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Welcome to TRI

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Welcome to TRI

10:00-10:05	Greeting and Intros
10:05-11:05	TRI Overview Robotics Overview Tour of Robotics Lab
11:05-11:35	SIC Overview
11:35-11:45	Break/walk to lunch
11:45-12:45	Lunch

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TRI Overview

Eric Krotkov

"We are rapidly accelerating our pace in advancing Toyota's automated driving capabilities with a vision of saving lives, expanding access to mobility, and making driving more fun and convenient."

Gill Pratt
CEO, Toyota Research Institute
Fellow, Advanced R&D Company,
Toyota Motor Corporation

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Quick Facts

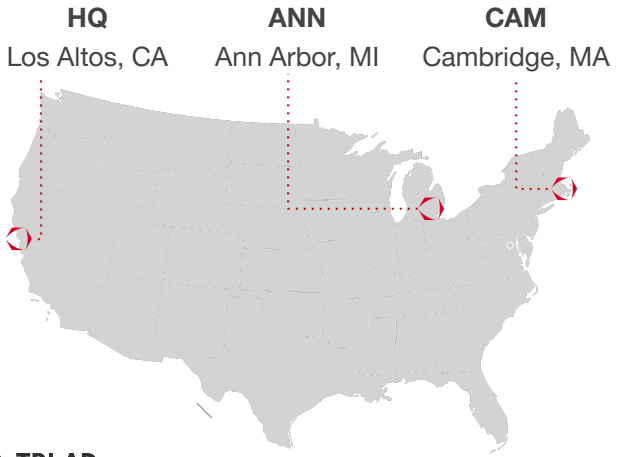
~$300M/yr
Budget

~ 300
Employees

3
sites

- Established in January 2016
- What we do: Automated driving, Robotics, Exploratory research
  - Leadership with experience from key government agencies & companies
  - 45% of R&D staff hold PhD degrees
- Three facilities in Cambridge, Ann Arbor, & Silicon Valley
- Working closely with related Toyota Companies:

TOYOTA AI VENTURES
TOYOTA connected
CSRC Collaborative Safety Research Center TOYOTA
TRI-AD



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TRI: Our Leadership Team

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TRI: Our People & Culture

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What We Do

AUTOMATED DRIVING

Two-track development approach:

Chauffeur: full autonomy where the human is essentially removed from the driving equation

Toyota Guardian: amplifies human vehicle control, not replace it

ROBOTICS

Developing intelligent, capable, & assistive robots that improve the quality of human life & extend people's independence

EXPLORATORY RESEARCH

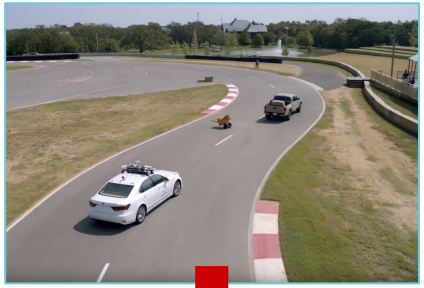
ACCELERATED **M**ATERIAL **D**ESIGN & **D**ISCOVERY

MACHINE **A**SSISTED **C**OGNITION

UNIVERSITY COLLABOR-ATIONS

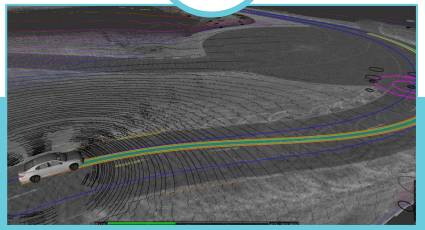
TRI Aims to Transform the Human Condition

Safety



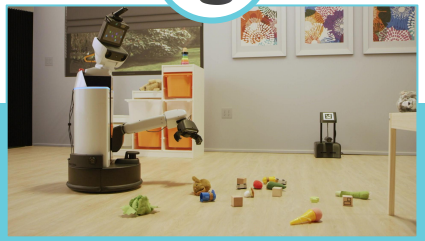
Guardian

Access



Chauffeur

Quality of Life



Robots

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Automated Driving Approach:

One System, Two Modes

GUARDIAN

CHAUFFEUR

Driver always engaged, but vehicle monitors and intervenes to help prevent collisions

