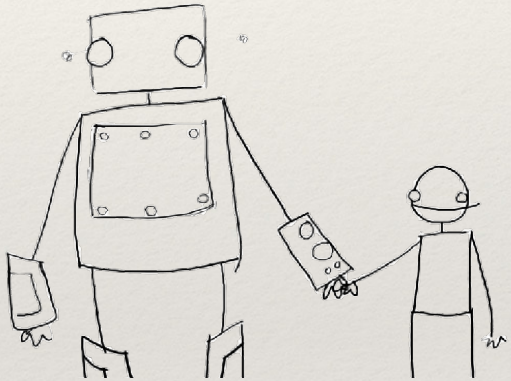
EASY PEASY ROBOTICS

ROBOT VISION



Vadim Tikhanoff & Claudio Fantacci

ROBOT VISION

Crash Course - Schianto di corso

- A little about us
- Introduction to Digital Image & Computer Vision
- Fundamentals and Applications
- Resources

ROBOT VISION

Who are we?

Easy Peasy Robotics

Vadim Tikhanoff
Istituto Italiano di Tecnologia

www.iit.it/people/vadim-tikhanoff

github.com/vtikha

www.linkedin.com/in/vtikha/

Scientist / Technologist, with a background in Artificial Intelligence and Robotics Systems, in particular the humanoid robots: iCub & R1

My superpower? I am actually a robot…

It is a fantastic opportunity to meet you all and mentor you through these intense couple of days

Easy Peasy Robotics

Claudio Fantacci
Istituto Italiano di Tecnologia
Humanoid sensing and Perception

https://www.linkedin.com/in/claudiofantacci/

https://www.iit.it/people/claudio-fantacci

https://github.com/claudiofantacci

R&D Engineer / Scientist with background in recursive Bayesian estimation (Kalman and particle filters) and software engineering.

Superpower?! I'm Ironman (or Robert Downey Jr.?!).

I will be **mentoring** you during the course and you will learn how to code on a real humanoid robot (head)!
Student: *Not a great plan. When the time comes, and it WILL, everything will just go wrong.*
Claudio: *We have a Hulk.*

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Introduction to Digital Image & Computer Vision

- What is a Digital Image?
  - It is an array of numbers

45	51	88	89	94	100	98	103	104	104
47	146	102	100	118	183	125	101	99	100
34	135	33	32	53	88	73	34	29	30
48	84	39	63	55	25	33	32	31	31
151	43	114	151	152	135	134	129	134	165
208	115	35	33	36	39	39	72	93	176
210	171	39	34	39	40	109	86	77	208
209	175	40	39	37	53	90	39	80	222
200	185	49	38	35	75	72	45	90	197
66	85	39	35	33	52	86	49	49	83

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Introduction to Digital Image & Computer Vision

- An image is a two-dimensional function: f(x,y).
  - x and y are the spatial coordinates.
  - f(x,y) is the intensity of the image at the point (x,y)
  - In a digital image, x, y, and f(x,y) are finite, discrete quantities.
  - These elements are called picture elements.

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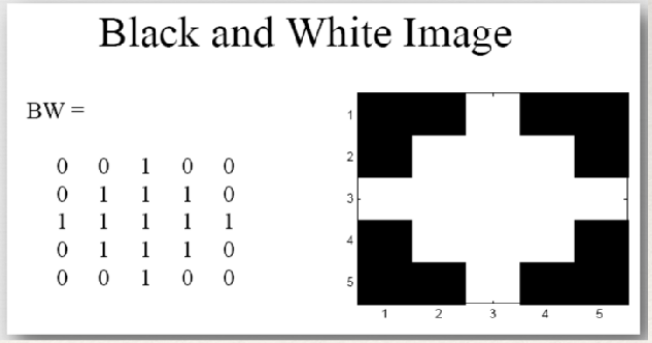
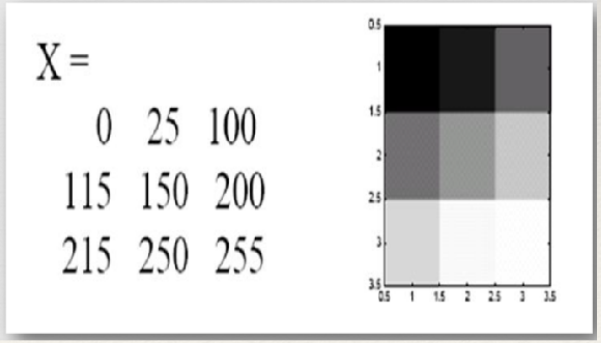
Introduction to Digital Image & Computer Vision

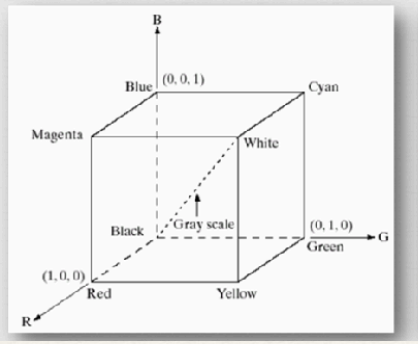
- Digital Image Types:
  - Black & White images
  - Gray Scale Images
  - Coloured Images

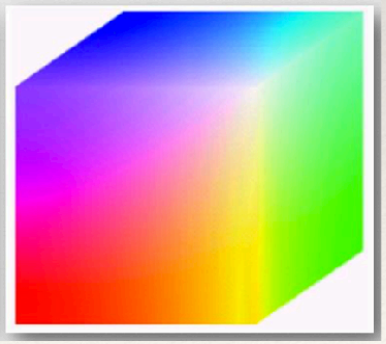


Binary 0-1



Gray Scale 0-255





RGB representation (HSL, HSV, LAB, YUV, …)

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Introduction to Digital Image & Computer Vision

Image Processing <======> Computer Vision

acquisition

compression

enhancement

restoration

segmentation

representation

pattern recognition

understanding

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Make computers / robots understand images and video

- Specific Recognition Tasks
  - Outdoor, indoor.
  - City, forest, factory.
- Image Annotation
  - street
  - people
  - building
  - mountain
  - tourism
  - cloudy
  - brick

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Make computers / robots understand images and video

