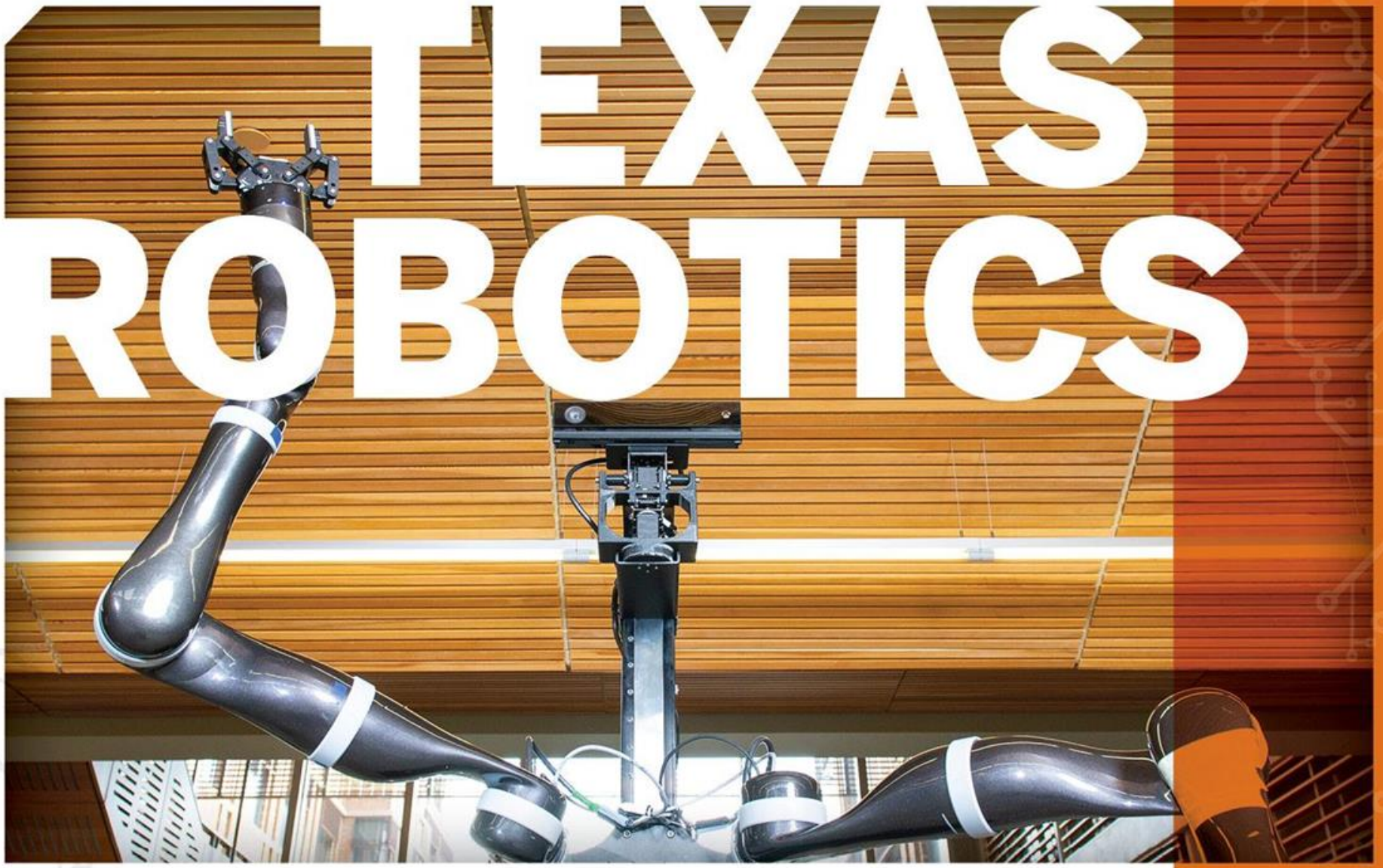
TEXAS ROBOTICS



WHAT STARTS HERE CHANGES THE WORLD

The University of Texas at Austin

WHAT IS TEXAS ROBOTICS?

TOP RANKED

Texas Robotics is a partnership between four Top 10 ranked departments

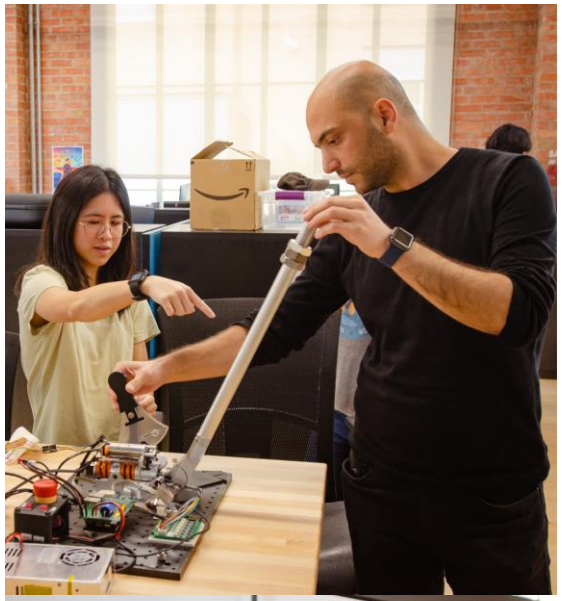
- AEROSPACE ENGINEERING
- COMPUTER SCIENCE
- ELECTRICAL & COMPUTER ENGINEERING
- MECHANICAL ENGINEERING

WHAT IS TEXAS ROBOTICS?

GRADUATE STUDIES
Robotics Graduate
Portfolio Program

UNDERGRADUATE STUDIES
Undergraduate
Minor in Robotics

COMMUNITY ENGAGEMENT
Hosting events for K-12
Tours for community members



RESEARCH
Leading robotics research across diverse disciplines

FACULTY
Hosts cutting edge research on emerging fields

FACILITIES
State-of-the-art facilities in the heart of campus

INDUSTRY
Extensive Industry Affiliate Partnerships

GRADUATE PORTFOLIO PROGRAM

Multidisciplinary robotics training developing industry-ready top talent

43 robotics-relevant courses available

Graduates earn a Robotics Certification on their transcript

UNDERGRADUATE PROGRAM

MINOR IN ROBOTICS

- Minor in Robotics noted on Undergraduate Degree
- Unique gateway course curated for Texas Robotics Curriculum
- Courses available across the Engineering and Computer Science colleges

FRESHMAN RESEARCH INITIATIVE

- Robotics research opportunity to incoming freshmen in engineering and computer science

RESEARCH

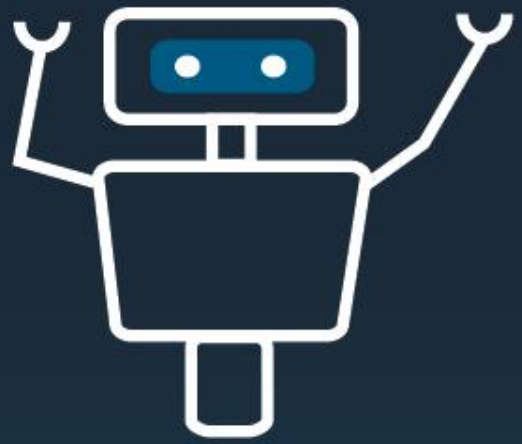
TEXAS ROBOTICS RESEARCH

- Encompasses all major robotics research at UT Austin
- Designed to enable Texas Robotics to perform large-scale, highly collaborative research with university and industry affiliates

RESEARCH

CORE COMPETENCIES

Long-term Autonomy



Human-Robot Interaction

Robot Manipulation

RESEARCH LABS

With 15+ research labs, Texas Robotics conducts world-class research in the following areas:

- General Purpose Autonomy
- Robotics in Hazardous Environments
- Autonomous Off-Road Vehicles
- Assisted Rehabilitation
- Robotic Surgery
- Reinforcement Learning
- Autonomous Systems
- Human Robot Interaction
- Multiagent Systems

FACULTY

Ann Majewicz Fey
Mechanical Engineering

Ashish Deshpande
Mechanical Engineering

David Fridovich-Keil
Aerospace Engineering &
Engineering Mechanics

Josè del R. Millàn
Electrical & Computer
Engineering

Joydeep Biswas
Computer Science

Lilly Chin
Electrical and Computer
Engineering

Justin Hart
Computer Science

Farshid Alambeigi
Mechanical Engineering

Luis Sentis
Aerospace Engineering &
Mechanical Engineering

Mitch Pryor
Mechanical Engineering

Nick Fey
Mechanical Engineering

Peter Stone
Director of TX Robotics

Roberto Martin-Martin
Computer Science

Sandeep Chinchali
Electrical & Computer
Engineering

Ufuk Topcu
Aerospace Engineering &
Engineering Mechanics

Yuke Zhu
Computer Science

RESEARCH LABS

HUMAN-ENABLED ROBOTIC TECHNOLOGY (HeRo) LAB

LAB MISSION

We aim to translate effective robotic technology into clinical use by focusing on novel electro-mechanical systems, intuitive teleoperation strategies, and human-robot sensory interactions for medical intervention, simulation, and training. We work closely with surgeons and surgical educators at UTSW Medical Center and Dell Medical School.

RESEARCH AREAS

Medical, Rehabilitative, and Surgical Robotics | Teleoperation, Haptics, and Wearable Robotics | Human-Robot Interaction | Dynamics and Control

ANN MAJEWICZ FEY

http://utexas.edu/herolab

RESEARCH LABS

ReNEU ROBOTICS LAB

LAB MISSION

Design robots that work closely with humans in order to improve recovery after injuries, quality of life of the disabled, productivity of workers, and safety & performance of soldiers, astronauts and everyday people.

RESEARCH AREAS

Exoskeletons | Robotic Manipulation | Advanced Actuators and Control | Human Neuromuscular Control

ASHISH DESHPANDE

http://reneu.robotics.utexas.edu/

RESEARCH LABS

ROBOTICS INTELLIGENT SYSTEMS & CONTROL LAB

LAB MISSION

Make both practical and theoretical contributions to single- and multi-agent robotic decision making problems. We target a wide variety of application domains, ranging from autonomous vehicle navigation to quadrotor flight.

RESEARCH AREAS

Optimal Control | Dynamic Game Theory | Multi-Agent Planning | Learning and Control | Robot Safety

DAVID FRIDOVICH-KEIL

http://dfridovi.github.io

RESEARCH LABS

ADVANCED ROBOTIC TECHNOLOGIES FOR SURGERY (ARTS) LABS

LAB MISSION

The ARTS Lab, in collaboration with the UT Dell Medical School, will work toward engineering the surgery (Surgineering) and partnering dexterous intelligent robots with surgeons. Our goal is to elevate the clinicians' skills to further improve quality of the surgery and patient safety.

RESEARCH AREAS

Bio-Inspired Robotics and Biomechanics | Medical, Rehabilitative, and Surgical Robotics | Robot Mechanisms and Design | Long-Term Autonomy | Soft Robotics | Dynamics and Control | Grasping and Manipulation | Human-Robot Interaction

FARSHID ALAMBEIGI

http://sites.utexas.edu/arts-lab/

RESEARCH LABS

CLINICAL NEUROPROSTHETICS & BRAIN INTERACTION LAB

LAB MISSION

The focus of our research is on the direct use of human brain signals for human-robot interaction and control of neuroprostheses. The overarching objective of our research is to bring brain-machine interfaces (BMI) out of the laboratory to augment human capabilities, recover from insults to our central nervous system, and facilitate user's acquisition of BMI skills.

RESEARCH AREAS

Brain-robot interaction | Brain-machine Interfaces (BMI) | Neuroprosthetics | Neurorehabilitation | Statistical machine learning | Neuroscience

JOSÈ DEL R. MILLÀN

http://sites.utexas.jdrmillan/

RESEARCH LABS

AUTONOMOUS MOBILE ROBOTICS LAB

LAB MISSION

AMRL performs research in robotics to make robots more autonomous, accurate, robust, and efficient, in real-world unstructured environments. We are working on a wide range of problems, including perception for long-term autonomy, high-speed multi-agent planning in adversarial domains, time-optimal control for omnidirectional robots, and correcting and learning complex autonomous behaviors from human interactions.

JOYDEEP BISWAS

https://www.joydeepb.com/

RESEARCH AREAS

Long-term Autonomy | Terrain Aware Navigation | Reinforcement learning | Planning | Human-Robot Interaction

RESEARCH LABS

LEARNING AGENTS RESEARCH GROUP

LAB MISSION

I research artificial intelligence and human-robot interaction. Significant to my work at UT is the development of comprehensive systems and enabling technologies for general purpose service robots. Topics include the construction of architectures for long-term autonomy, knowledge representation, semantic mapping as it relates to both planning and scene understanding, and autonomous human-robot interaction.

Justin Hart

https://robotics.utexas.edu/people

RESEARCH AREAS

Human Robot Interaction | Long-term Autonomy | Navigation

RESEARCH LABS

THE HUMAN CENTERED ROBOTICS LAB

LAB MISSION

To lower barriers of entry for human-centered robots such as humanoid robots and exoskeletons. To decrease the mechanical design complexity. To decrease the complexity of deploying mobile manipulation and human augmentation applications.

RESEARCH AREAS

Humanoid Robots| Exoskeletons | Mobile Manipulation | Multi-Robot Search

LUIS SENTIS

http://sites.utexas.edu/hcrl

RESEARCH LABS

NUCLEAR AND APPLIED ROBOTICS

LAB MISSION

Reduce the exposure of human operators to hazards while minimizing the overall costs (training, execution, time, and money) associated with the use of remote systems and do so in a way that increases the number of engineering scientists in the world who can develop these systems at UT and beyond.

RESEARCH AREAS

Hazardous Environments (Nuclear, O&G, etc.) | Mobile Manipulation | Compliant Control | Human-Machine Interface | Autonomous Survey | Situational Awareness

MITCH PRYOR

http://robotics.me.utexas.edu

RESEARCH LABS

SYSTEMS FOR AUGMENTING HUMAN MECHANICS LAB

LAB MISSION

The SAHM Lab develops and applies mechanical and biomedical engineering techniques to positively influence the neuromechanics of able and disabled individuals. We address this challenge through the informed design and control of wearable assistive technologies.

NICK FEY

https://www.me.utexas.edu/people/faculty-directory/fey

RESEARCH AREAS

Human Augmentation | Overground Ambulation | Prostheses | Exosuits | Neuromuscular Biomechanics | Sonomyographic and Myoelectric Sensing | Intent Recognition and Optimal Control | Human-Robot Interaction | Military Health | Physical Medicine & Rehabilitation

RESEARCH LABS

LEARNING AGENTS RESEARCH GROUP

LAB MISSION

The Learning Agents Research Group is devoted to AI research on understanding how we can best create complete intelligent agents, including physical robots that are capable of long-term autonomous interaction in the real world.

RESEARCH AREAS

Artificial Intelligence | Multi-Robot Systems | Robot Learning | Long-Term Autonomy | Planning | Human-Robot Interaction | Legged Robots | Localization, Mapping, and Navigation | Motion and Path Planning | Perception

PETER STONE

http://www.cs.utexas.edu/~pstone/

RESEARCH LABS

ROBIN: ROBOTIC INTERACTIVE INTELLIGENCE

LAB MISSION

Our research explores the mechanisms that enable intelligence in embodied agents. Inspired by biological intelligence, we developed robotic algorithms that improve robot autonomy in perception, control, knowledge representation and decision making through learning. Our goal is to create robotic helpers that enhance human everyday life.