Builds on similar hardware and software development as fully-autonomous Chauffeur

Fully autonomous driving system engaged at all times

Staged commercial release, likely beginning with shared mobility fleets

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Robotics

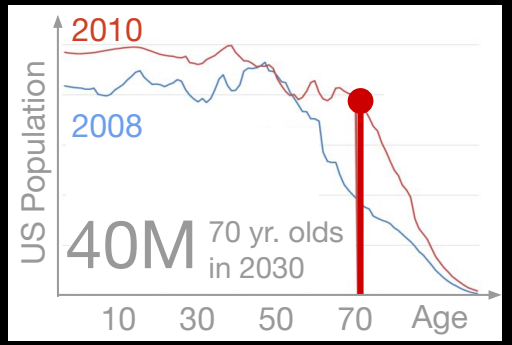
Enabling intelligent, physically-capable, & socially-assistive robots

Situational Awareness

Manipulation

*Source: IFR World Report, METI/NEDO, Tractica, BCG, P&S Market Research, Dream Incubator

Global Trend



US Population Age over 65
Today: 13% 2030: 20%

Japan Population Age over 65
Today: 20% 2035: 40%

Global Robots Market
2020: $68B 2030: $400B

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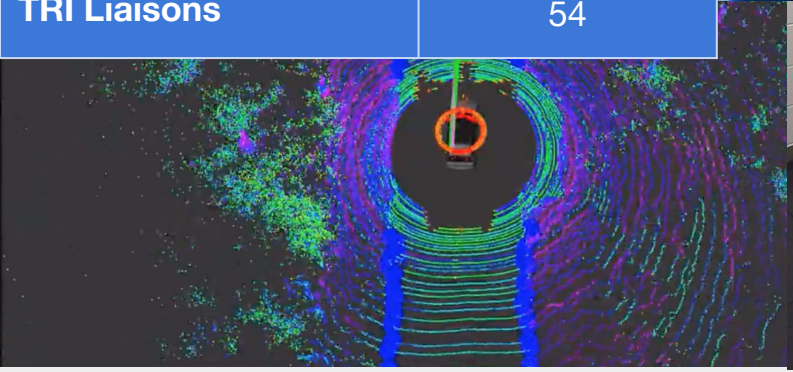
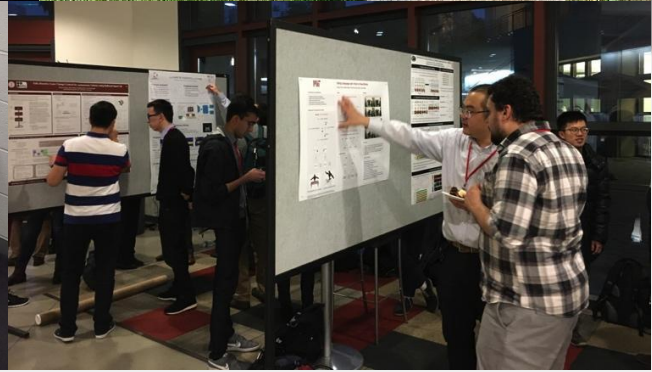
University Research Program

Projects	96
Faculty	> 100
Students & Postdocs	> 200
TRI Liaisons	54





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Program Outputs (Through July 2019)

	Interns	Hires	Papers	Patent Filings
Stanford	10	4	146	12
MIT	3	6	116	16
Michigan	8	8	54	5
Totals	21	18	316	33

CVPR 2018 Best Paper. ICRA 2019 Best Paper

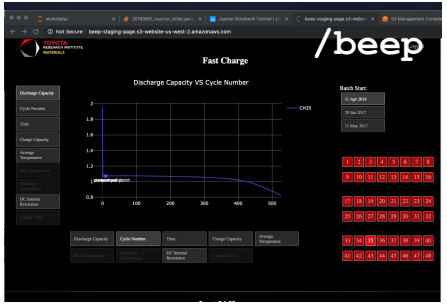
ICRA 2019 Finalist Best Paper

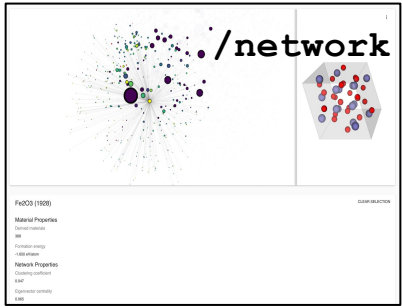
AMDD
(Accelerated Material Design & Discovery)