- Object Detection
  - Find Pedestrian

- Image Segmentation

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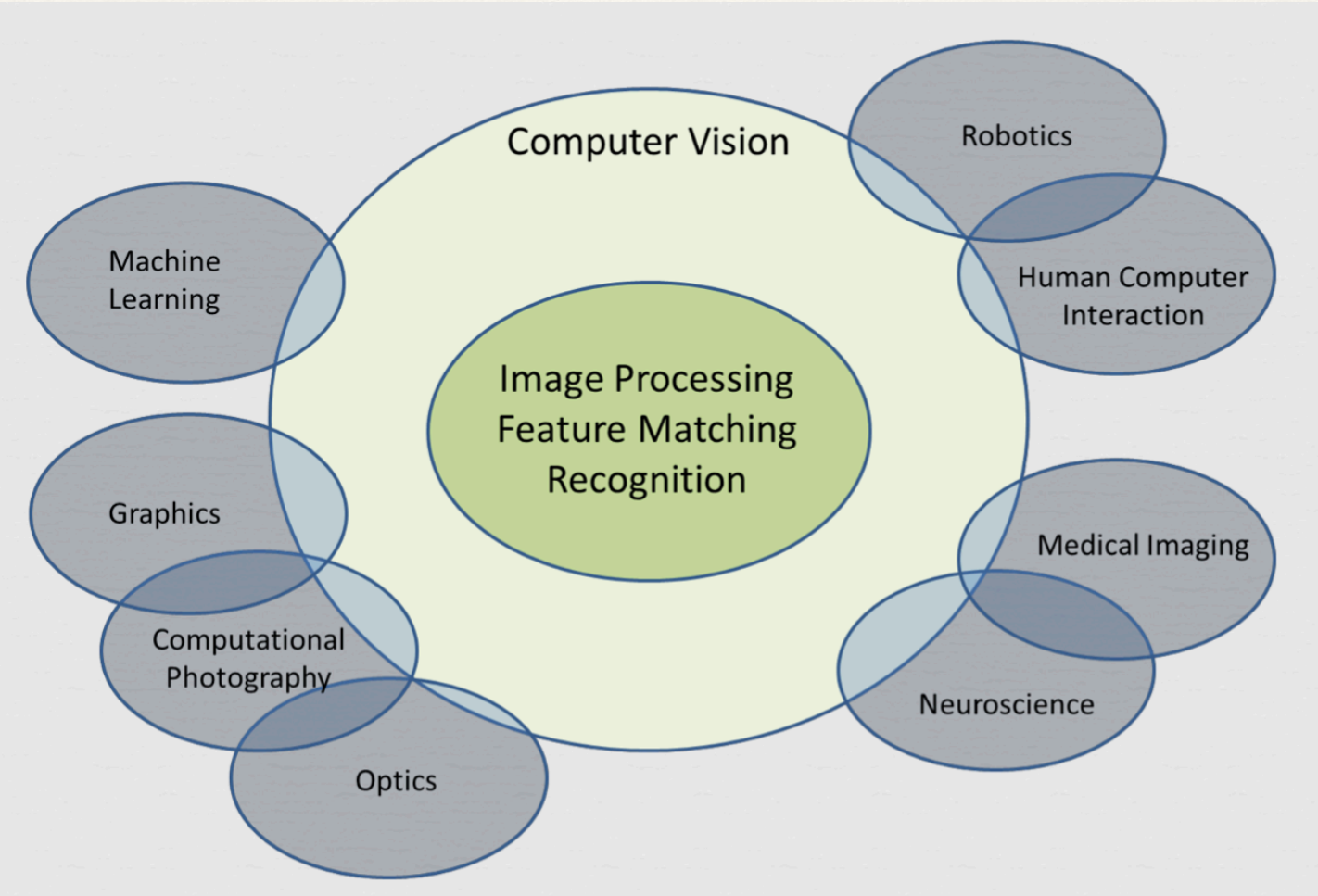
Computer Vision Scope



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Computer Vision is **Really Hard…**

ROBOT VISION

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ROBOT VISION

Computer Vision is **Really Hard…**

- Where was this picture taken ?
- How many people are there ?
- What are they doing ?
- What is the object the person on the left is standing on?
- Why is this a funny picture ?

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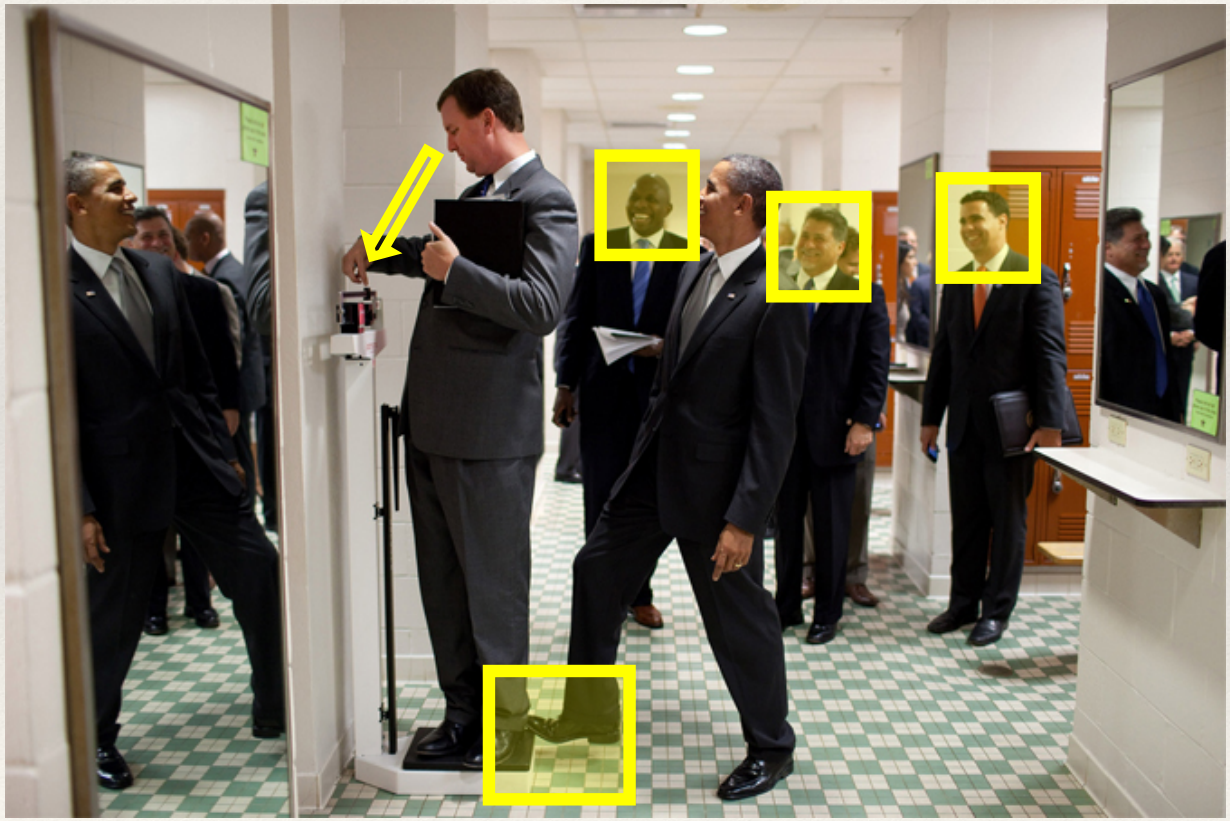

