



Computer Vision

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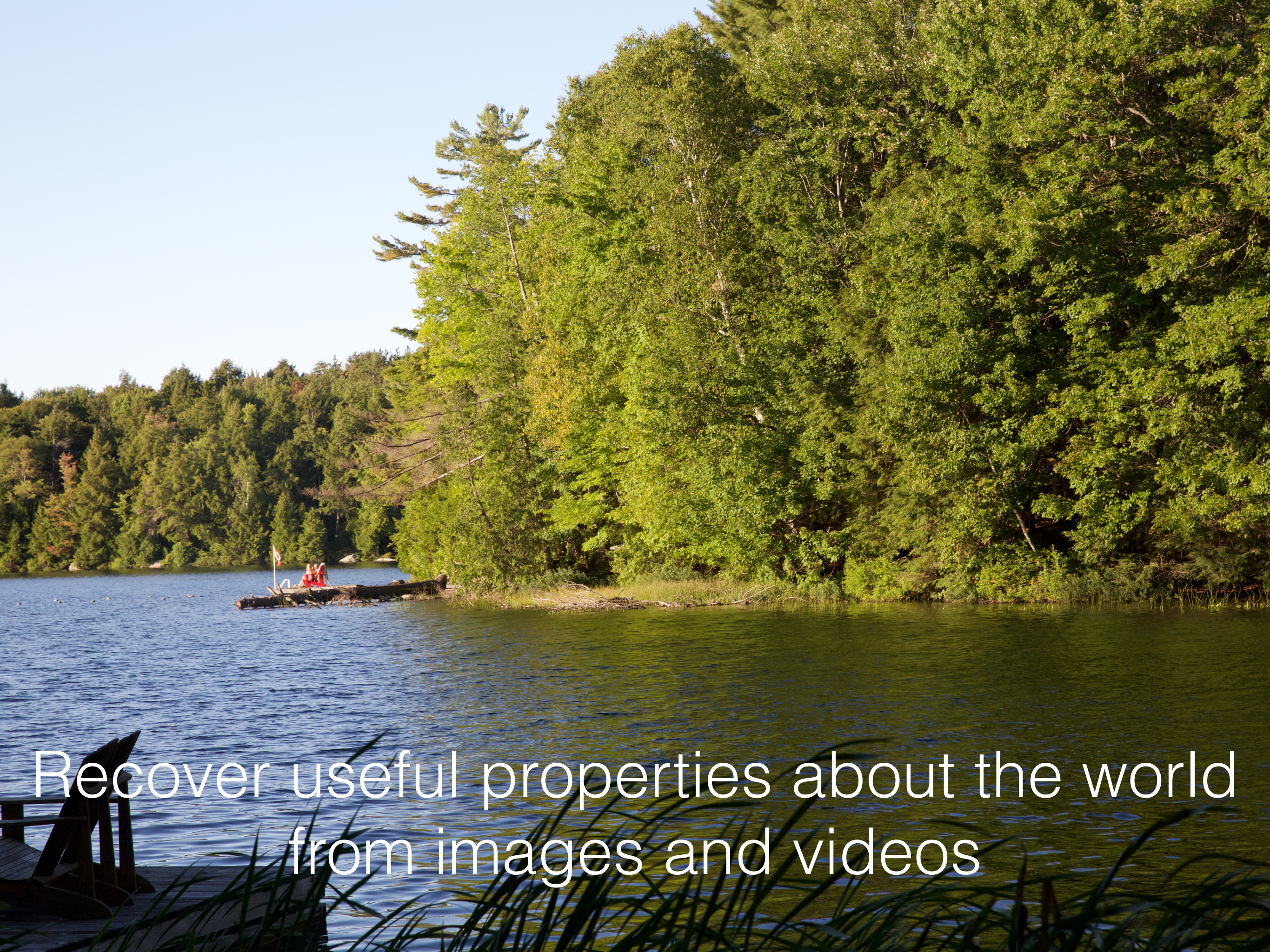
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Credits

These slides draw upon other computer vision courses. I would in particular like to thank S. Seitz, D. Forsyth, K. Derpanis, J. Hoiem, A. Efros, Criminisi and many others for making their material available for teaching and learning purposes.



