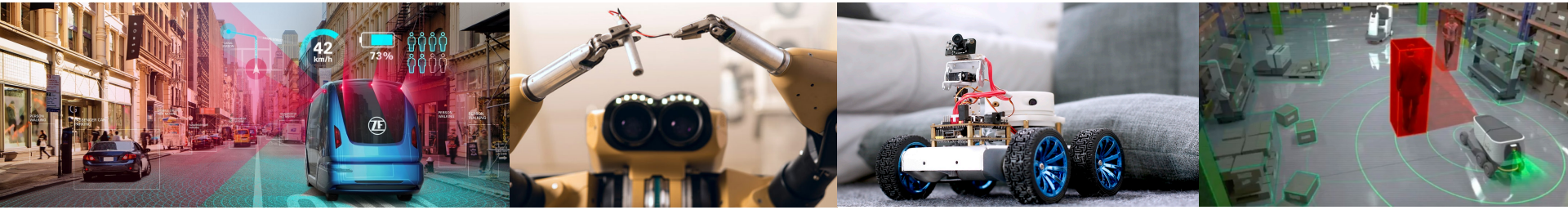
3D Vision and Robotics Workshop

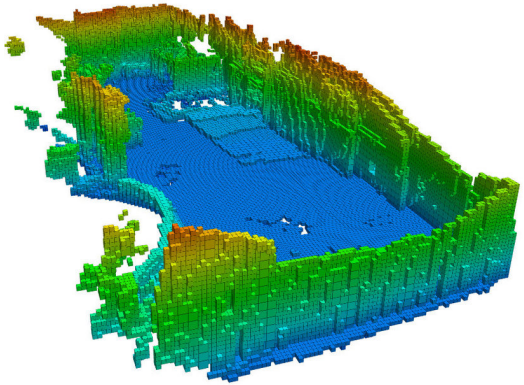
3DVR @ CVPR 2021



Yuke Zhu

The University of Texas at Austin

What is This Workshop About?



3D Vision

+

Robotics

Challenges in Robot Perception

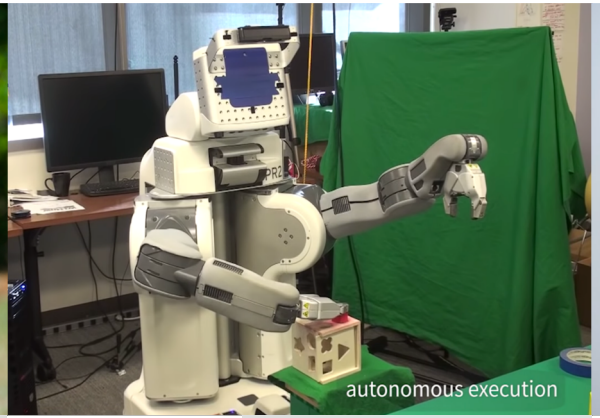
Making sense of and interacting with the unstructured 3D world…

- Incomplete knowledge of objects and scene
- Imperfect actions may lead to failure
- Environment dynamics and other agents

The Perception-Action Loop

… where the challenges and promises in 3D Vision + Robotics reside.

[Sa et al. IROS 2014]

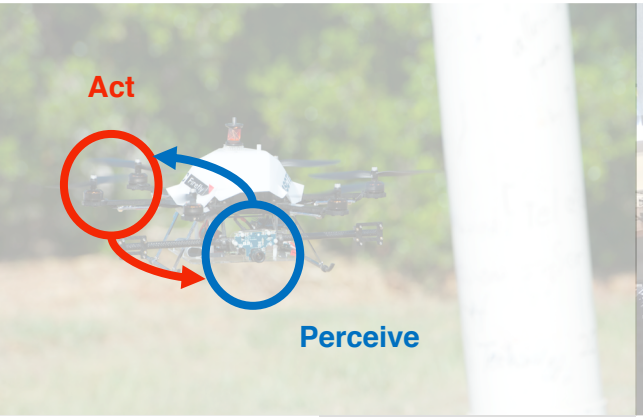


[Levine et al. JMLR 2016]

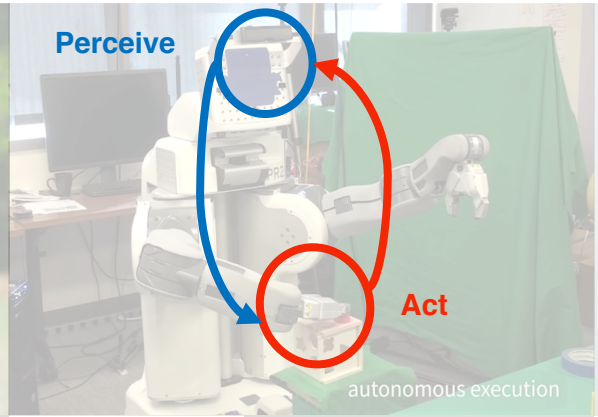
[Bohg et al. ICRA 2018]