RESEARCH AREAS

Robot learning | (Interactive) Perception | Robot Control Task and Motion Planning | Representation Learning Manipulation | Reinforcement and Imitation Learning

ROBERTO MARTÍN-MARTÍN

www.cs.utexas.edu/people/faculty-researchers/roberto-martin-martin

RESEARCH LABS

SWARM ROBOTICS LAB

LAB MISSION

Our mission is to develop algorithms for swarms of inexpensive, energy-efficient robots to safely operate in society. We enable robot fleets to augment their intelligence by leveraging cloud computing and next-generation wireless networks for collaborative perception and continual learning.

RESEARCH AREAS

Long-Term Autonomy | Robot Learning | Robot Vision | Artificial Intelligence | Dynamics and Control | Perception

SANDEEP CHINCHALI

http://ece.utexas.edu/people/faculty/sandeep-chinchali

RESEARCH LABS

AUTONOMOUS SYSTEMS GROUP

LAB MISSION

Develop theory and algorithms for the design and verification of autonomous systems.

RESEARCH AREAS

Formal Methods | Control Theory | Reinforcement learning

UFUK TOPCU

http://u-t-autonomous.info

RESEARCH LABS

ROBOT PERCEPTION & LEARNING LAB

LAB MISSION

Our research aims to build general-purpose robot autonomy in the wild. We develop intelligent algorithms for robots and embodied agents to reason about and interact with the real world.

RESEARCH AREAS

Robot Learning | Grasping and Manipulation | Perception | Artificial Intelligence | Planning | Dynamics and Control | Robot Vision

YUKE ZHU

http://rpl.cs.utexas.edu

FACULTY

Ann Majewicz Fey
Mechanical Engineering

Ashish Deshpande
Mechanical Engineering

David Fridovich-Keil
Aerospace Engineering &
Engineering Mechanics

Josè del R. Millàn
Electrical & Computer
Engineering

Joydeep Biswas
Computer Science

Lilly Chin
Electrical and Computer
Engineering

Justin Hart
Computer Science

Farshid Alambeigi
Mechanical Engineering

Luis Sentis
Aerospace Engineering &
Mechanical Engineering

Mitch Pryor
Mechanical Engineering

Nick Fey
Mechanical Engineering

Peter Stone
Director of TX Robotics

Roberto Martin-Martin
Computer Science

Sandeep Chinchali
Electrical & Computer
Engineering

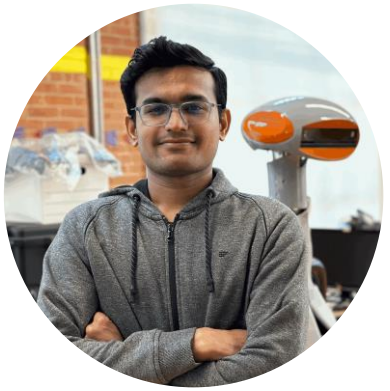
Ufuk Topcu
Aerospace Engineering &
Engineering Mechanics

Yuke Zhu
Computer Science

STAFF

Dr. Sridevi Rao
Managing Director
Texas Robotics

Jaci Finch
Sr. Events & Communications Coordinator
Texas Robotics



Nikunj Arvindbhai Parmar
Robotics Engineer
Texas Robotics

Stephanie Gamba
Sr. Academic Program Coordinator
Texas Robotics

AFFILIATED STAFF

Beth Hood
Director of Industry and Research Relations
Department of Computer Science

Ellen Cantor
Director of Development
Department of Computer Science

Lainey Cie Corliss
Director of Industry Engagement
Cockrell School of Engineering

Zarko Vukovich
Facilities Manager, Anna Hiss Gymnasium
College of Natural Sciences

COLLABORATION AMONG FACULTY

- Exoskeletons
- Bipeds
- Human-robot interaction
- Long-term autonomy
- Service robots
- Brain-machine interfaces
- Manipulation
- Machine learning
- Reinforcement learning
- Applied robotics
- Rehabilitation and surgical robotics

STATE OF THE ART FACILITIES

Over 55, 000 sq. ft including the Anna Hiss Gymnasium
Robotics Research Space

- 4 specialized fabrication shops
- 2 open, reconfigurable lab spaces
- 1 simulated apartment
- 1,200 square foot motion capture and drone flight area
- 1 heavy robotics bay for large mobile robots and autonomous vehicles
- 1 surgical robotics lab
- 2 rehabilitation robotics labs

FACILITIES

THE HISTORIC ANNA HISS GYMNASIUM

Homed in the historic Anna Hiss Gymnasium

Renovated space designed specifically to support research and academic programs for Aerospace Engineering and Engineering Mechanics, Robotics, Computer Science, Electrical and Computer Engineering, Mechanical Engineering, and Fine Arts.

INDUSTRY

INDUSTRIAL AFFILIATE PROGRAM

Our industry partners have access to top talent and cutting-edge research through collaboration with robotics students and researchers at UT Austin.
Partners receive benefits including **recruiting, research, networking & visibility**

amazon · BOSCH · Doosan Robotics · FOX robotics · Google · Grit · RRAI · WILDER SYSTEMS · YASKAWA

In addition, Texas Robotics is engaged with Army Futures Command to develop leading-edge robotics solutions.

INDUSTRY

WORLD-CLASS TALENT RECRUITMENT

Engage with and recruit highly qualified students

- Talented candidates for co-ops, internships, and permanent positions
- Exclusive access to robotics portfolio student resume book
- Invitations to host tech talks and seminar series
- Recruitment at university events including the Texas Robotics Symposium
- Custom events for your company to meet and recruit Texas Robotics students

INDUSTRY

PREMIER ACCESS TO RESEARCH

Learn first hand about cutting edge research

- Lab tours of Texas Robotics facilities
- Live demos of emerging technologies
- Fellowship opportunities
- One-on-one research discussions with robotics faculty
- Consultation with Texas Robotics faculty, staff, and students

INDUSTRY

INDUSTRY AFFILIATE TESTIMONIALS

Through our Texas Robotics membership, we have formed lasting relationships and leveraged our collaboration to push the boundaries of research, creating joint high-impact publications, developing industry-leading products, and growing and transitioning robotics talent into the Bosch family.

Dr. Kay Stepper,
Senior Vice President,
Robert Bosch LLC

Grit is thrilled to sponsor Texas Robotics. We see a bright future for robotics in Texas. Grit believes in the cutting edge research, marquee faculty and talented students from Texas Robotics. Grit has already funded two successful startups which have spun out from Texas Robotics labs! What starts here changes the world.

Jennifer Gill Roberts,
Grit Ventures Co-Founder,
Managing Partner

RESEARCH LABS

NUCLEAR AND APPLIED ROBOTICS

LAB MISSION

Reduce the exposure of human operators to hazards while minimizing the overall costs (training, execution, time, and money) associated with the use of remote systems and do so in a way that increases the number of engineering scientists in the world who can develop these systems at UT and beyond.