Understand images and videos



Recover useful properties about the world
from images and videos

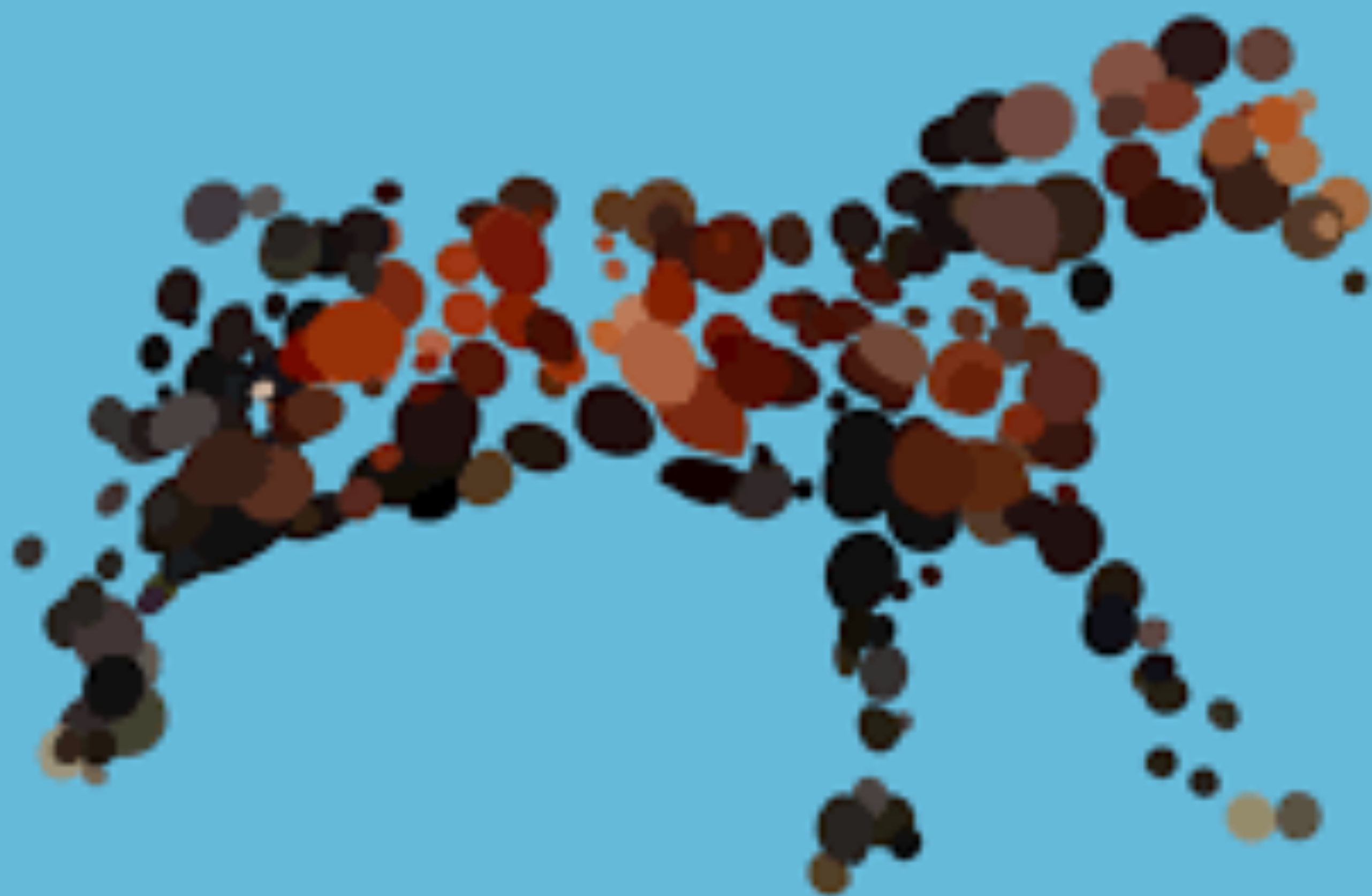
Computer Vision is Hard

- Visual cortex occupies about 50% of Macaque brain
- Greater fraction of human brain devoted to vision than anything else



Cave of Altamira, near Santander, Spain.





MASSACHUSETTS INSTITUTE OF TECHNOLOGY
PROJECT MAC

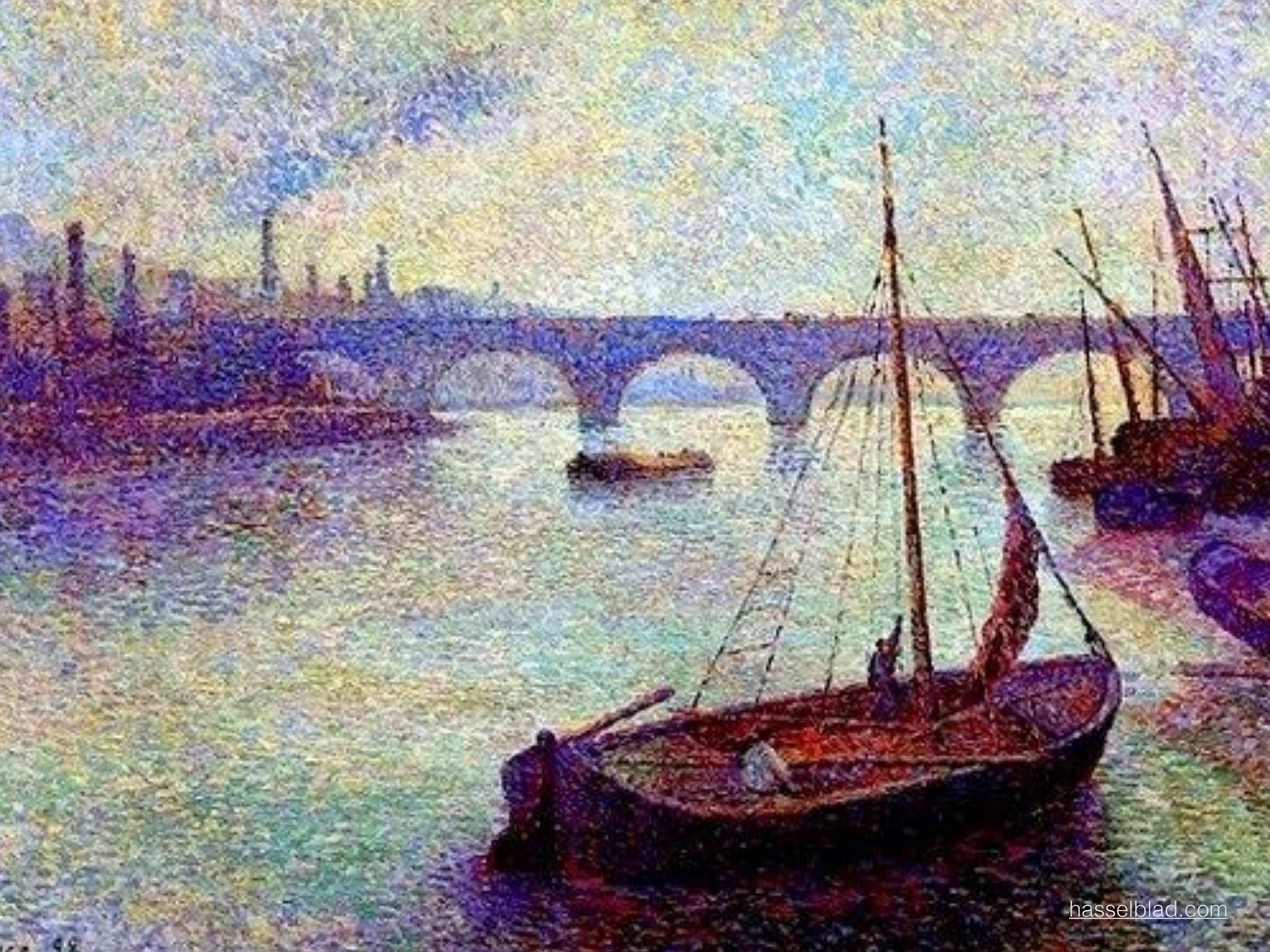
Artificial Intelligence Group
Vision Memo. No. 100.

