

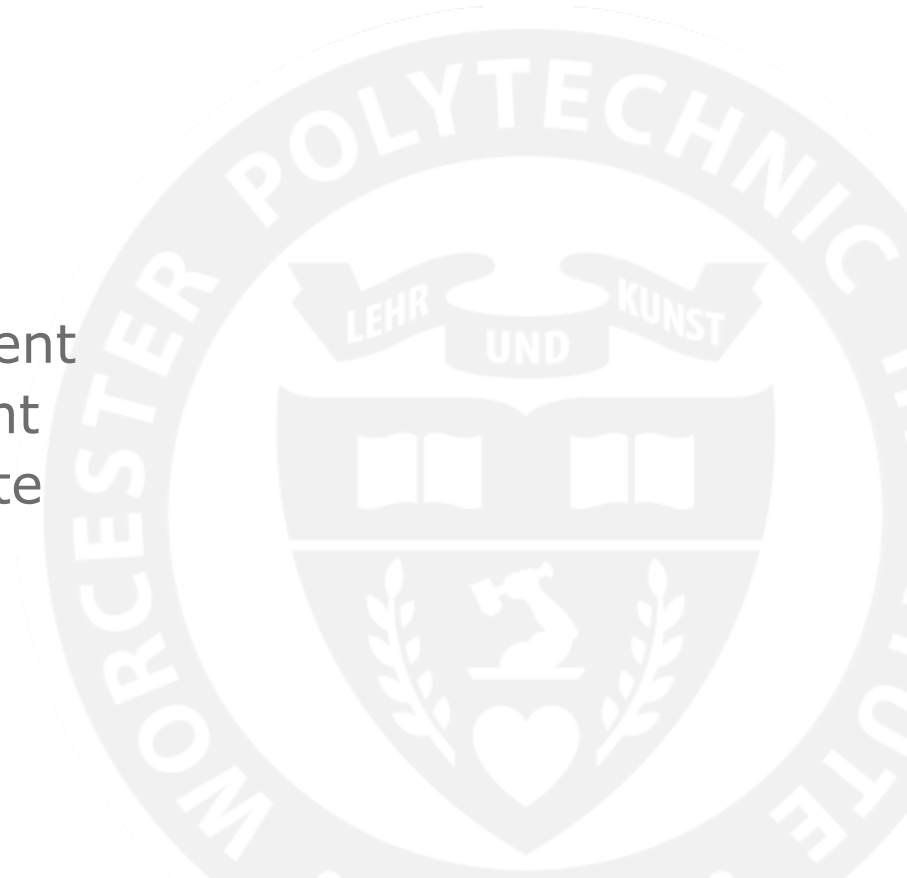
Facilitating Benchmarks for Robotic Manipulation

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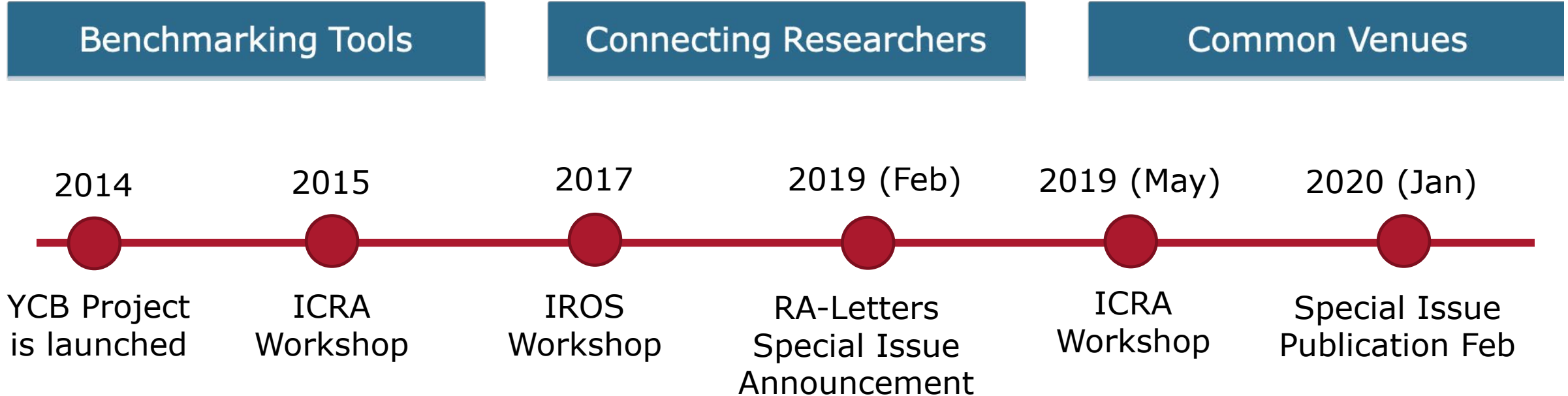