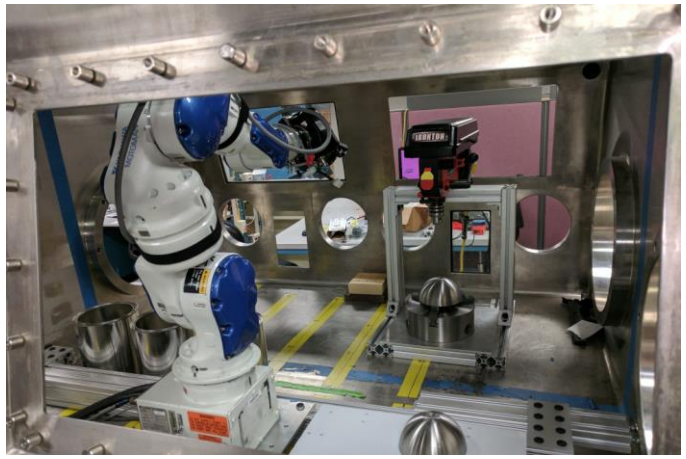
RESEARCH AREAS

Hazardous Environments (Nuclear, O&G, etc.) | Mobile Manipulation | Compliant Control | Human-Machine Interface | Autonomous Survey | Situational Awareness

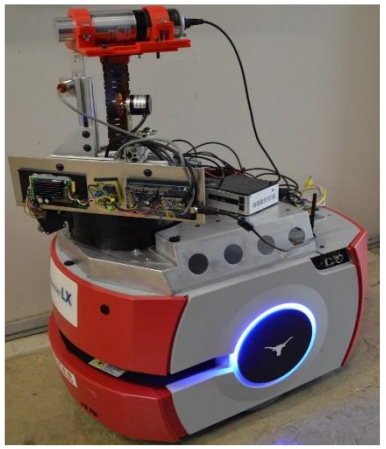
MITCH PRYOR

http://robotics.me.utexas.edu

NRG Core Competencies



Manufacturing/Manipulation
Hazardous Materials

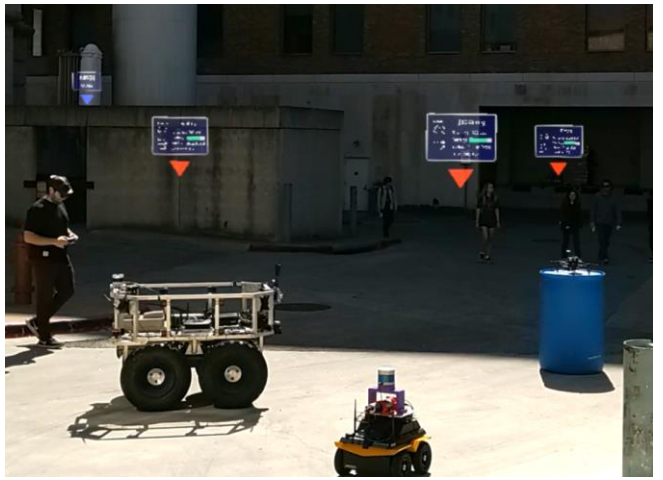


Autonomous Mobile Platforms
Survey

Mobile Manipulation

Autonomous Scan ‘n Plan

Wall-climbing robots



Situational Awareness
AR-based HMI

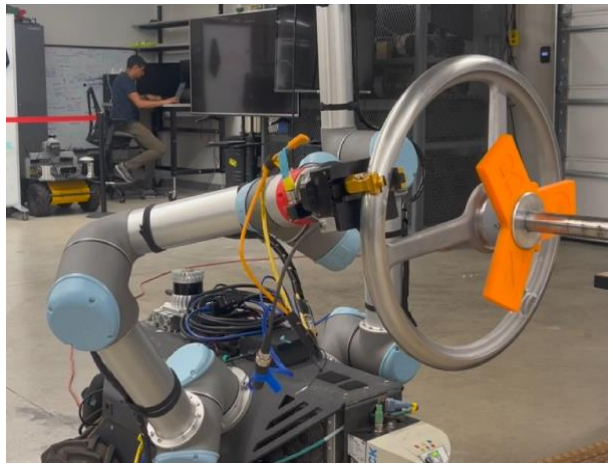
Focus: 3 Key Challenges

- Scalable solutions
  - Inspect not one valve but 1,000s valves
- Multidisciplinary: understand those domains
  - Each creates its own unique challenges
- Situational awareness (remote & local)
  - No PhD needed

Current 3 Key Challenges

- Scalable solutions
  - Inspect not one valve but 1,000s valves
- Multidisciplinary: understand those domains
  - Each creates its own unique challenges
- Situational awareness (remote & local)
  - No PhD needed

Comprehensive Autonomous Radiation Survey (DoE)



Teach Contact Tasks (Industry)

Corrosion Survey, Mitigation & Repair (Industry)

Robot Augmented Teams (DoD)

Current 3 Key Challenges

- Scalable solutions
  - Inspect not one valve but 1,000s valves
- Multidisciplinary: understand those domains
  - Each creates its own unique challenges
- Situational awareness (remote & local)
  - No PhD needed

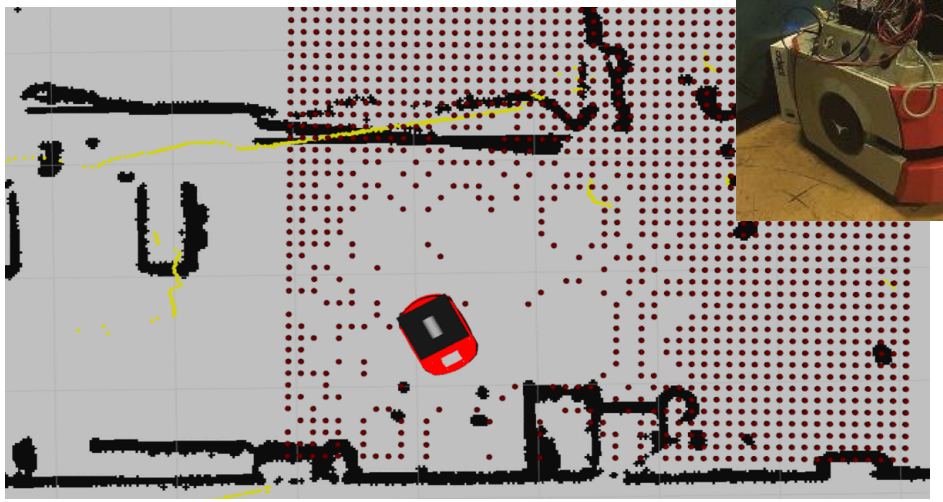
Comprehensive Autonomous Radiation Survey (DoE)

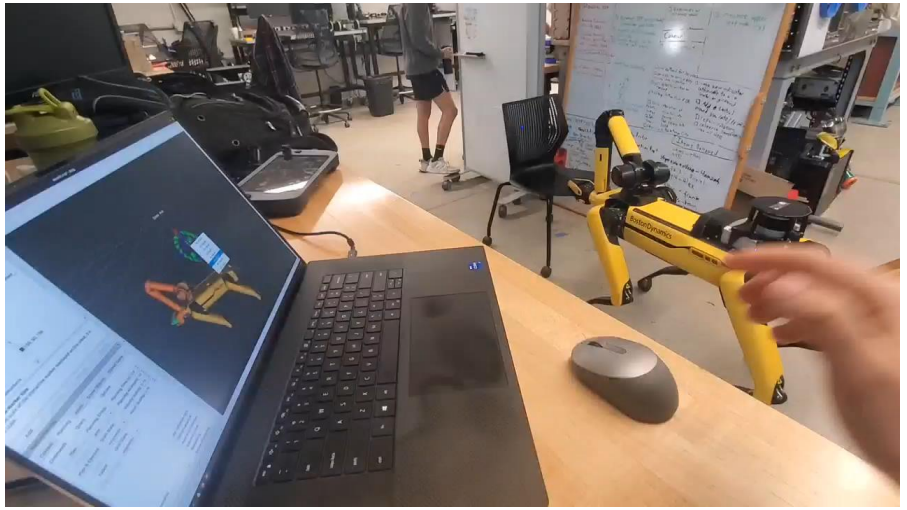
Teach Contact Tasks (Industry)

Corrosion Survey, Mitigation & Repair (Industry)

Robot Augmented Teams (DoD)