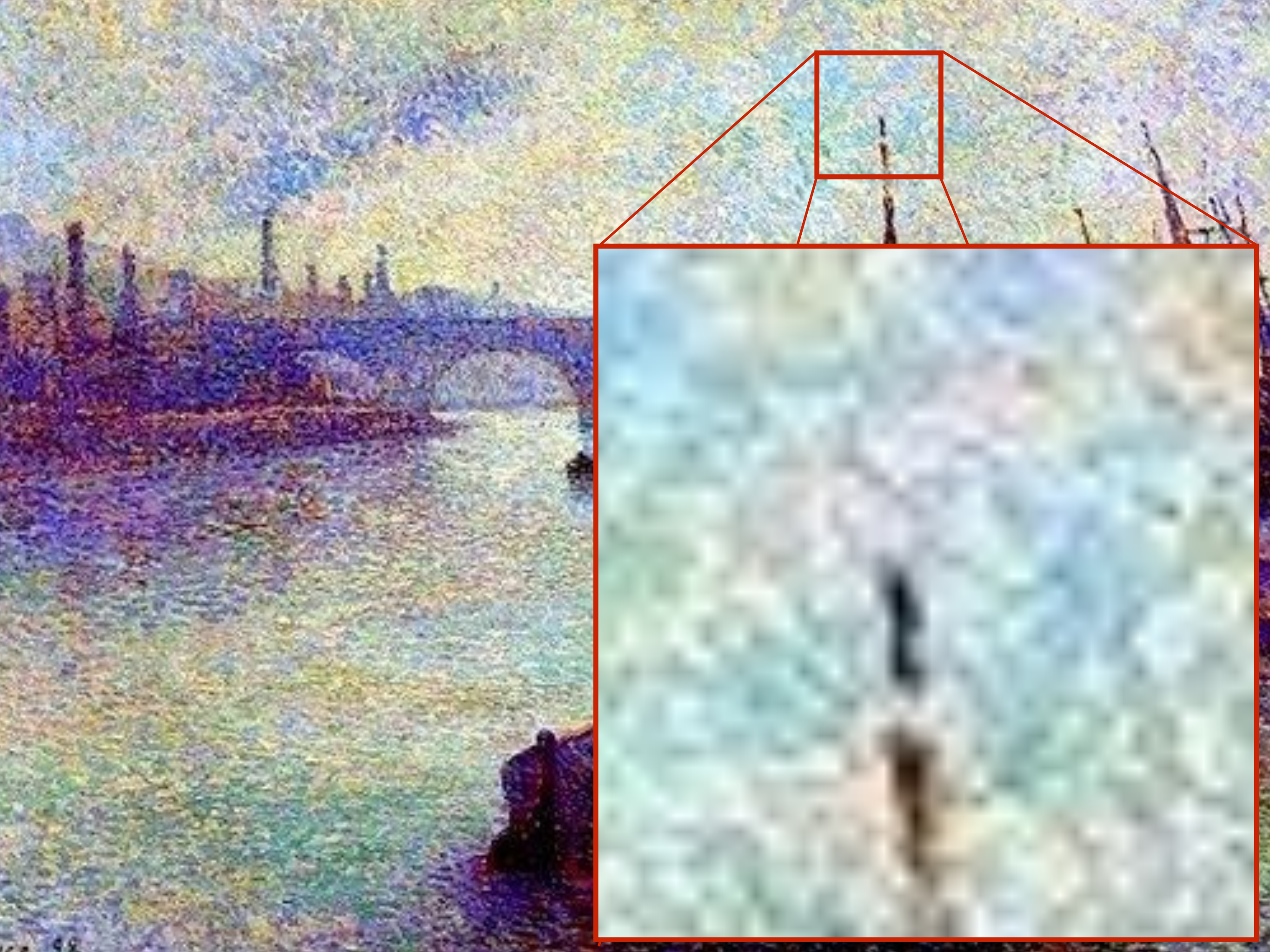
July 7, 1966

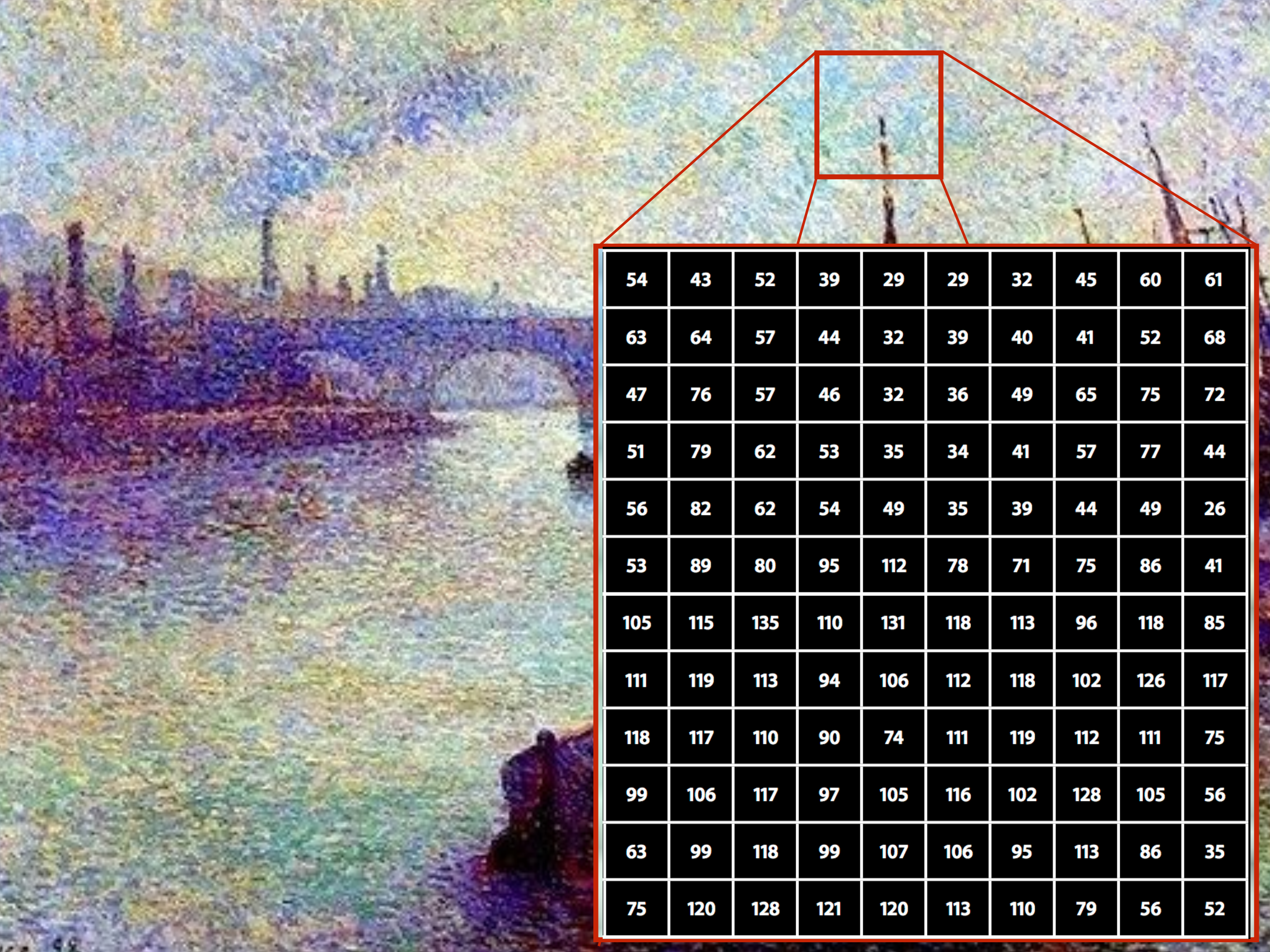
THE SUMMER VISION PROJECT

Seymour Papert

The summer vision project is an attempt to use our summer workers effectively in the construction of a significant part of a visual system. The particular task was chosen partly because it can be segmented into sub-problems which will allow individuals to work independently and yet participate in the construction of a system complex enough to be a real landmark in the development of "pattern recognition".







54	43	52	39	29	29	32	45	60	61
63	64	57	44	32	39	40	41	52	68
47	76	57	46	32	36	49	65	75	72
51	79	62	53	35	34	41	57	77	44
56	82	62	54	49	35	39	44	49	26
53	89	80	95	112	78	71	75	86	41
105	115	135	110	131	118	113	96	118	85
111	119	113	94	106	112	118	102	126	117
118	117	110	90	74	111	119	112	111	75
99	106	117	97	105	116	102	128	105	56
63	99	118	99	107	106	95	113	86	35
75	120	128	121	120	113	110	79	56	52