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ROBOT VISION

Fundamentals and Applications - 2D Vision

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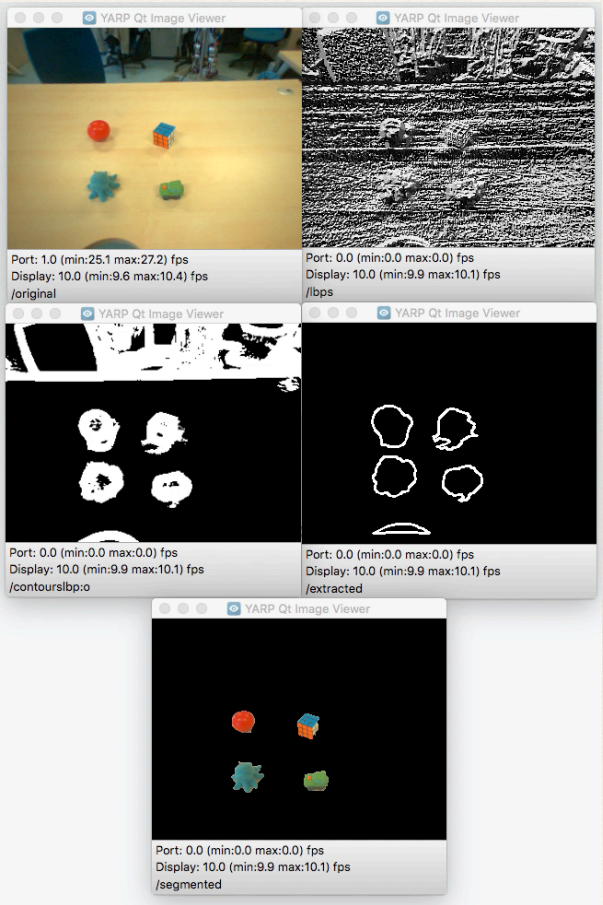
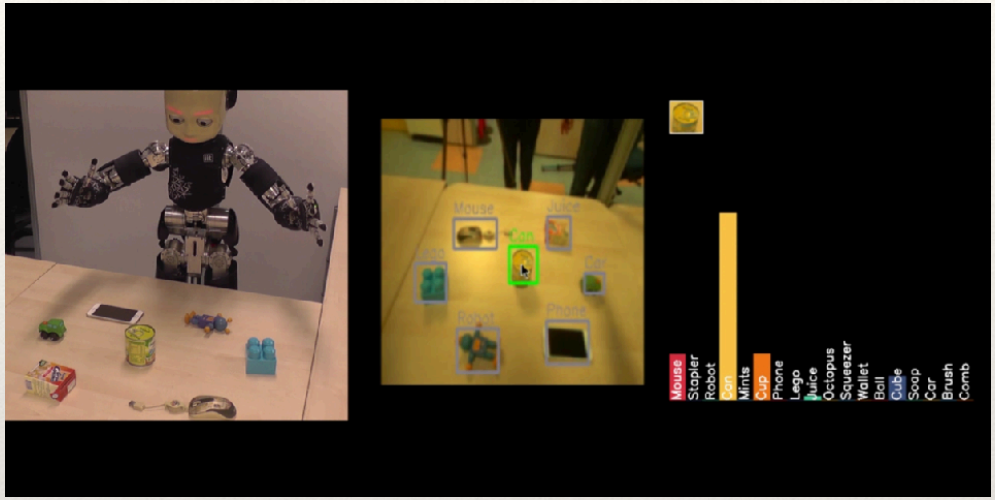
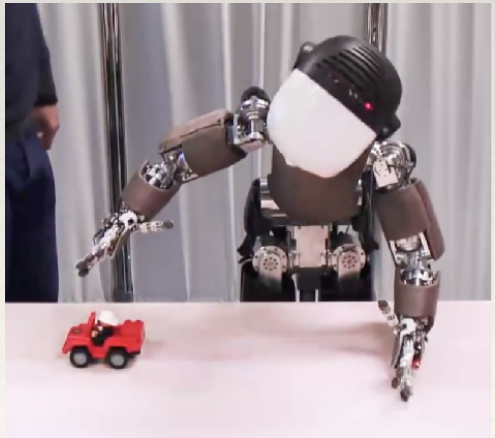
Fundamentals and Applications - 2D Vision







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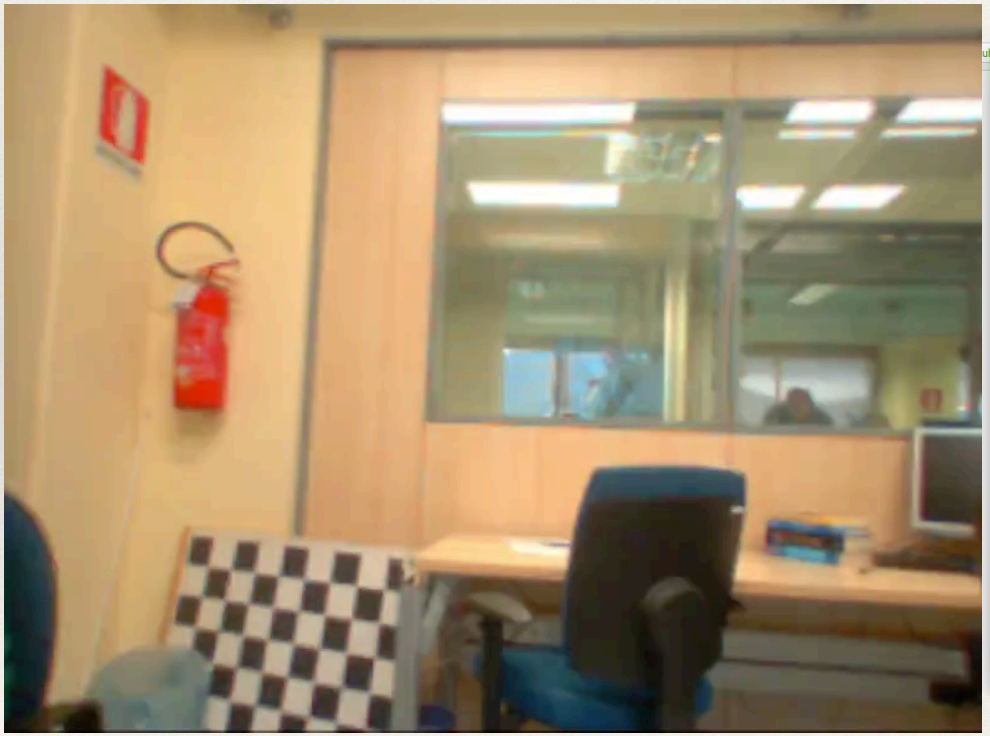
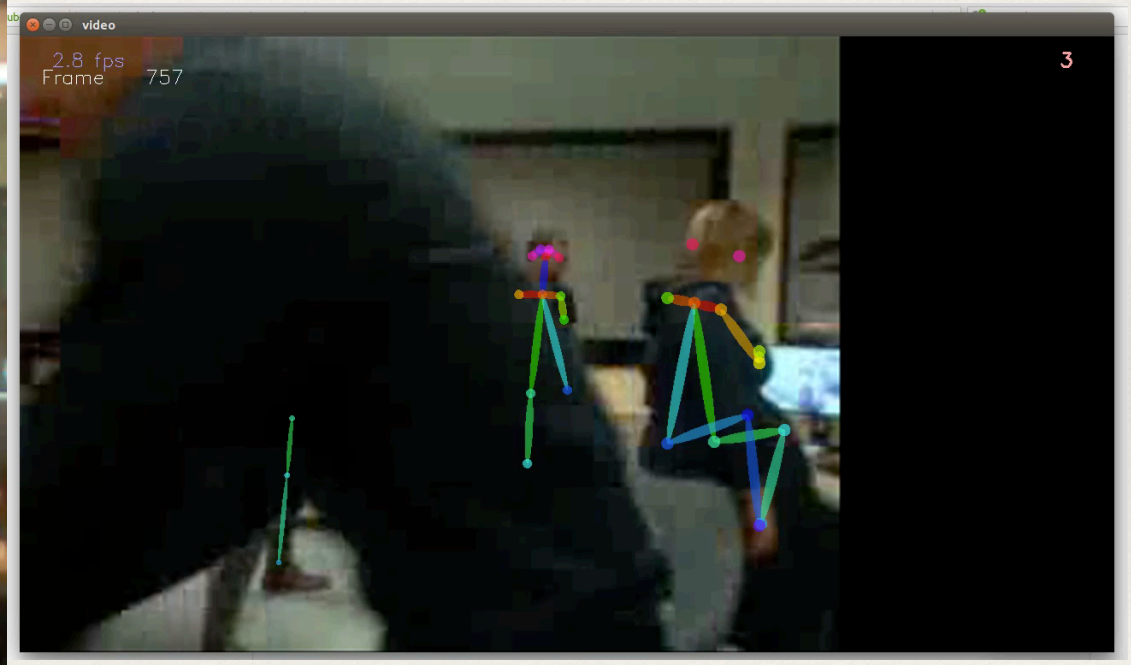
Fundamentals and Applications - 2D Vision