The Perception-Action Loop

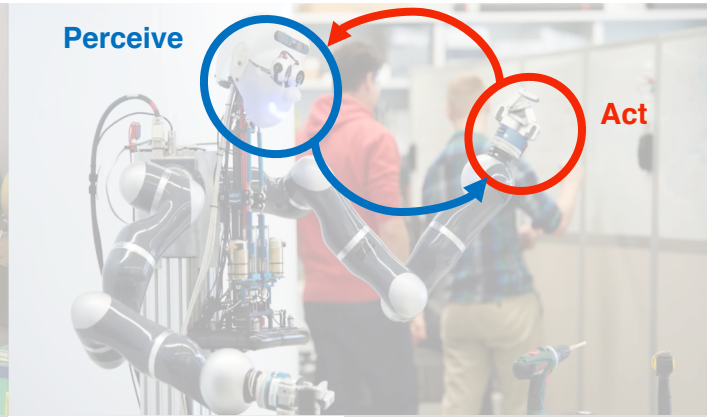
… where the challenges and promises in 3D Vision + Robotics reside.



[Sa et al. IROS 2014]



[Levine et al. JMLR 2016]



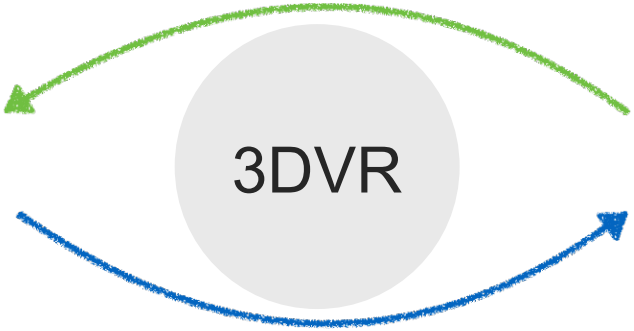
[Bohg et al. ICRA 2018]

The Perception-Action Loop

Robotics

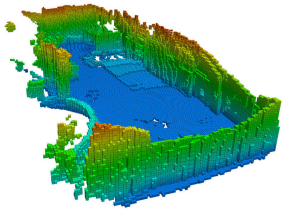
Perception

making sense of the 3D environment



Action

interacting with the physical world



3D Vision

3D Vision and Robotics: Landscape

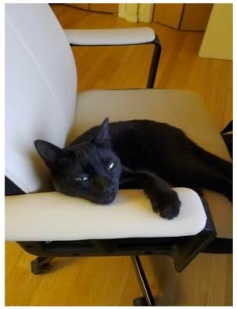
Four key themes that we will cover in this workshop:

1. Representations: 3D representations that inform physical interactions;
2. Modalities: Model architectures for processing raw sensory data;
3. Tasks: 3D vision and robotic tasks and datasets as new frontiers;
4. Applications: cutting-edge robotic applications empowered by 3D vision.

3D Vision and Robotics: Representations

A fundamental problem in robot perception is to learn the proper **representations** of the unstructured 3D world.

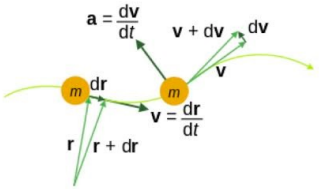
Things...

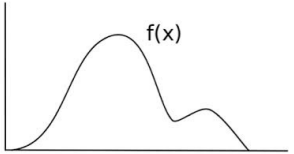


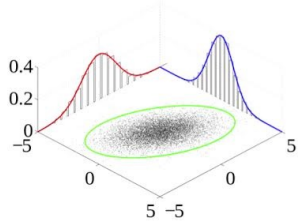
My heart beats as if the world is dropping, you may not feel the love but i do its a heart breaking moment of your life. enjoy the times that we have, it might not sound good but one thing it rhymes it might not be romantic but i think it is great,the best rhyme i've ever heard.

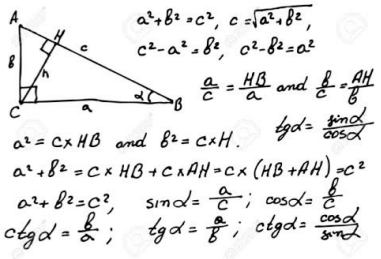
Representation

Engineering Knowledge...