Images are highly complex functions of several variables





Slide credit: K. Derpanis

3D Lego Terracotta Army

Leon Keer, Ruben Poncia, Remko van Schaik and Peter Westerink



Slide credit: K. Derpanis





Viewpoint differences

Varying **SCALES**



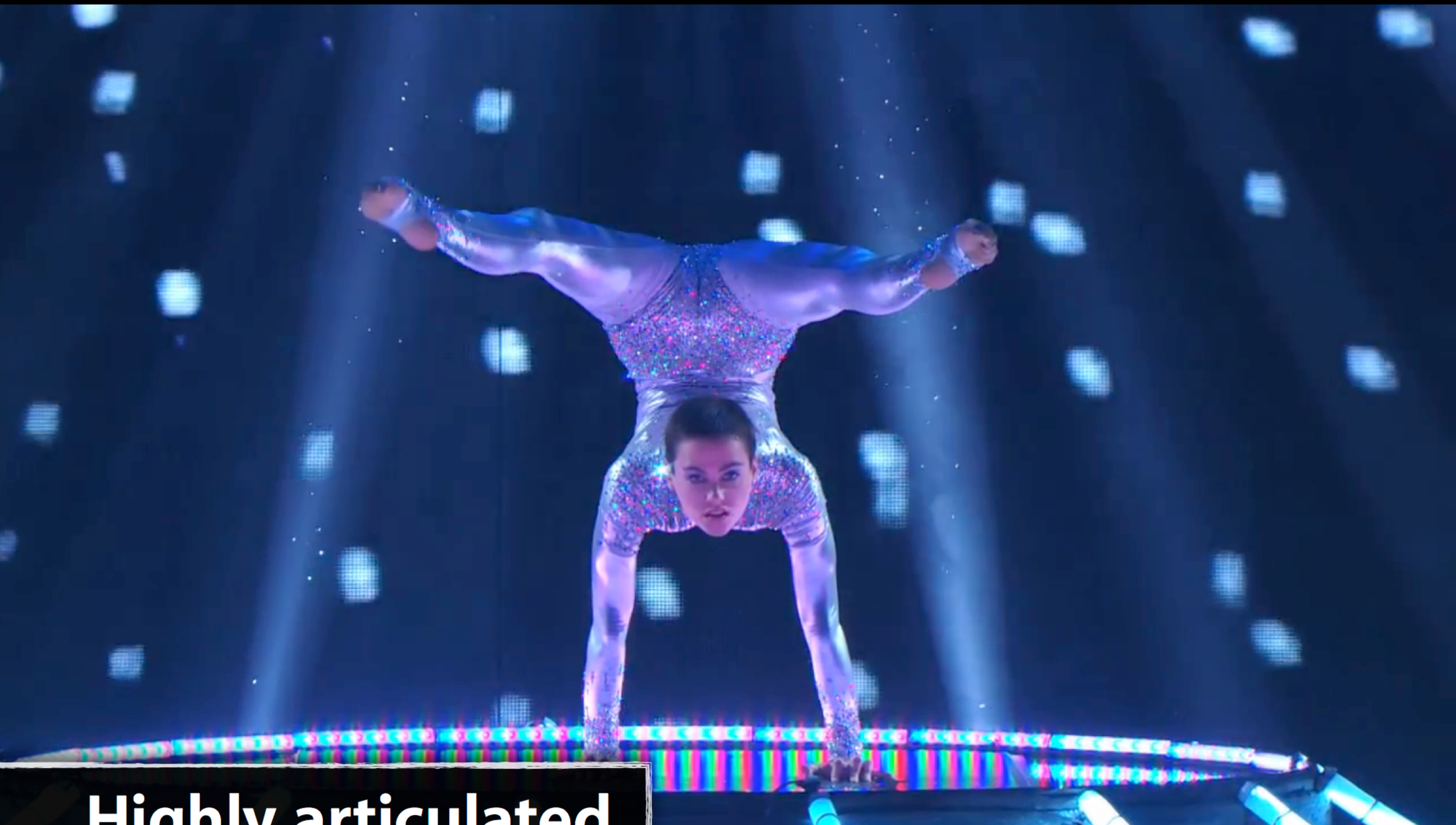
Slide credit: K. Derpanis



Varying instances

Occlusion



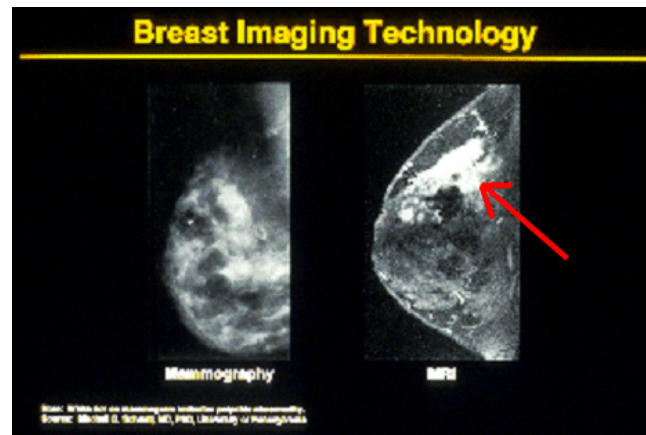


Highly articulated

Why Computer Vision Matters?