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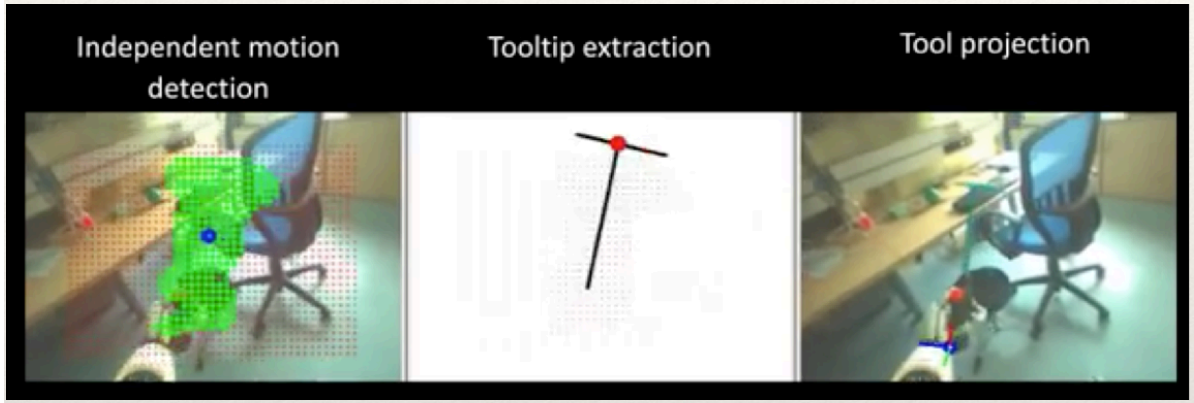
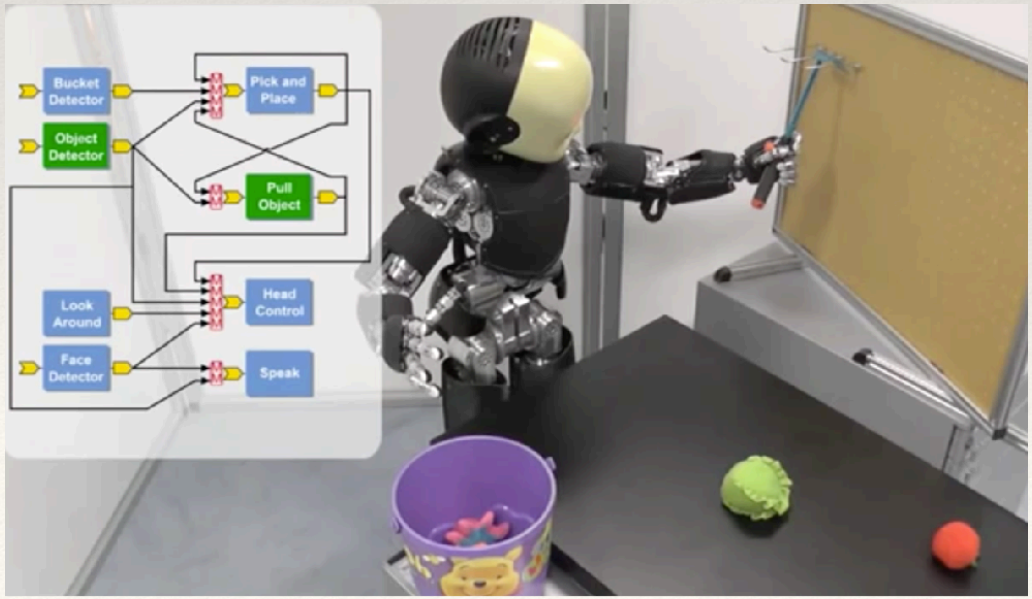
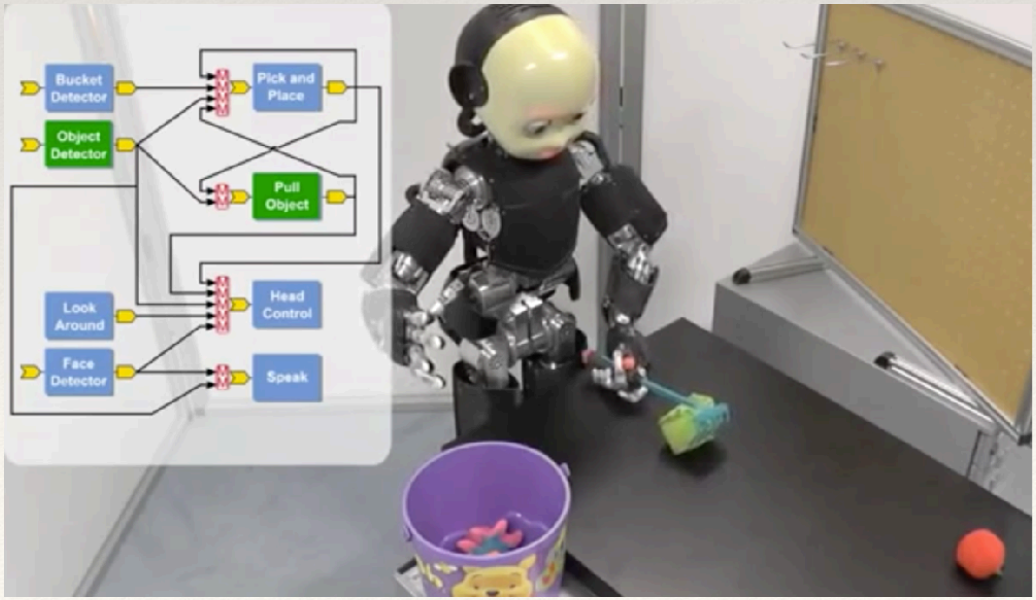
Fundamentals and Applications - 2D Vision