WPI



Outline

- Efforts to enable benchmarking in robotic manipulation



Outline

- Efforts to enable benchmarking in robotic manipulation

Benchmarking Tools

Connecting Researchers

Common Venues

2014

YCB Project
is launched



[1]



[2]



[3]



[4]

[1] Andreas ten Pas, Robert Platt, Using Geometry to Detect Grasps in 3D Point Clouds, 2015

[2] Ravi Balasubramanian, Ling Xu, Peter D. Brook, Joshua R. Smith, Yoky Matsuoka, Human-Guided Grasp Measures Improve Grasp Robustness on Physical Robot, ICRA, 2010

[3] David Fischinger and Markus Vincze, Empty the Basket - A Shape Based Learning Approach for Grasping Piles of Unknown Objects, IROS 2012.

[4] Ashutosh Saxena Justin Driemeyer Andrew Y. Ng Robotic Grasping of Novel Objects using Vision, IJRR, 2008.

Facilitating Benchmarking in Robotic Manipulation

2014

YCB Project is launched

YCB
Object and Model Set



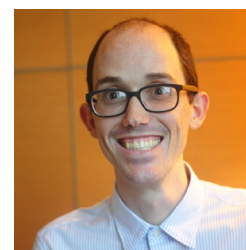
Aaron Dollar



Berk Calli



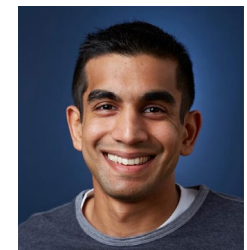
Sidd Srinivasa



Aaron Walsman



Pieter Abbeel



Arjun Singh

Facilitating Benchmarking in Robotic Manipulation

YCB Object and Model Set



Benchmarking Tools

YCB

Object and Model Set



YCB Object and Model Set



- Presented the set in the ICRA workshop
- Distributed it for free to the attendants
- Started online distribution (to what it costs)
- ~200 sets have been distributed so far