Safety



Healthcare



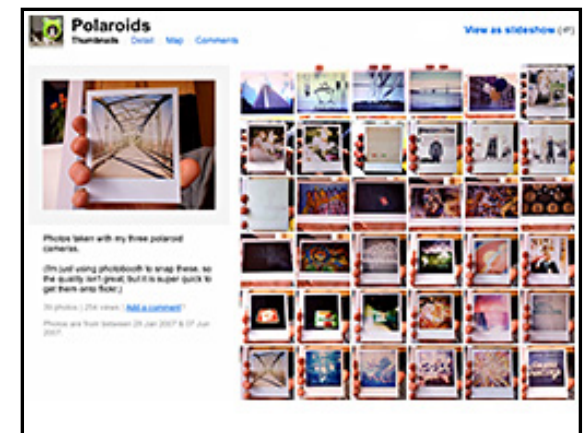
Automation



Robots



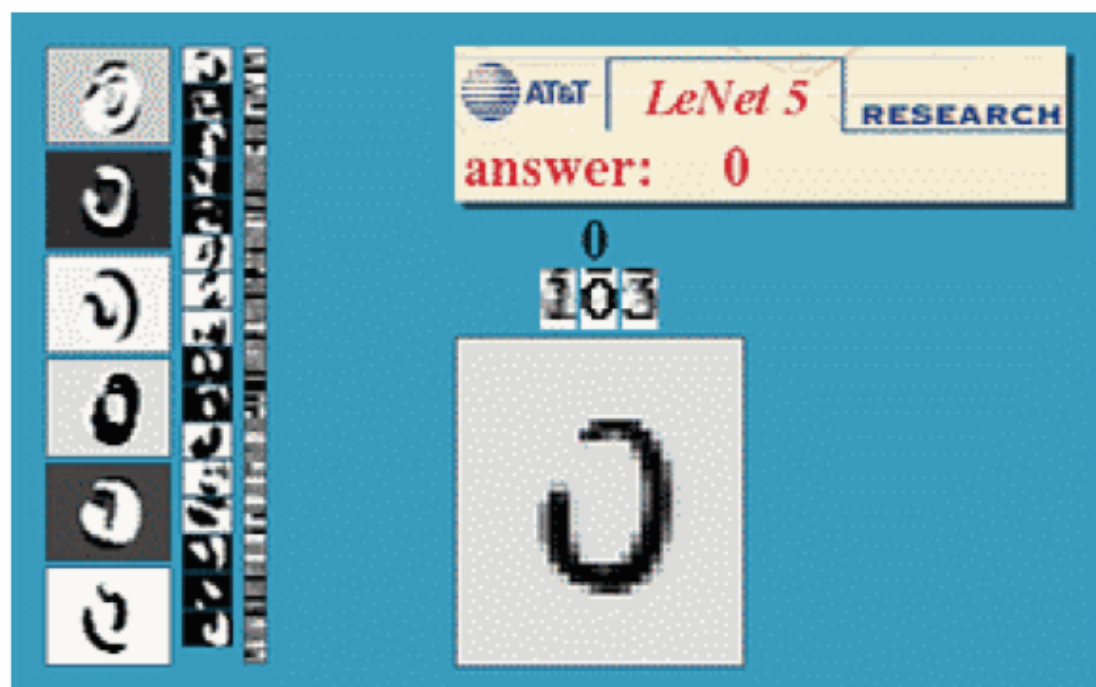
Entertainment



Access



Optical Character Recognition



Digit recognition, AT&T labs

<http://www.research.att.com/~yann/>



License plate readers

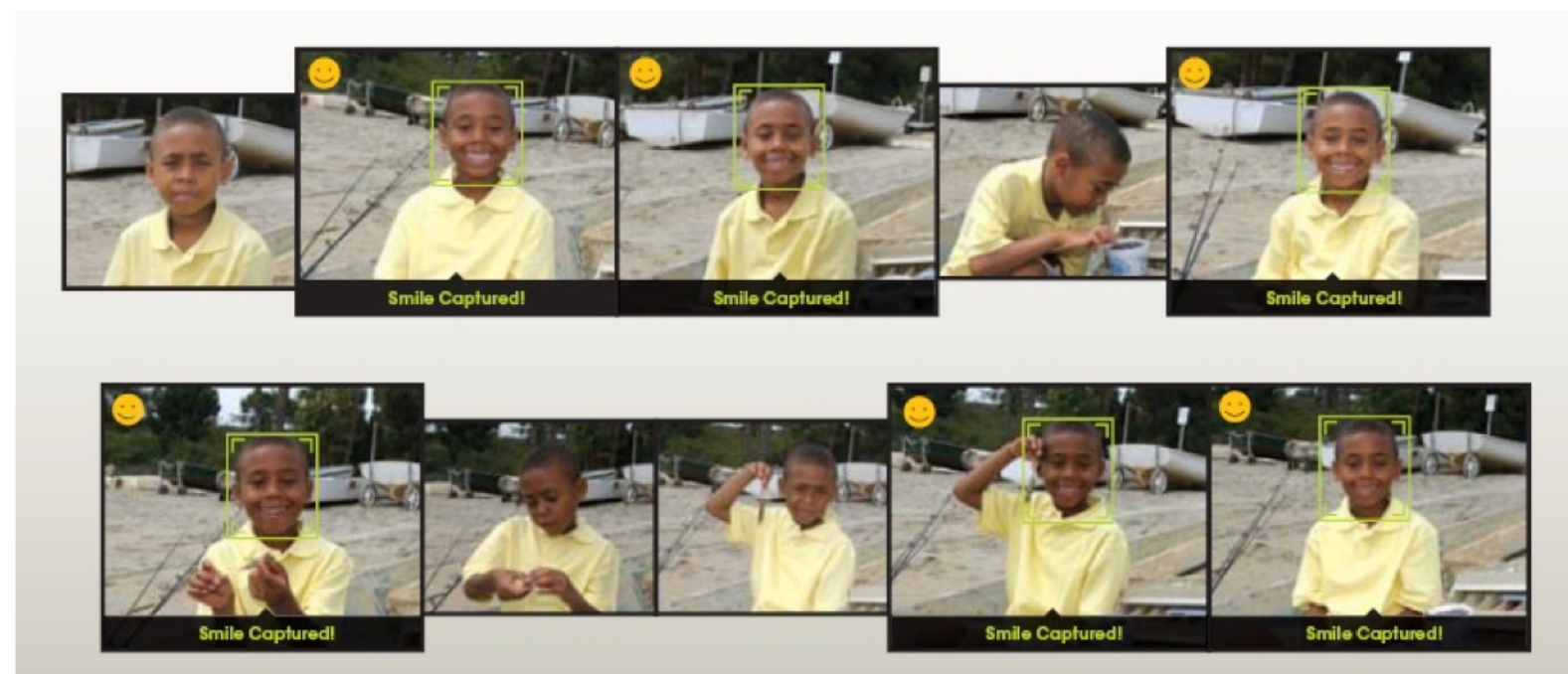
http://en.wikipedia.org/wiki/Automatic_number_plate_recognition