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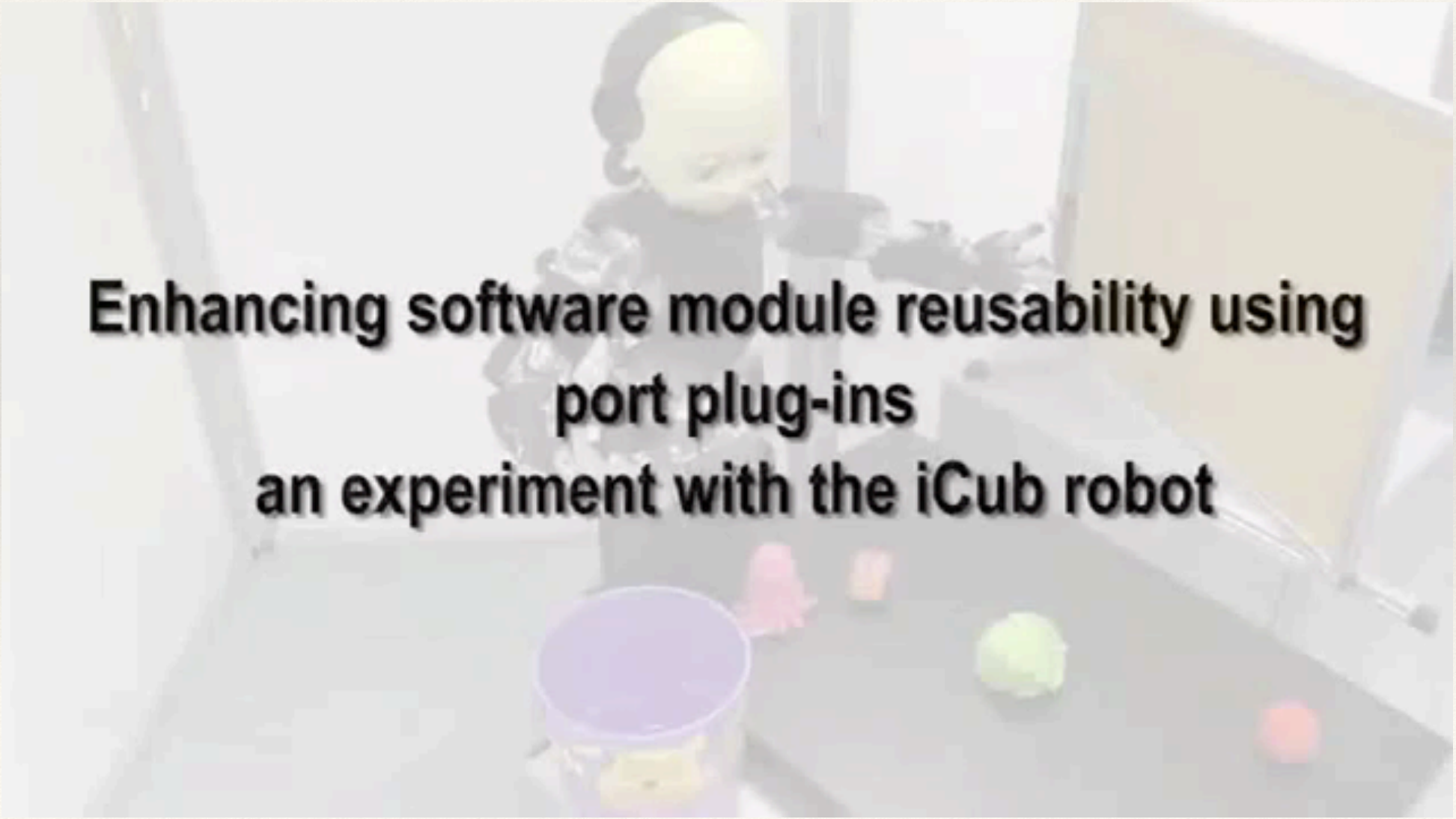

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Fundamentals and Applications - 3D Vision

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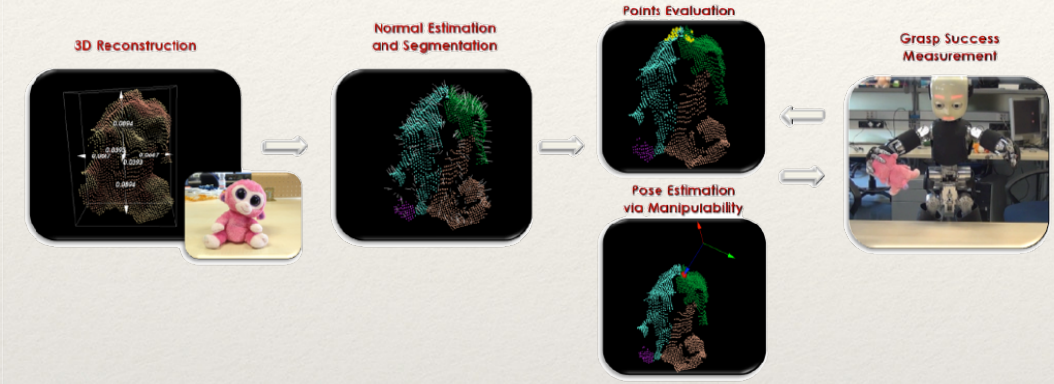