Multidisciplinary





- Surveying
  - Autonomous
  - Comprehensive
  - Alpha, Beta, Gamma
  - All surfaces
- Mapping
  - Secure
  - 3D mapping
- Path Planning
  - No tracking
  - Speed optimization from count statistics
- Visualization
  - Identify hazards
  - Identify safe paths

Radiation Survey

- Surveying
  - Autonomous
  - Comprehensive
  - Alpha, Beta, Gamma
  - All surfaces
- Mapping
  - Secure
  - 3D mapping
- Path Planning
  - No tracking
  - Speed optimization from count statistics
- Visualization
  - Identify hazards
  - Identify safe paths

3 Key Challenges

- Scalable solutions
  - Inspect not one valve but 1,000s valves
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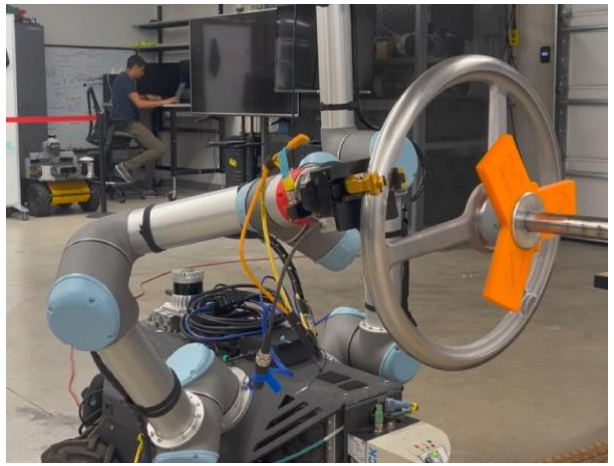
Comprehensive Autonomous Radiation Survey (DoE)



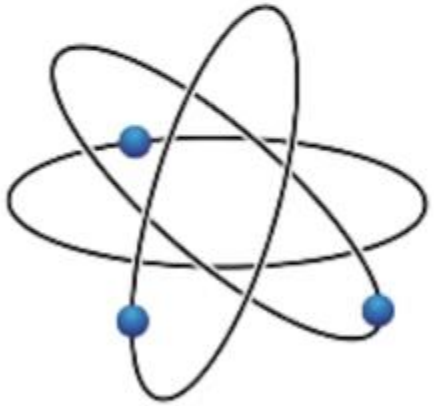
Teach Contact Tasks (Industry)

Corrosion Survey, Mitigation & Repair (Industry)

Robot Augmented Teams (DoD)

Using Single Demonstrations to Define Autonomous Manipulation Contact Tasks in Unstructured Environments via Object Affordances

TEXAS Robotics



Nuclear & Applied Robotics Group

From Last Year: 3 Key Challenges

- Scalable solutions
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Comprehensive Autonomous Radiation Survey (DoE)

Teach Contact Tasks (Industry)

Corrosion Survey, Mitigation & Repair (Industry)

Robot Augmented Teams (DoD)

Challenges of Using Image-Based Models

- Traditional image-based detection methods can fail to accurately identify corroded material depending on environmental lighting conditions and can be prone to misclassifications.
- It is difficult to normalize lighting conditions artificially to reduce this problem.

Ambient Daylight

Direct Sunlight

Night w/ Artificial Light

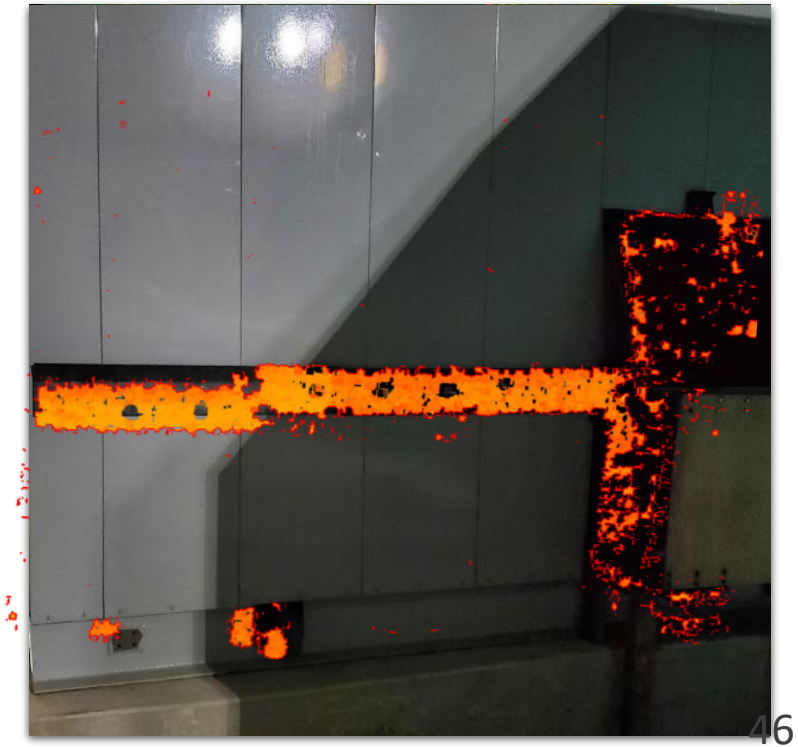
Using LiDAR to Improve Detection Accuracy

- Reflective properties of LiDAR data, which is already collected by many autonomous systems during deployment, seems to display observable difference in data that perhaps could be exploited to address these limitations of image-based models.

Ambient Daylight

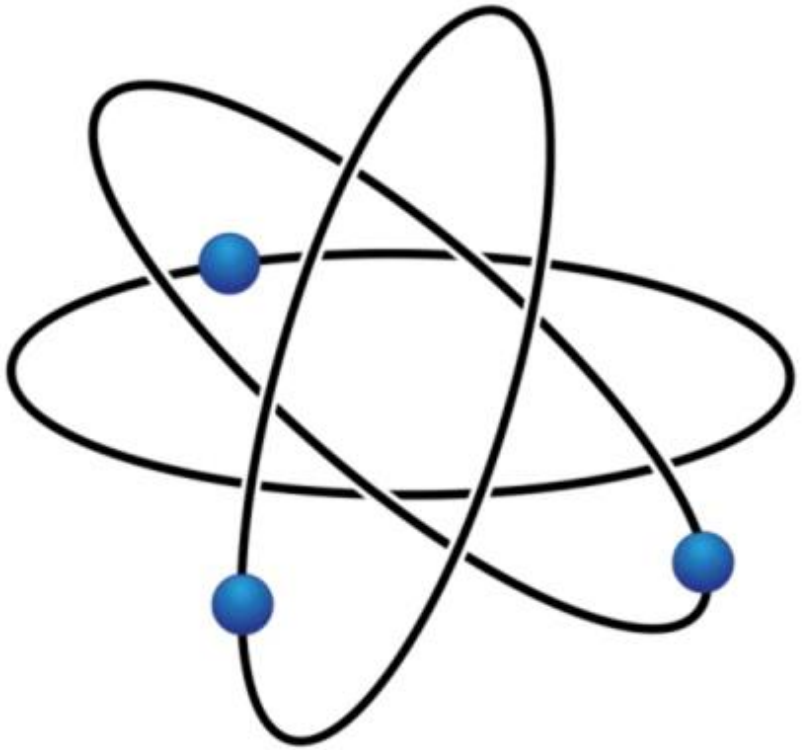
Direct Sunlight

Night w/ Artificial Light



Shell Technology Center Houston Deployment

Nuclear & Applied Robotics Group



The University of Texas at Austin

From Last Year: 3 Key Challenges

- Scalable solutions
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Comprehensive Autonomous Radiation Survey (DoE)