Face Detection



Face detection for focus/
exposure selection

Smile detection



Scene Reconstruction

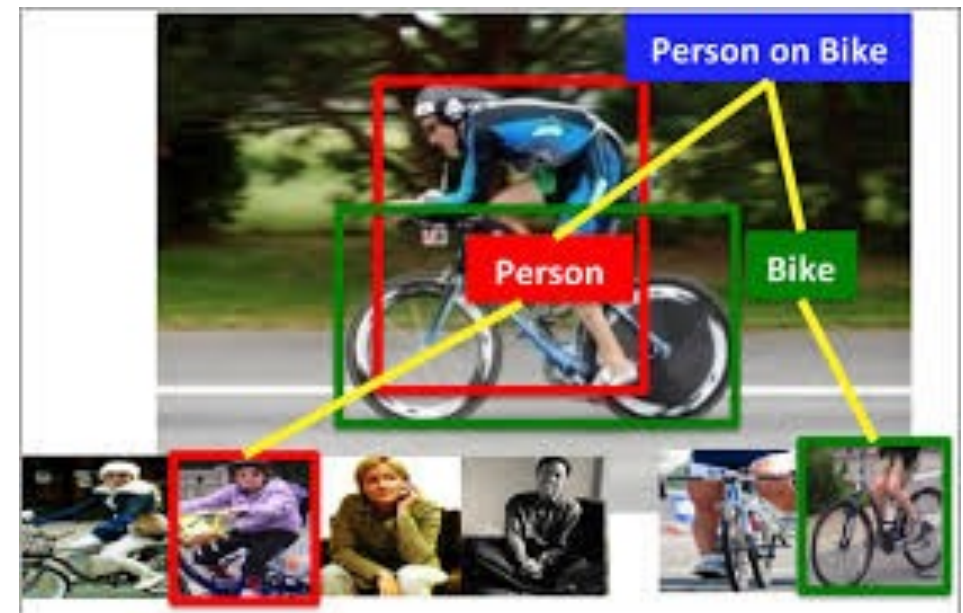


Building Rome in a Day, Aggarwal et al. 2009

Object Recognition

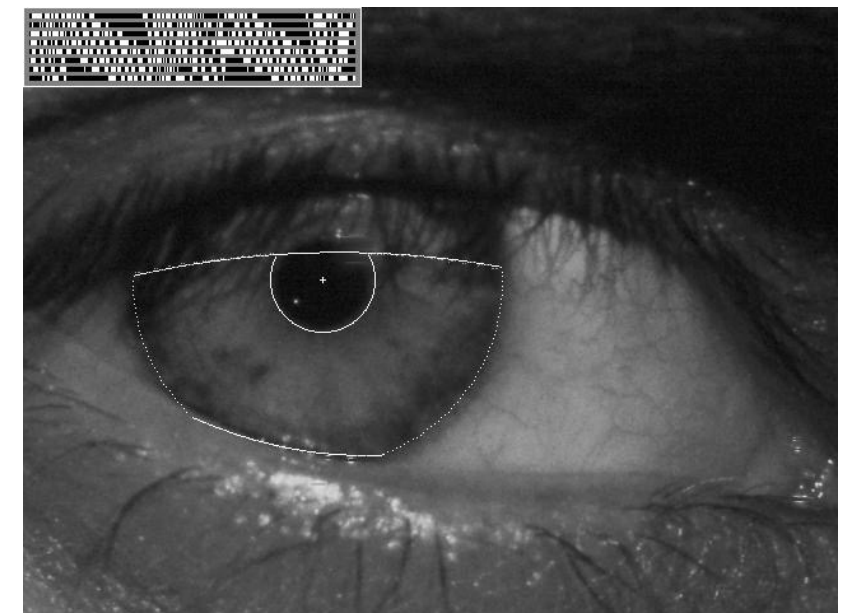
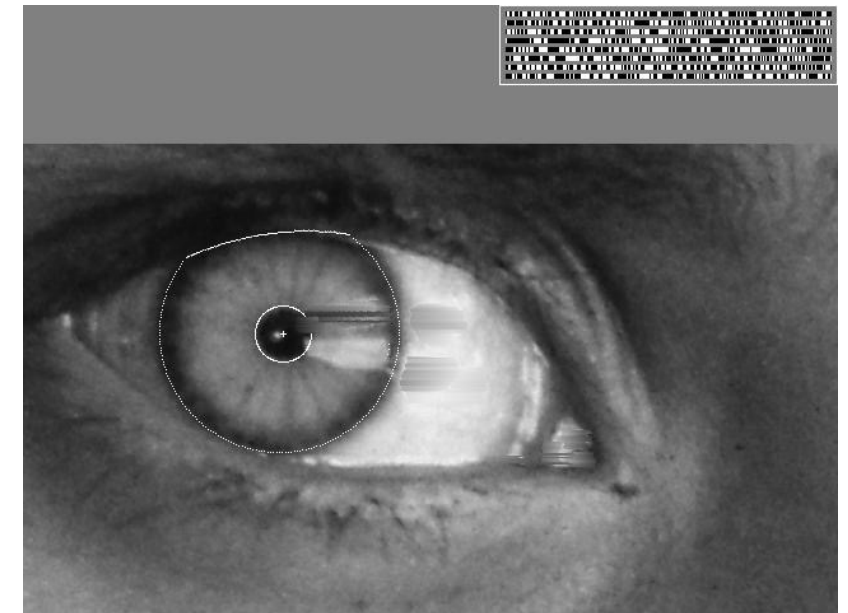


Datalogic



Tian Lan, Amazon Co.