Applying AI to accelerate discovery of advanced materials for future mobility

New Tools for advancing batteries and fuel cells

Collaborating with universities, research entities, & companies (~$35M over 4 years)





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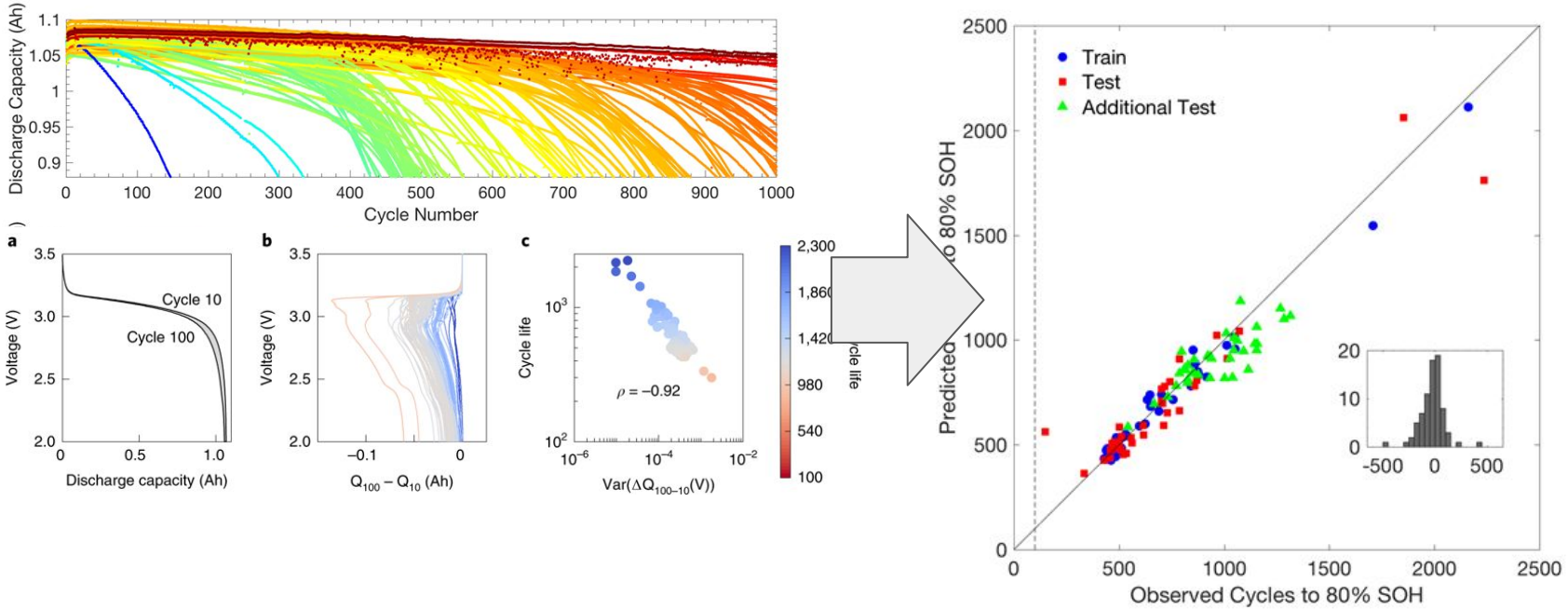
BEEP predicts battery cycle life quickly



Data driven prediction of battery cycle life before capacity degradation. Nature Energy, 2019.

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Machine Assisted Cognition (MAC)

Develop and demonstrate computational aids to amplify and augment human cognitive abilities

- Computational aids - AI-powered software systems that directly assist users with tasks requiring careful, deliberate thought
- Cognitive abilities - Prediction, judgment, decision making
- Amplify and augment - The goal is not to imitate or replace human abilities; instead, the goal is to leverage and extend them

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TRI Robotics

Russ Tedrake

Robotics Capabilities - Manipulation

Robotics Capabilities - Fleet Learning

Thank You