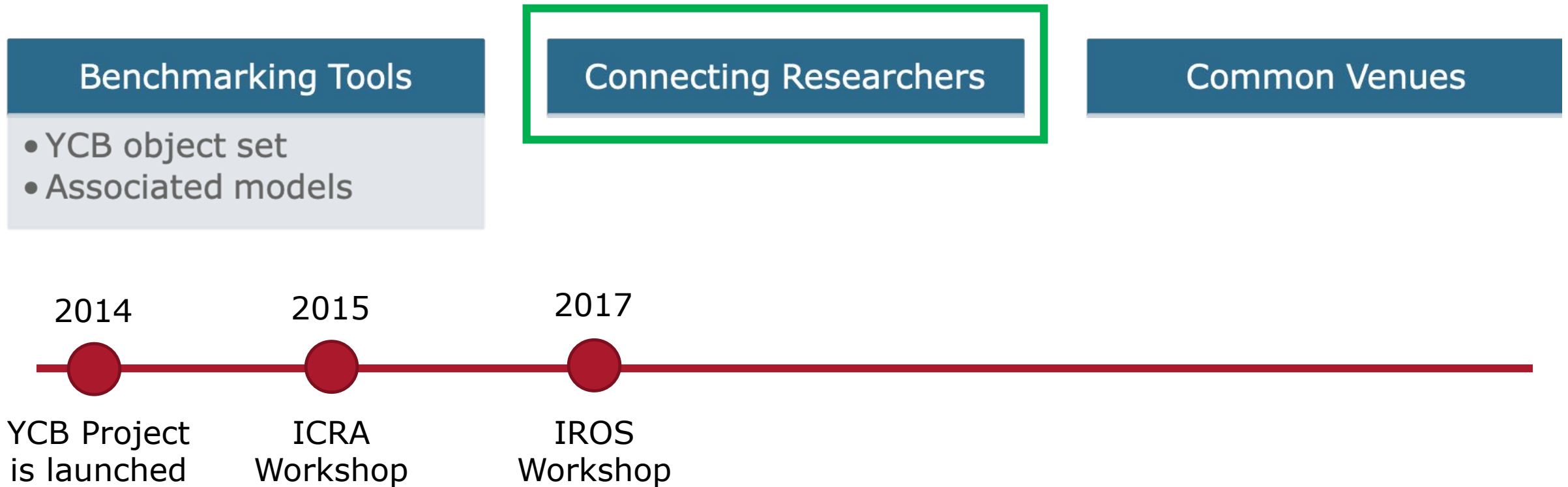
YCB Object and Model Set



- The set was widely utilized by the research community
- However,
 - Experimental procedures are not standardized
 - Quantification metrics are not standardized

Outline

- Efforts to enable benchmarking in robotic manipulation



Connecting Researchers

- Formed workgroups
 - We got in-touch with people
 - 8 groups are formed in various sub-fields
 - Each group has researchers from different institutions

Examples of the Workgroups

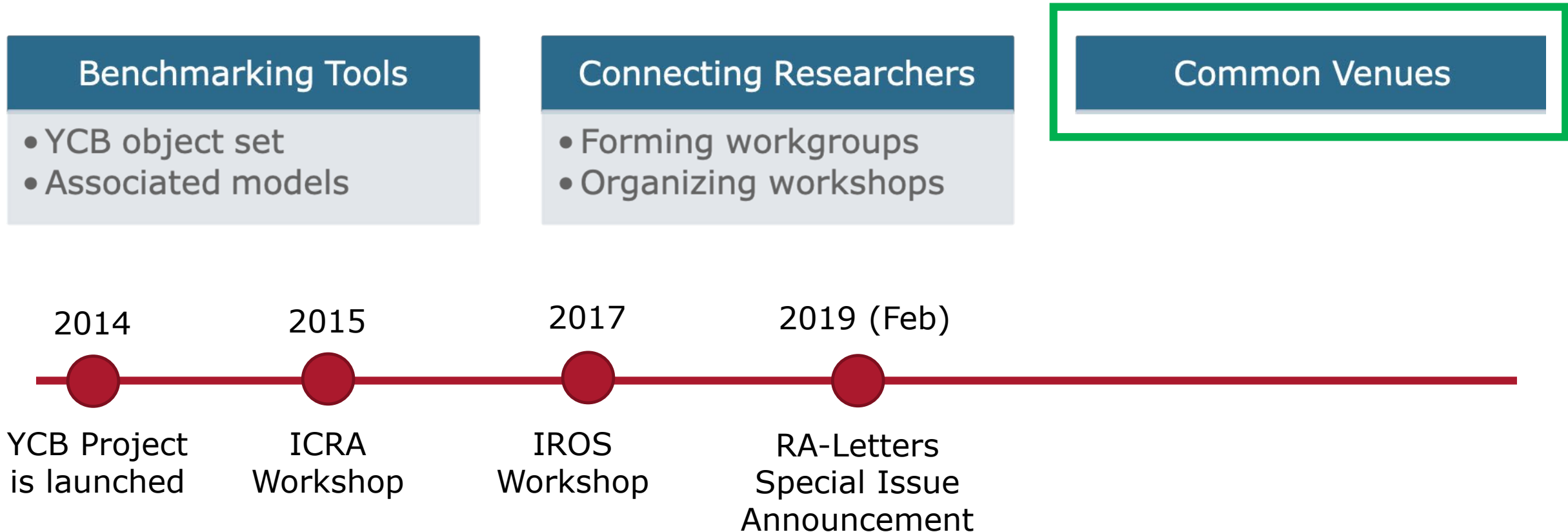
Force/tactile sensing for manipulation	Nikolaus Correll (U of Colorado)
	Rob Howe (Harvard)
	Veronica Santos (UCLA)
	Matei Ciocarlie (Columbia)
	Oliver Brock (TU Berlin)
Within-hand manipulation	Tucker Hermans (U of Texas)
	Vikash Kumar (U of Washington)
	Alberto Rodriguez (MIT)
	Nikhil Narsingh Chavan Dafle (MIT)
Aerial manipulation	Anibal Ollero (University of Seville)
	Kostas Alexis (U of Nevada)
	Antonio Franchi (CNR)

