, modular open systems, and human-collaborative robotics for national security and space applications. He also served as Space Robotics & Autonomous Control Lead at APL. During the prior two decades, he was with NASA JPL as a Senior Robotics Engineer and Group Leader of its Advanced Robotic Controls Group. There he served as a Mars rover systems engineer for autonomous navigation, and rover engineering team lead for mobility and robotic arm operations on the surface of Mars. He maintains expertise in autonomous field robotics & intelligent systems, in which he has authored over 150 publications and co-edited 4 books. Dr. Tunstel is a Fellow of the IEEE and President of the IEEE Systems, Man, and Cybernetics Society. He is also a member of the IEEE Robotics and Automation Society, NSBE Professionals, and AIAA.

POSTERS

Automatic Verification of Linear Controller Software	Junkil Park
Autonomous Cross-Paradigm Knowledge Transfer in Lifelong Machine Learning	Varun Gupta
Autonomy for Ocean Applications	Dhanushka Kularatne
Bridging Machine Learning and Controls for Volatile Energy Markets	Achin Jain
Building Safe Autonomous Vehicles: A Driver's License Test for Driverless Vehicles	Matthew O'Kelly
Computer-aided Clinical Trials for Medical Devices	Kuk Jang
Context-Aware Detection in Medical Cyber-Physical Systems	Radoslav Ivanov
Cyber-Physical System Checkpointing & Recovery	Fanxin Kong
Data/Service Delivery to Connected Vehicles via Edges	Deepak Gangadharan
Deep Learning for Object Identification and Localization from Aerial Imagery	Shreyas Aditya, Xu Liu, Steven Chen, Nivedha Sivakumar, Tyler Altenhofen, Sandeep Dcunha, Shreyas Shivakumar, Jnaneshwar Das, Vijay Kumar

POSTERS

Depth Super-Resolution using GANs	Sakthivel Sivaraman, Sai Krishnan Chandrasekar, and Anvith Ekkati
Dynamic lighting for Controlling Circadian Rhythm	Luis Garcia
Empirical Validation of a Spined Sagittal-Plane Quadrupedal Model	Jeff Duperret
F1tenth	Jalaj Maheshwari
GPU Drano: Detecting Uncoalesced Accesses in GPU Programs	Nimit Singhania
Hypocount: An Open Source Tool for Anaylzing Daytime vs Nocturnal Hypoglycemia	Sooyong Jang
Learning Force Based Mobile Manipulation	Daniel Edgar
Legged Locomotion for Desert Research	Feifei Qian
LogSafe: Secure and Scalable Data Logger for IoT Devices	Hung Nguyen
Mapping the Heart for Guided Cardiac Ablation Therapy	Jiyue He
MIDAS: Ensuring network QoS in 4G/5G network using SDN	Hyonyoung Choi

POSTERS

Mitigation of Message Flooding Attacks on Automotive-CAN?	Hyojin Jo
On the Robustness of Neural Networks to Adversarial Examples	Sangdon Park
Parameter Invariant Monitoring for Signal Temporal Logic	Ramneet Kaur, Nima Roohi
Quantifying Infant Physical Interactions Using Sensorized Toys in a Natural Play Environment	Wilson Torres
Quasi-Static and Dynamic Mismatch for Door Opening and Stair Climbing With a Legged Robot	Turner Topping
Real-Time Virtualization	Meng Xu
Smart Pitch	Eric Micallef
SMEDL: A State Machine-Based Runtime Verification Framework	Teng Zhang
Smooth Operator: Control of Systems using Robustness of Temporal Logic Specifications (Fly-by-Logic)	Yash Pant & Rhudii Quaye
Toward an Overhead-Free Compositional Framework for Hierarchical Scheduling Systems	Jin Hyun Kim
Towards a Variable Topology Truss for Shoring	Alexander Spinos
Using Unmanned Aerial Systems To Explore Hazardous Environments	Wenxin Liu, Dinesh Thakur, Giuseppe Loianno and Vijay Kumar
Using Upper Limb Kinematics to Assess Cognitive Deficits in People Living with Both HIV and Stroke	Kevin Bui

How to Connect to WiFi:

1. Select the “AirPennNet-Guest” network
2. Open a browser
3. Review and accept the Acceptable Use Policy terms and conditions
4. Enter a valid e-mail address
5. Click submit

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PRECISE

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