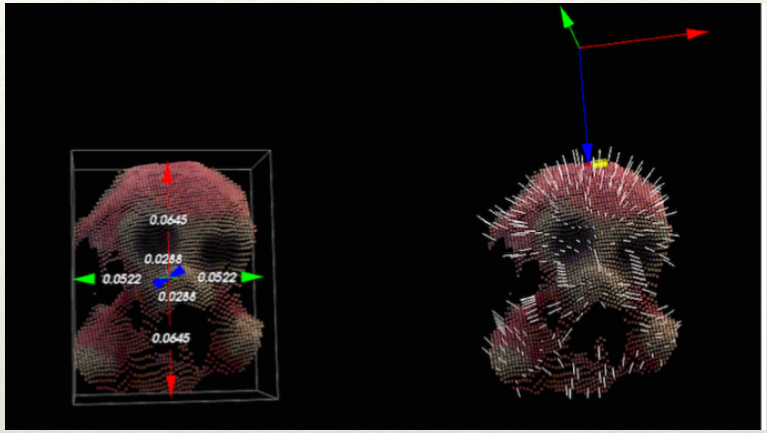

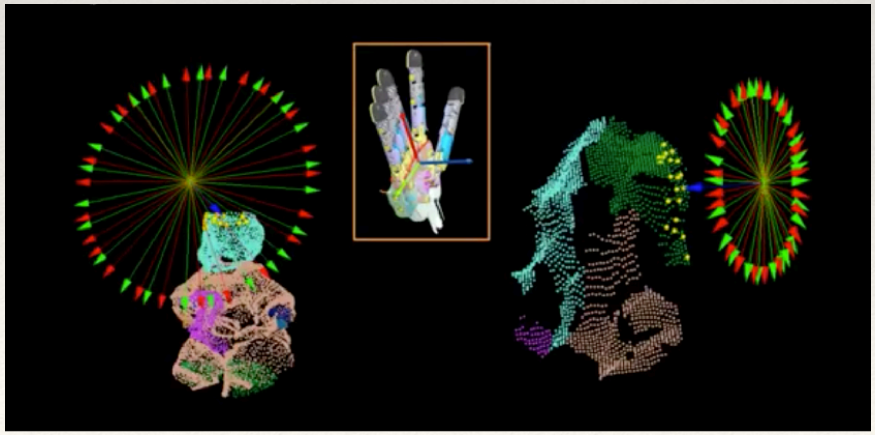

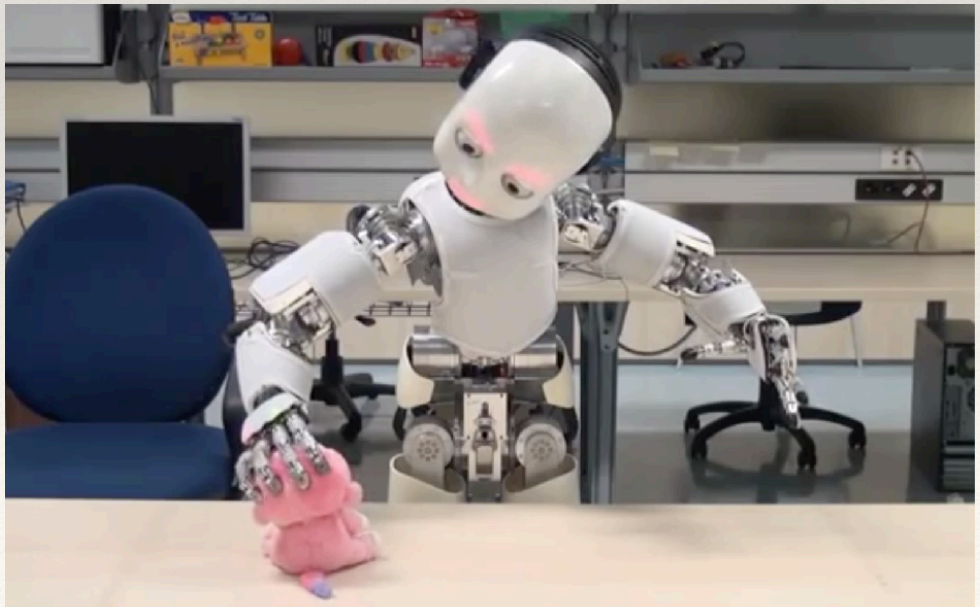

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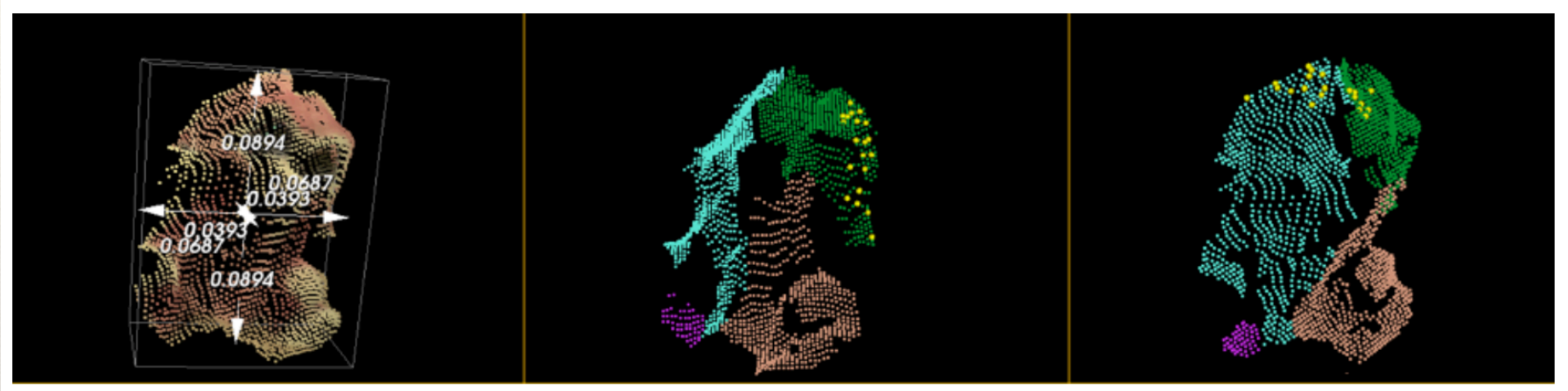

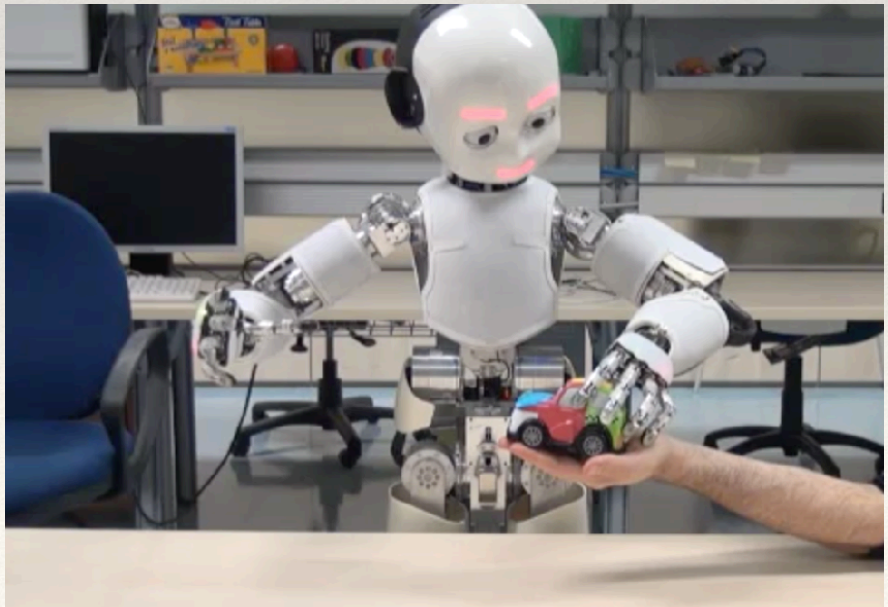

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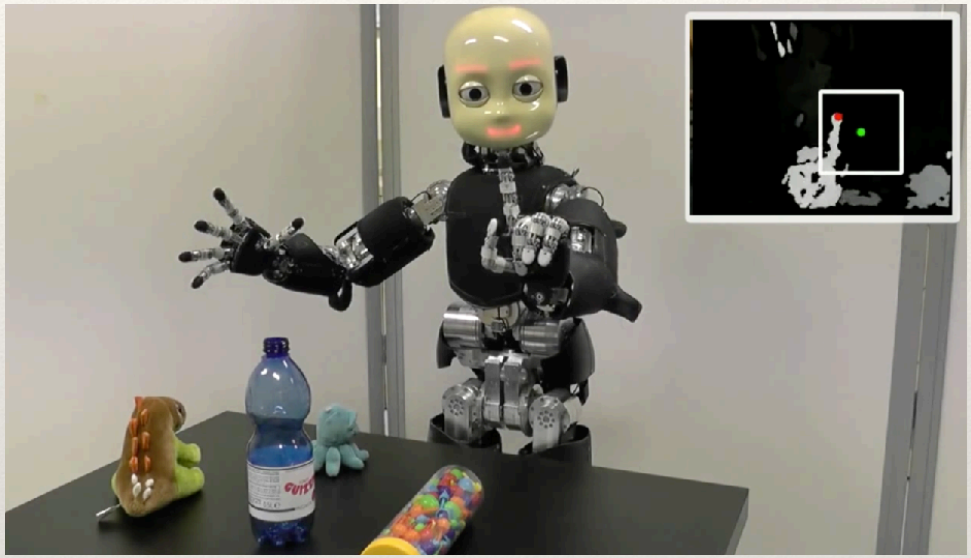

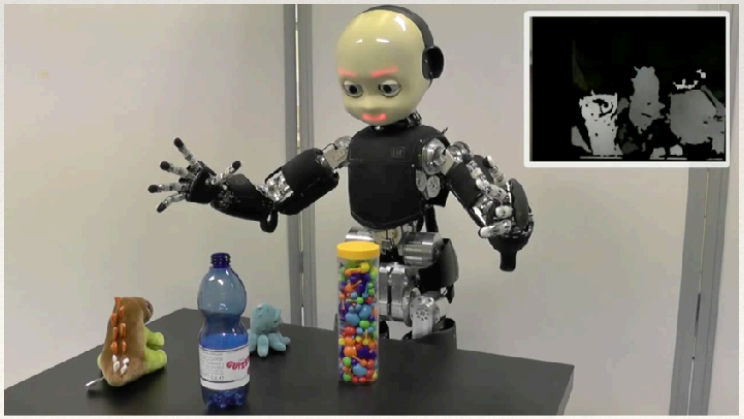

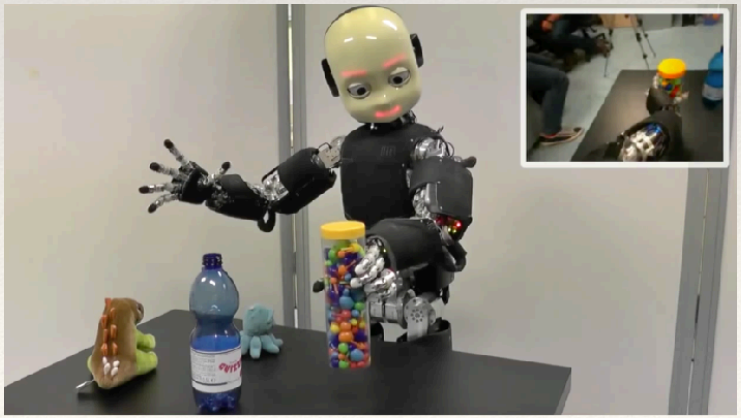

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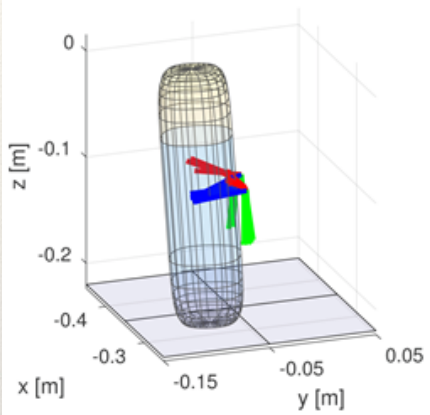