Connecting Researchers

- Formed workgroups
 - We got in-touch with people
 - 8 groups are formed in various sub-fields
 - Each group has researchers from different institutions
- Designing benchmark with collaboration
 - Reduces the risk of overfitting
 - Improves the dissemination of the benchmark
 - Fosters collaboration
- Organized a workshop to share the results

Outline

- Efforts to enable benchmarking in robotic manipulation



Editing a Special Issue

- A publication/reward mechanism was needed
- A concrete goal was needed
- Editing a special issue in IEEE RA-Letters
 - Asked for a letter of intent
 - Received over 25 letters
 - Connected people working towards the same goal
 - Sent guidelines to both authors and reviewers
 - Sent templates

Outline

- Efforts to enable benchmarking in robotic manipulation

Benchmarking Tools

- YCB object set
- Associated models

Connecting Researchers

- Forming workgroups
- Organizing workshops

Common Venues

- RA-Letters special issue
- Benchmarking website



Receiving feedback (ICRA 2019)

- The researchers presented their benchmarks, received feedback from other researchers
- Updated the benchmarks before the submission

Outline

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Connecting Researchers

- Forming workgroups
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Common Venues

- RA-Letters special issue
- Benchmarking website



ycbbenchmarks.com

Not Secure | ycbenchmarks.com/protocols-and-benchmarks/

Name	Publication Date	Authors	Purpose	Files (ID / Version)	Search
Bimanual Manipulation Benchmark	Feb. 2020	Konstantinos Chatzilygeroudis, Bernardo Fichera, Ilaria Lauzana, Fanjun Bu, Kunpeng Yao, Farshad Khadivar, and Aude Billard	Assess the motion planning and/or learning performance of a multi-arm systems	Protocol Benchmark Videos Paper	
Box and Blocks Benchmark	Feb. 2020	Andrew S. Morgan, Kaiyu Hang, Walter G. Bircher, Fadi M. Alladkani, Abhinav Gandhi, Berk Calli, Aaron M. Dollar	Assess unilateral gross manual dexterity	Protocol Benchmark Videos Supplementary Paper	
GRASPA-benchmark	Feb. 2020	Fabrizio Bottarel, Giulia Vezzani	Assess the performance of a grasp planning algorithm in a physical robot setup,	Protocol Benchmark Paper	

Discussion on Future Steps

- Divide into sub-categories
- Identify all the benchmarks out there
 - Have an updated website
 - List of how many groups are using them etc.
 - Leader boards
- Determine the strengths and weaknesses of these existing benchmarks
- We could also do surveys for two separate groups
 - The researchers who have used benchmarks
 - The researchers who have not utilized benchmarks
 - Asking them what can be improved
- We can determine the existing datasets and how they are used in literature, as well as some simulation platforms that are utilized
- An RA-Magazine paper introducing the portal?



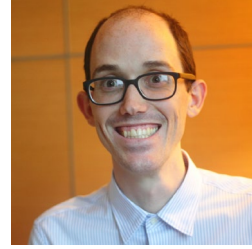
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Adam Norton



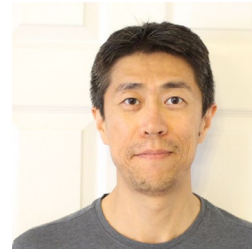
Joe Falco



Kurt Konolige



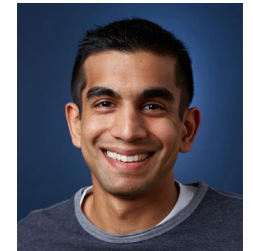
Jim Bruce



Yu Sun



Maximo Roa



Arjun Singh