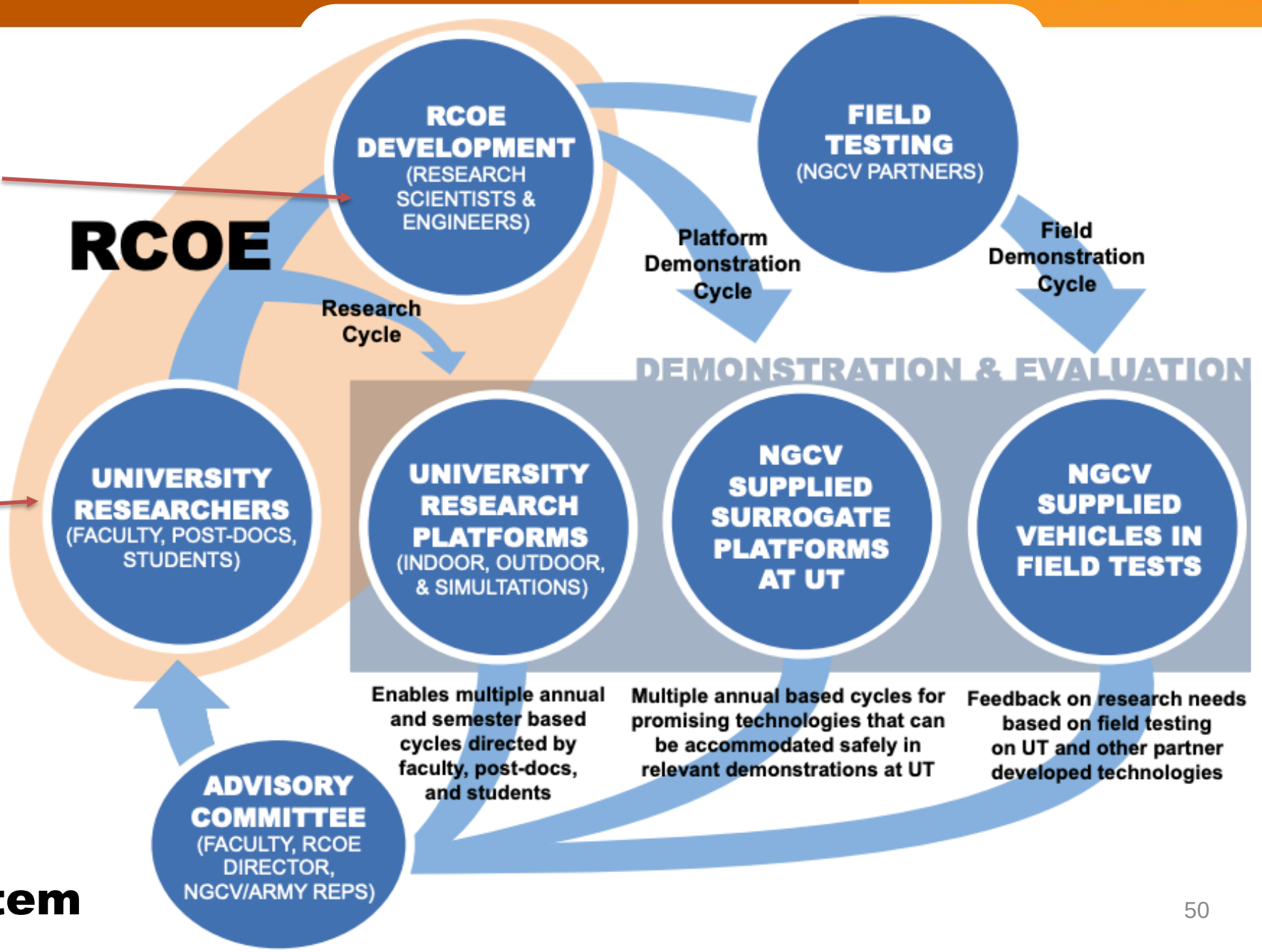
Teach Contact Tasks (Industry)

Corrosion Survey, Mitigation & Repair (Industry)

Robot Augmented Teams (DoD)

FACILITATING TECHNOLOGY TRANSFER

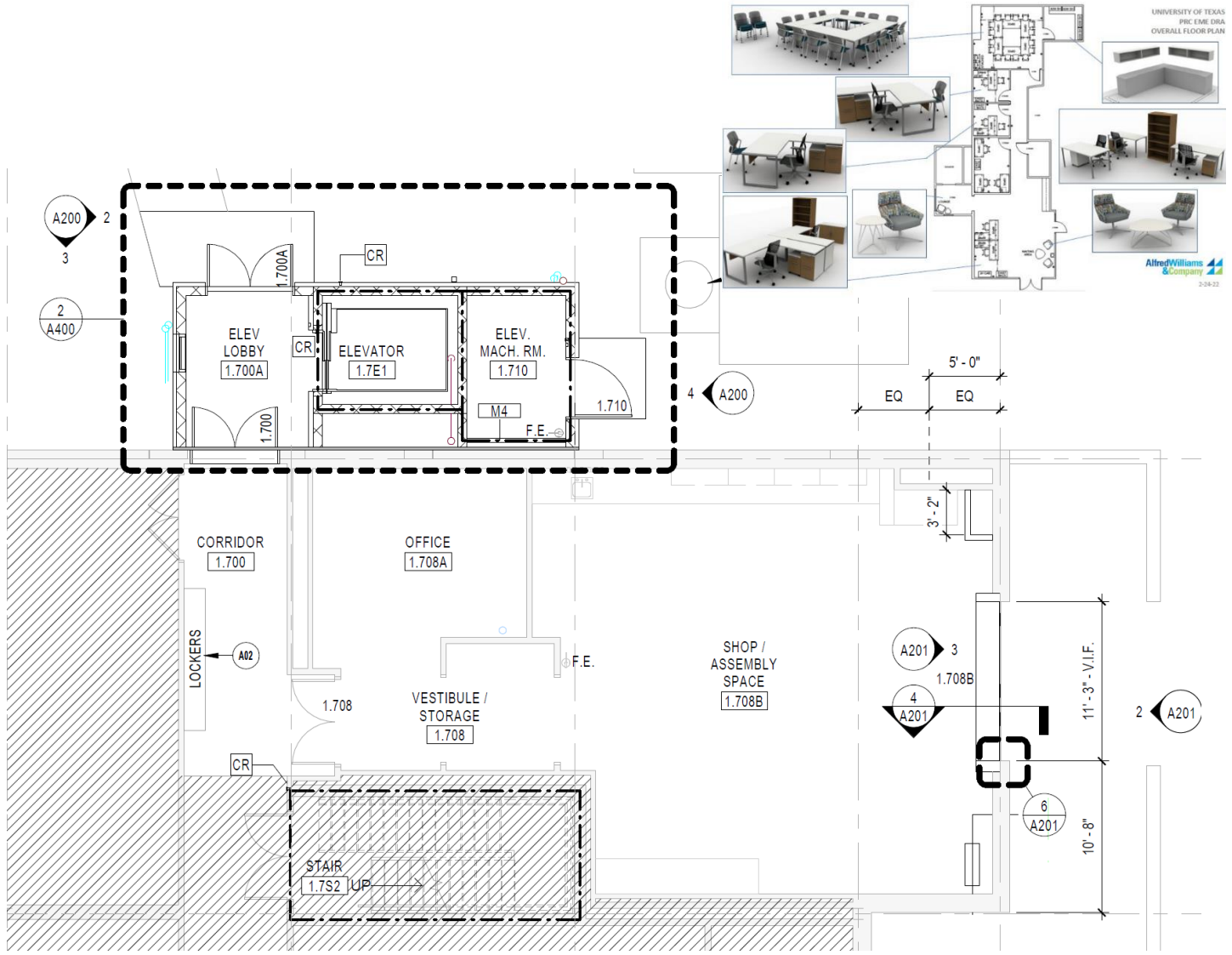
FOCUSED RESEARCH PROJECTS



RCOE UT Austin Example Transition Ecosystem

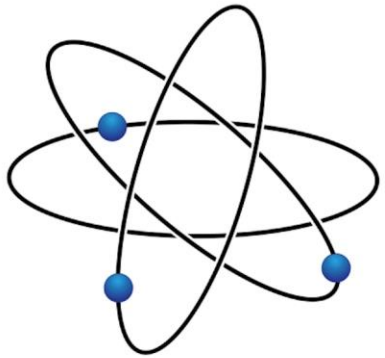
UT Secure Research Environment (SRE)