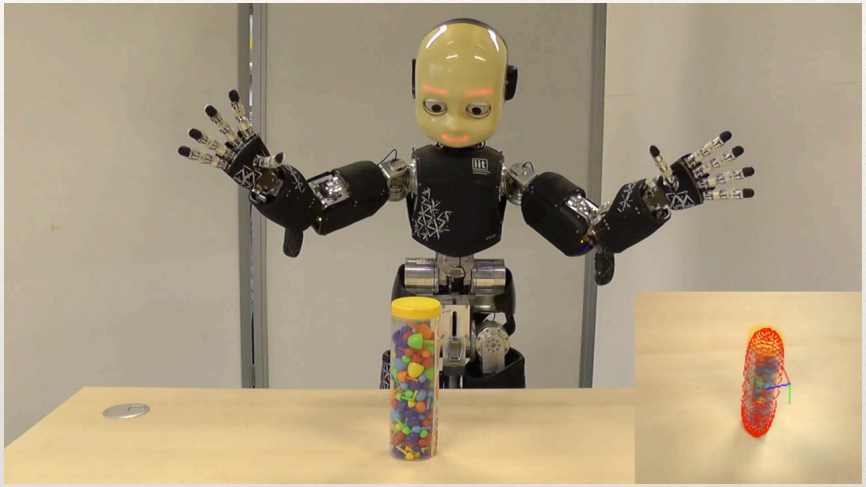

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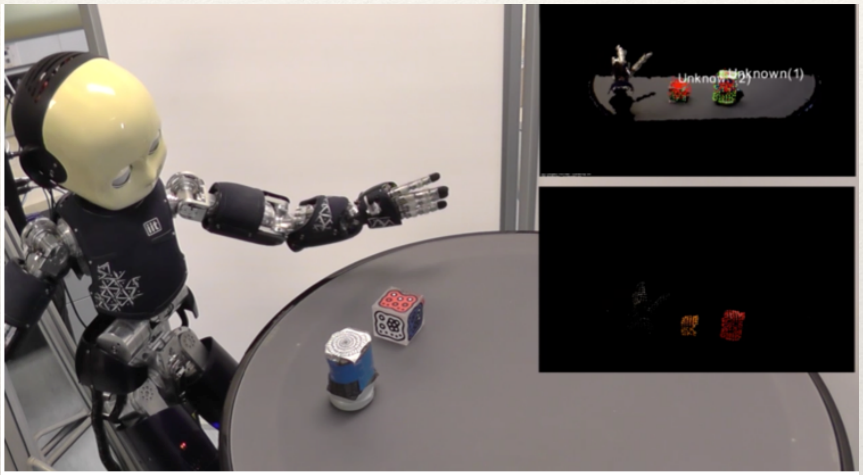

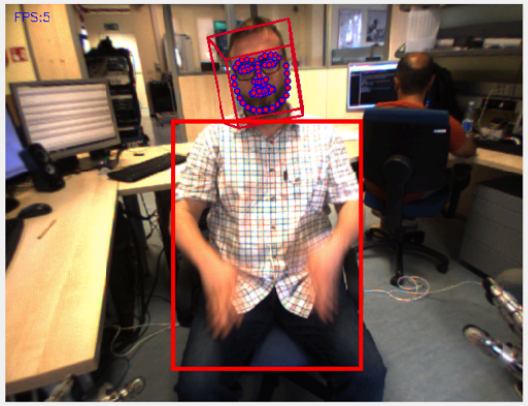

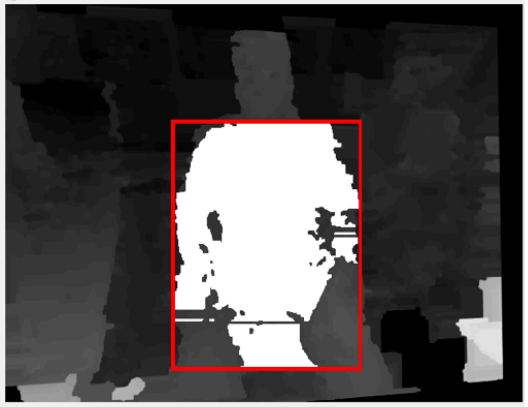

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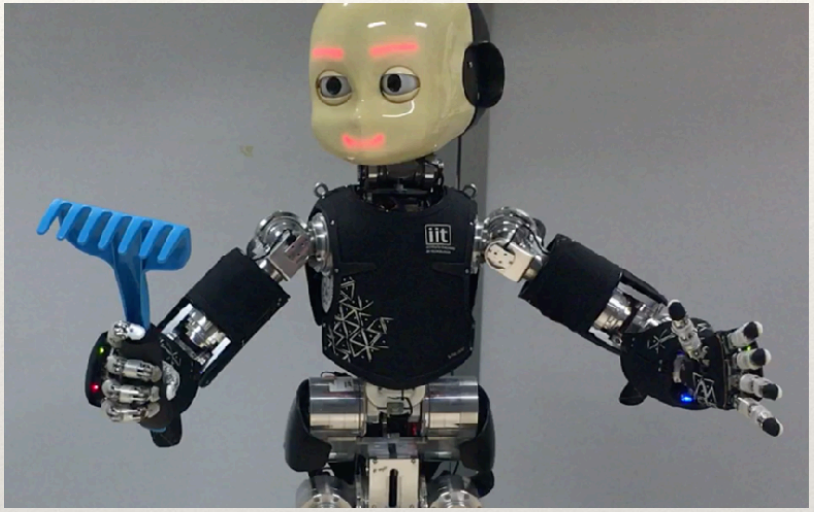
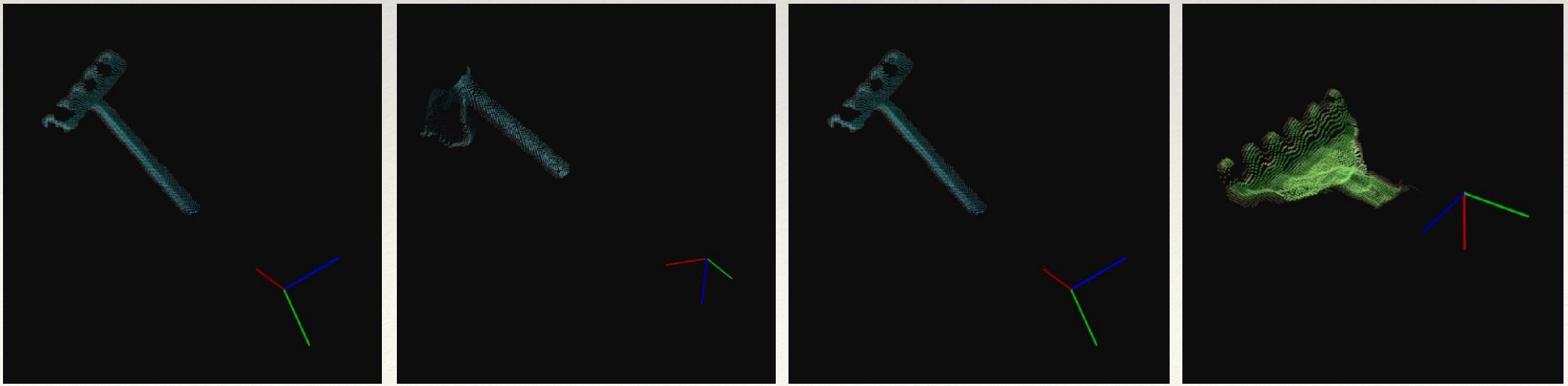
Fundamentals and Applications - 3D Vision