[Source: Stanford CS331b]

3D Vision and Robotics: Representations

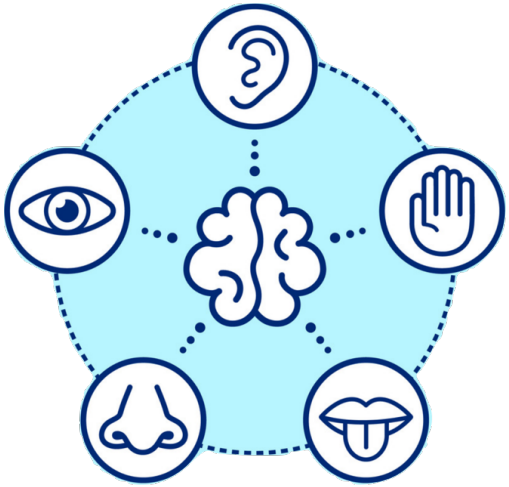
"Solving a problem simply means representing it so as to make the solution transparent."

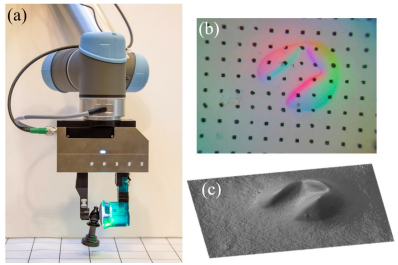
Herbert A. Simon, Sciences of the Artificial

What representations to learn? How to learn them?

3D Vision and Robotics: Modalities

Making contact of the physical world through multimodal senses



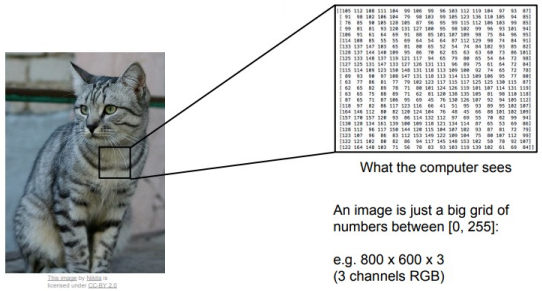


3D Vision and Robotics: Modalities

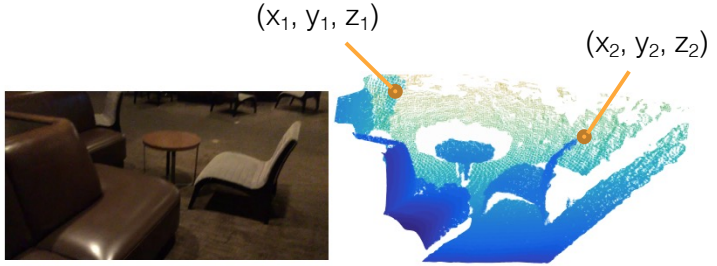
Making contact of the physical world through multimodal senses

[Source: HKU Advanced Robotics Laboratory]

3D Vision and Robotics: Modalities

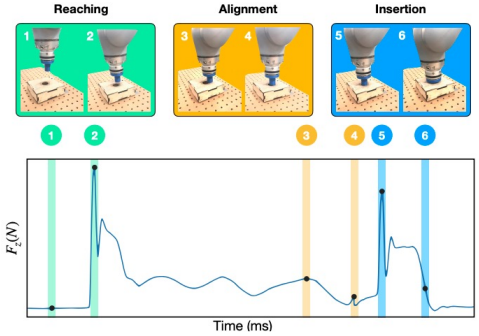


Pixels (from RGB cameras)



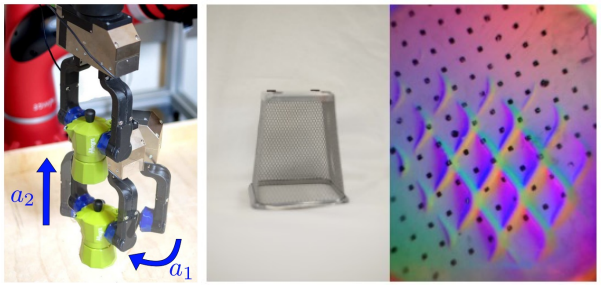
[Source: PointNet++; Qi et al. 2016]

Point cloud (from structure sensors)



[Source: Lee*, Zhu*, et al. 2018]

Time series (from haptics sensors)