- **UT Austin has renovated research with CUI.**
  - Pickle Research Campus, EME building
  - US Persons only
  - Dedicated IT infrastructure
  - Control Plan and Restrictive SOPs
  - 800-171 Compliant
- **Layout**
  - 15,000 sq ft.
  - Upper floor offices and lab space
  - Lower floor garage for large vehicles
- **Additional TACC / Virtual Server**
  - Store documents with limited distribution
- **Status**
  - Operational
  - Used by multiple research labs

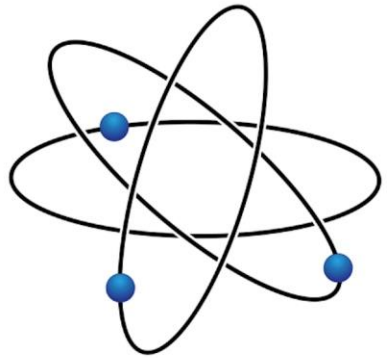


Previously

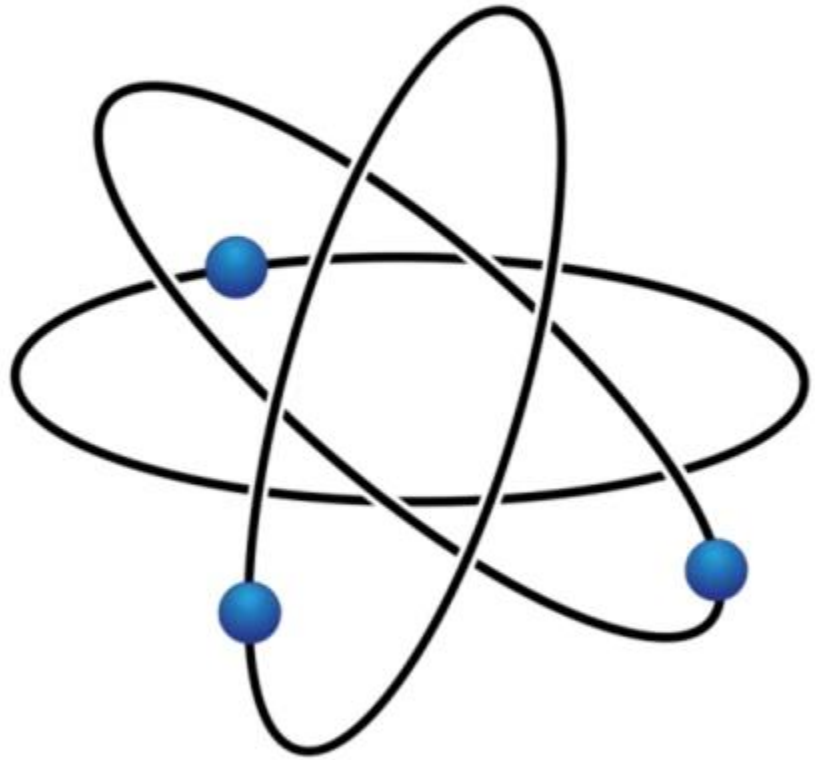
Full Demo



Highlights

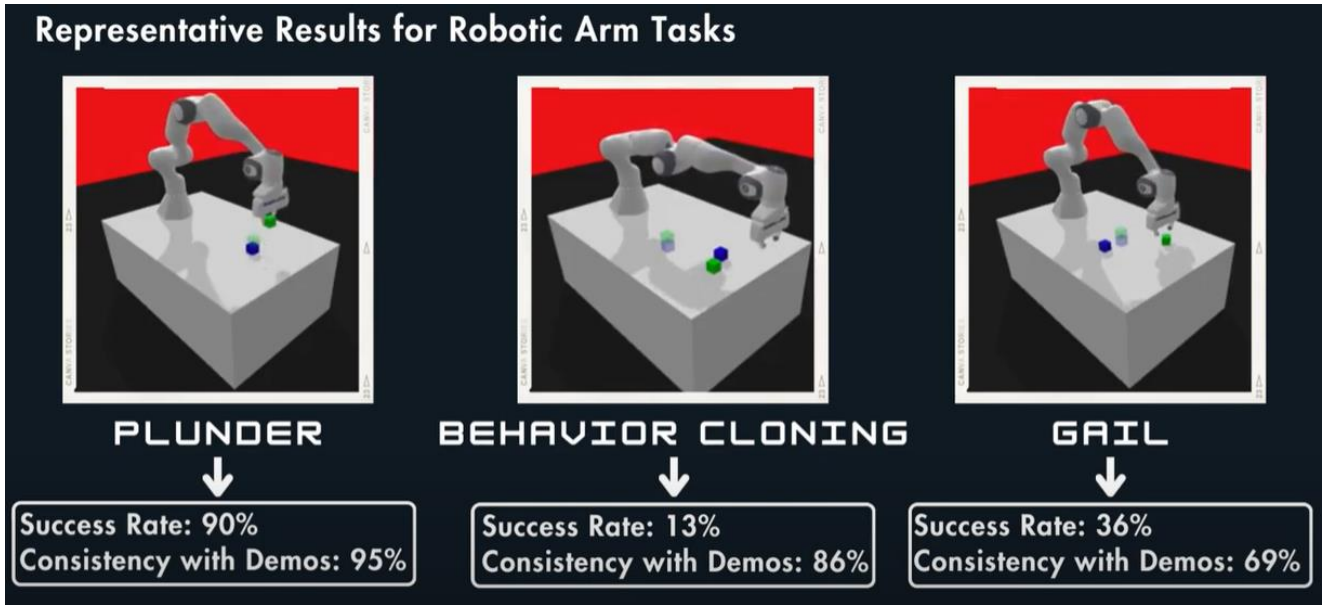


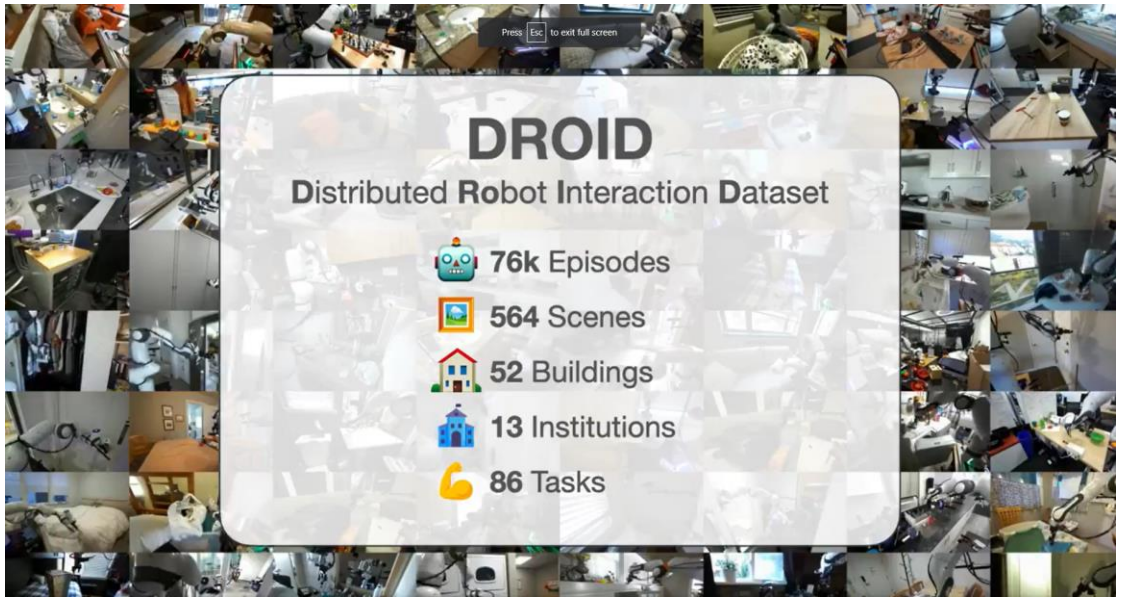
Nuclear & Applied Robotics Group

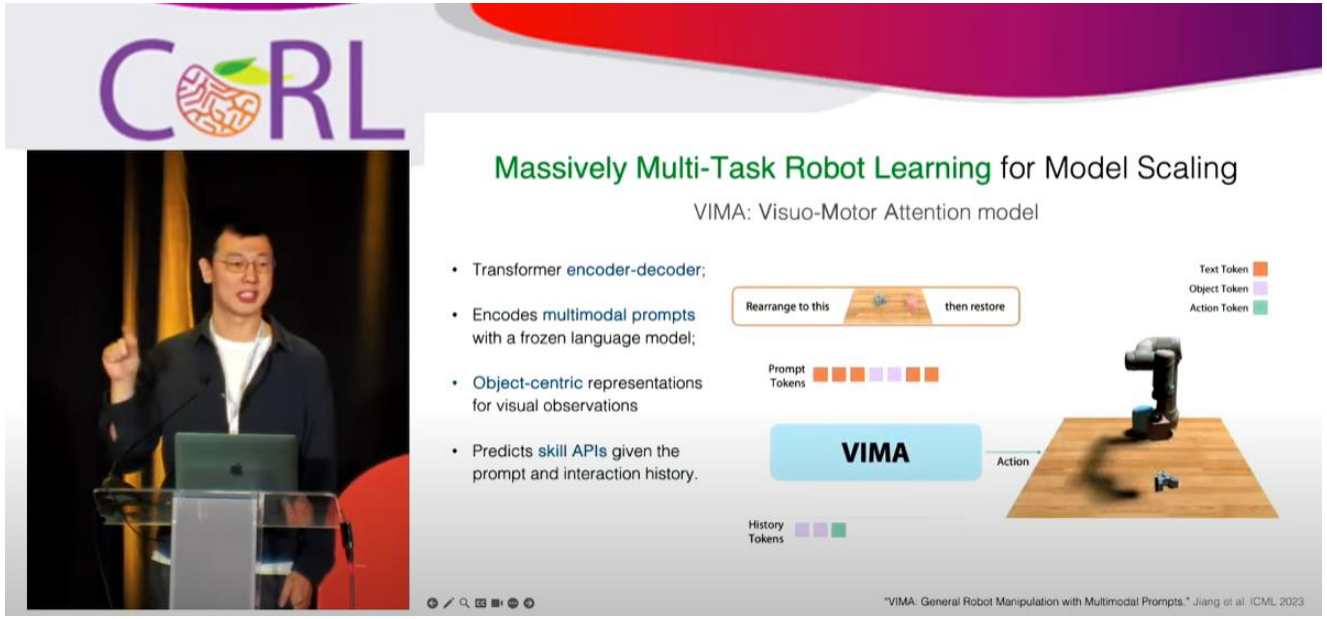