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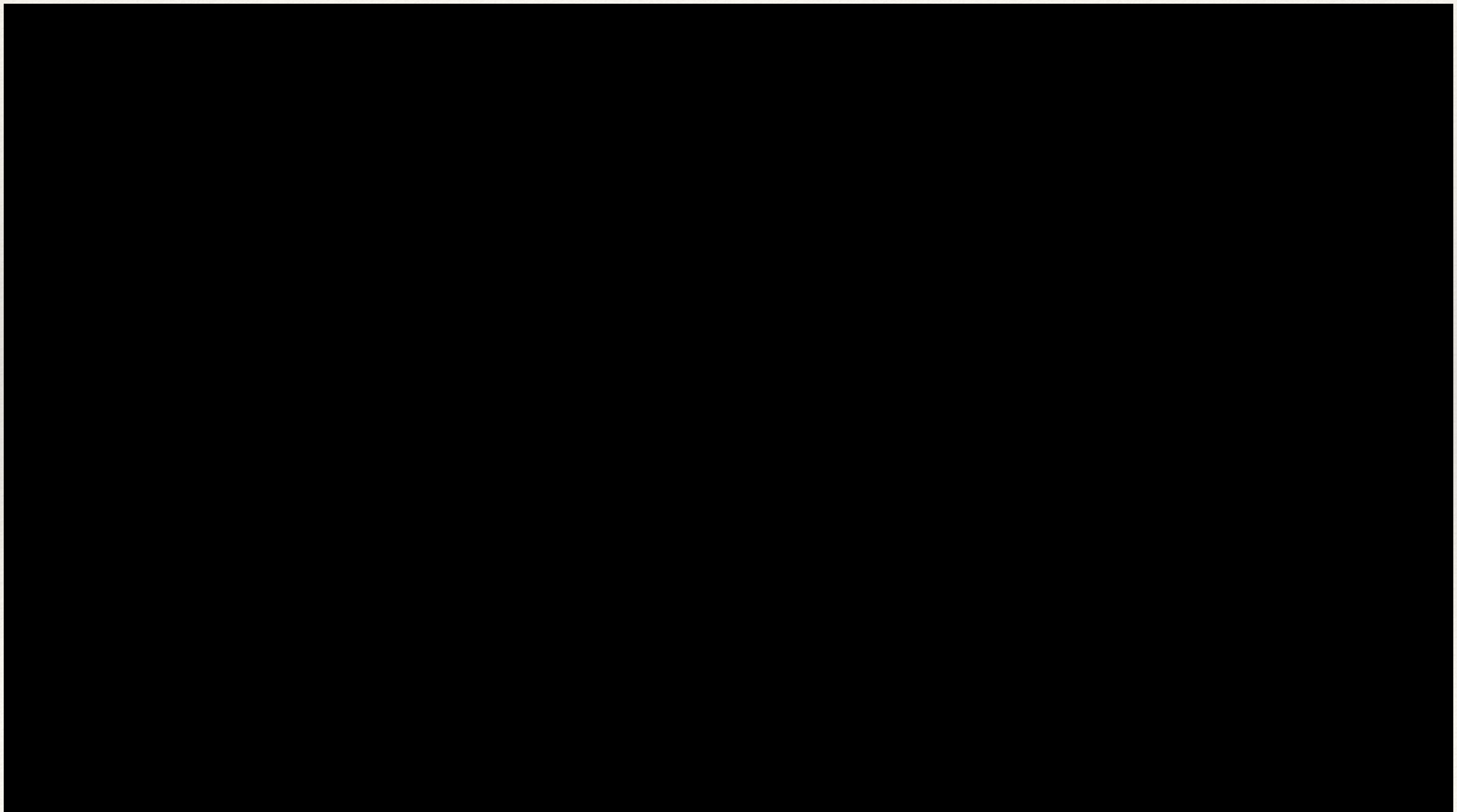

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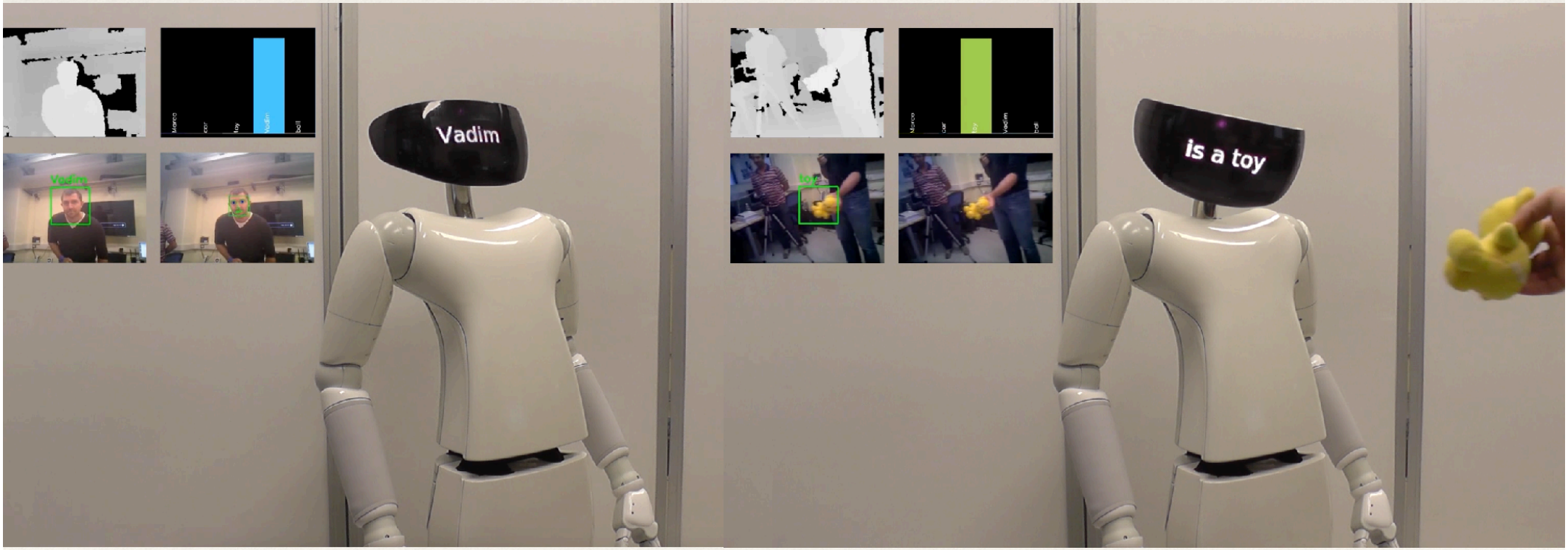

ROBOT VISION

- http://www.yarp.it
- http://www.icub.org
- http://opencv.org
- http://dlib.net