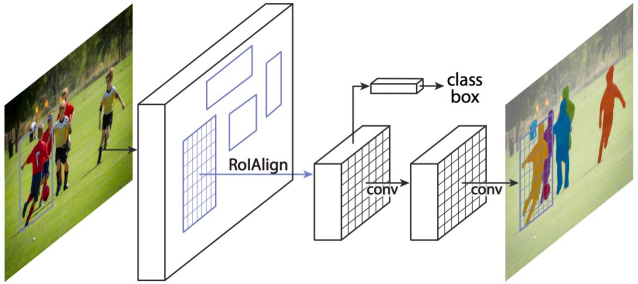


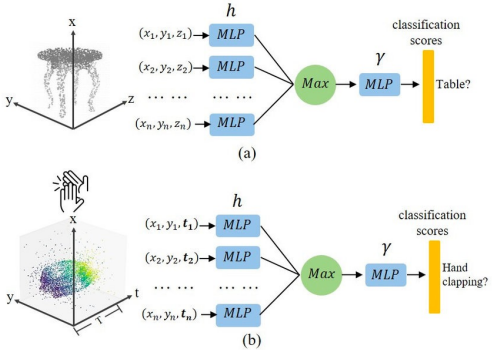
[Source: Calandra et al. 2018]

Tactile data (from the GelSights sensors)

3D Vision and Robotics: Modalities

How can we design the **model architectures** that effectively process raw sensory data in vastly different forms?

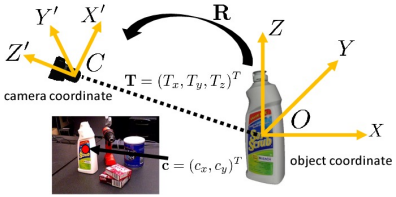




3D Vision and Robotics: Tasks

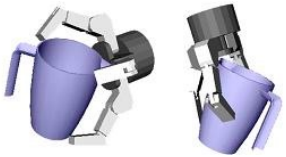
What **tasks** and **datasets** will expedite the fundamental advances in this field?

Noisy Sensory Data



Perceptual Abstraction

Robot Actions

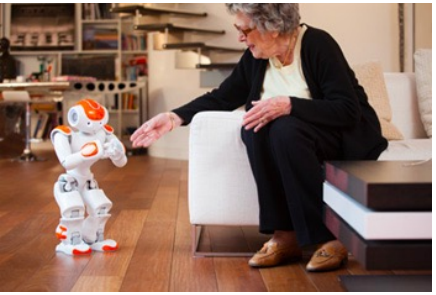


Perception & Computer Vision

Robot Control & Decision Making

3D Vision and Robotics: Applications

What real-world **applications** will be enabled by new advances in 3D vision?




Workshop Logistics

9:15am - 9:45am	**Sanja Fidler**, University of Toronto
9:45am - 10:15am	**David Held**, CMU
11:30am - 12:00pm	**Kristen Grauman**, UT Austin
12:00pm - 12:30pm	**Manolis Savva**, Simon Fraser University
12:30pm - 1:00pm	**Franziska Meier**, Facebook
2:00pm - 2:30pm	**Hao Su**, UC San Diego
2:30pm - 3:00pm	**Andy Zeng**, Google
4:00pm - 4:30pm	**Roozbeh Mottaghi**, AI2

Full-day workshop: 9:00am to 5:45pm CST

8 invited talks: 30min each

12 papers in 4 spotlight sessions

- Spotlight Session 1: Representation and Learning
- Spotlight Session 2: Recognition with Point Clouds

10:15am - 11:00am

- Spotlight Session 3: Datasets for Vision and Robotics
- Spotlight Session 4: Applications in Vision and Robotics

3:00pm - 3:45pm

Workshop Organizers

Angel X. Chang

Simon Fraser University

Katerina Fragkiadaki

Carnegie Mellon University

Qixing Huang

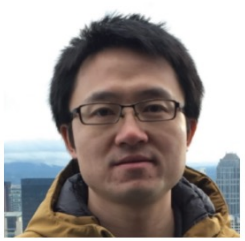
The University of Texas at Austin

Li Erran Li

Alexa AI at Amazon

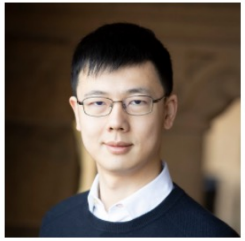
Charles Ruizhongtai Qi

Waymo LLC



Yu Xiang

NVIDIA Research



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https://sites.google.com/view/cvpr2021-3d-vision-robotics