The University of Texas at Austin

Finally, where does AI Fit?





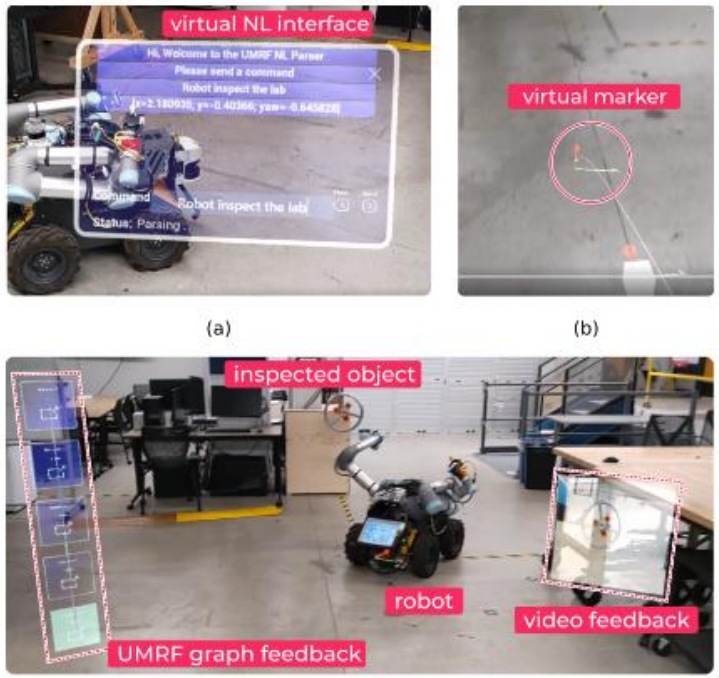


Where DOES AI Work?

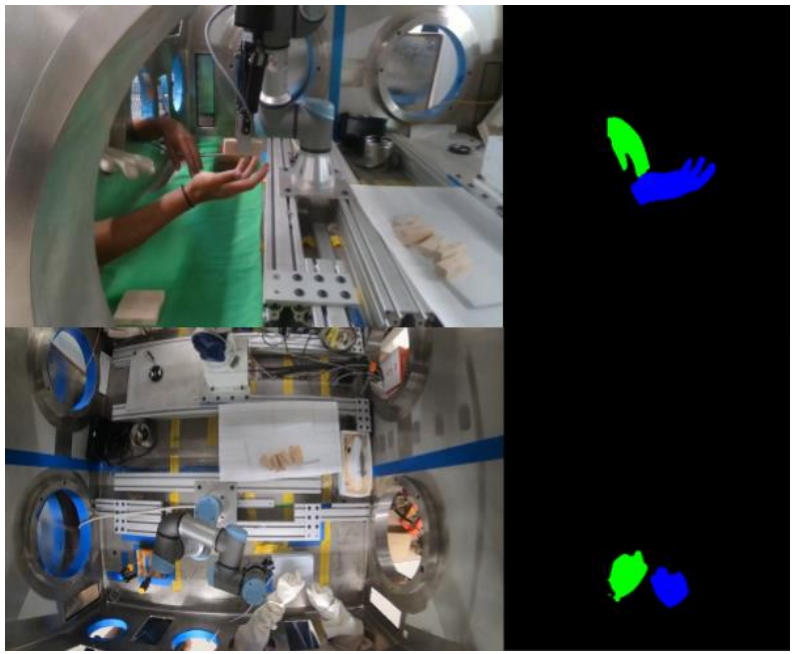
Where does AI Fit?

Where does AI Fit?

- Unlocking Underrepresented Use Cases for LLM Model Driven Human Robot Task Planning, *Advanced Robotics*
  - Mitch Pryor, et al. UT Austin
  - Selma Wanna, LANL
  - Robert Valner et al., University of Tartu, Estonia

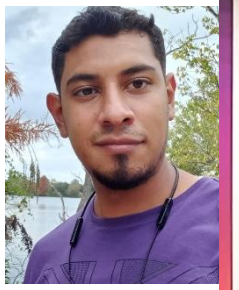


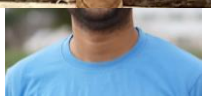
Human-in-the-Loop w/ Low Number of In Context Examples

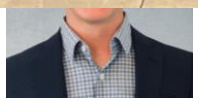


Gloved Hand Data Set

Thanks to the NRG Team







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robotics@utexas.edu

robotics.utexas.edu