Biometrics



<http://ngm.nationalgeographic.com/static-legacy/ngm/0204/feature0/>

Special Effects



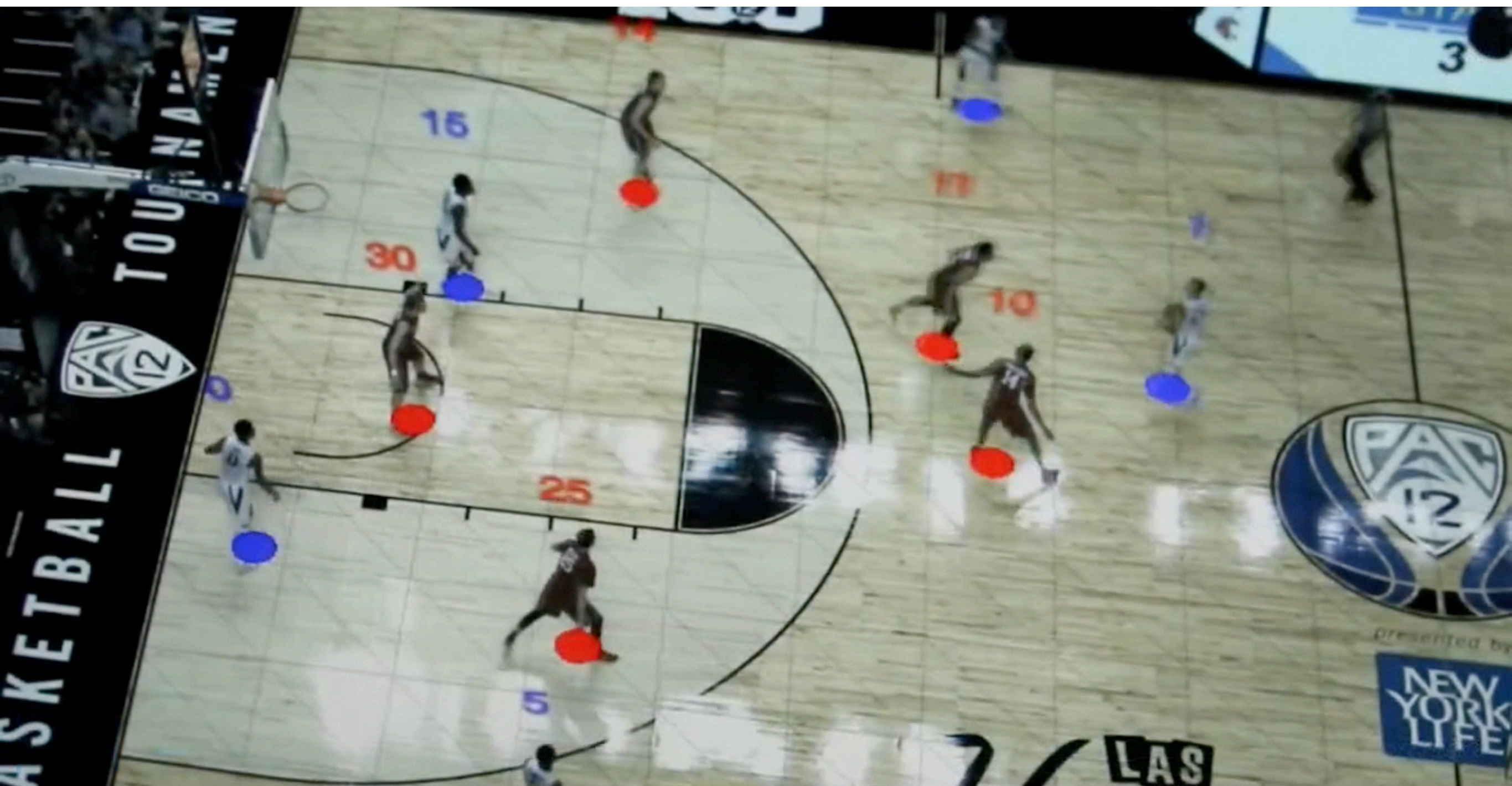
Planet of the Apes — Motion Capture

Special Effects



The Matrix — Shape Capture

Sports



Mapping



Google Streetview



<http://www.uavdataprocessing.com/>

Autonomous Vehicles



<https://www.google.com/selfdrivingcar/>

Games

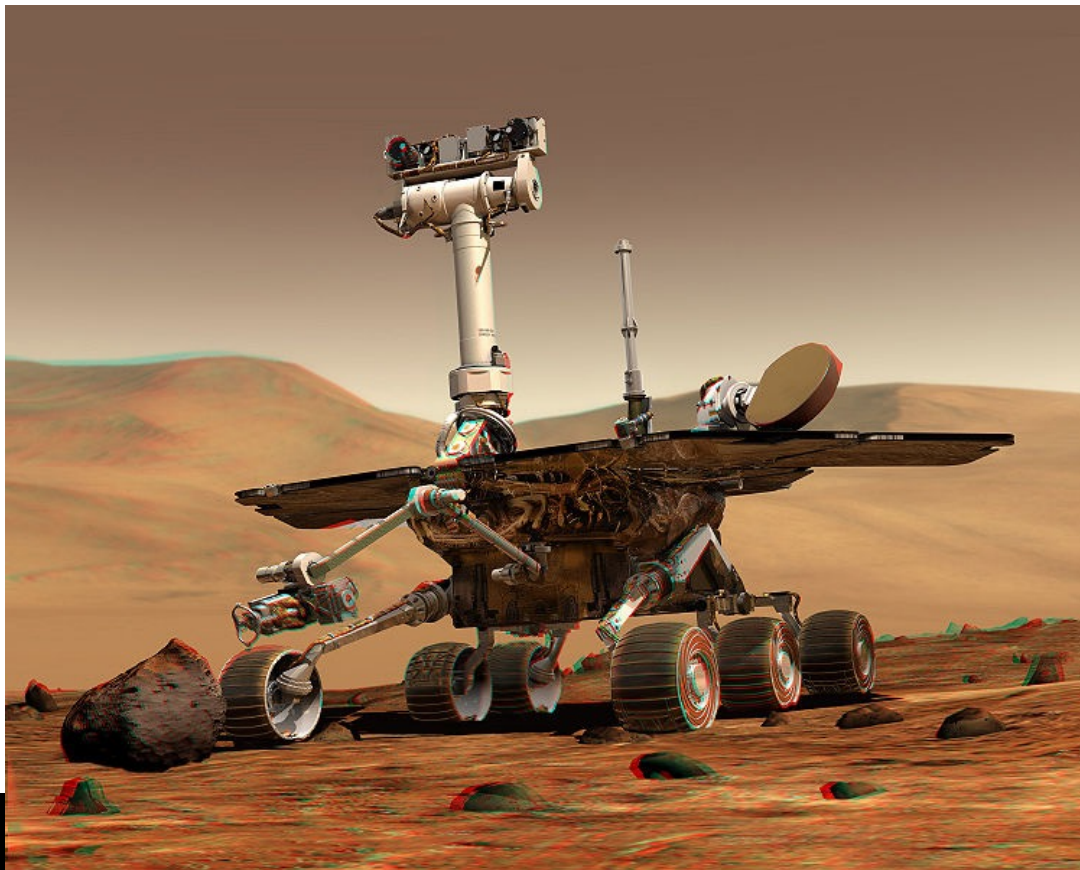


<http://www.robots.ox.ac.uk/~tvvg/projects.php>



Pokemon Go

Space Exploration



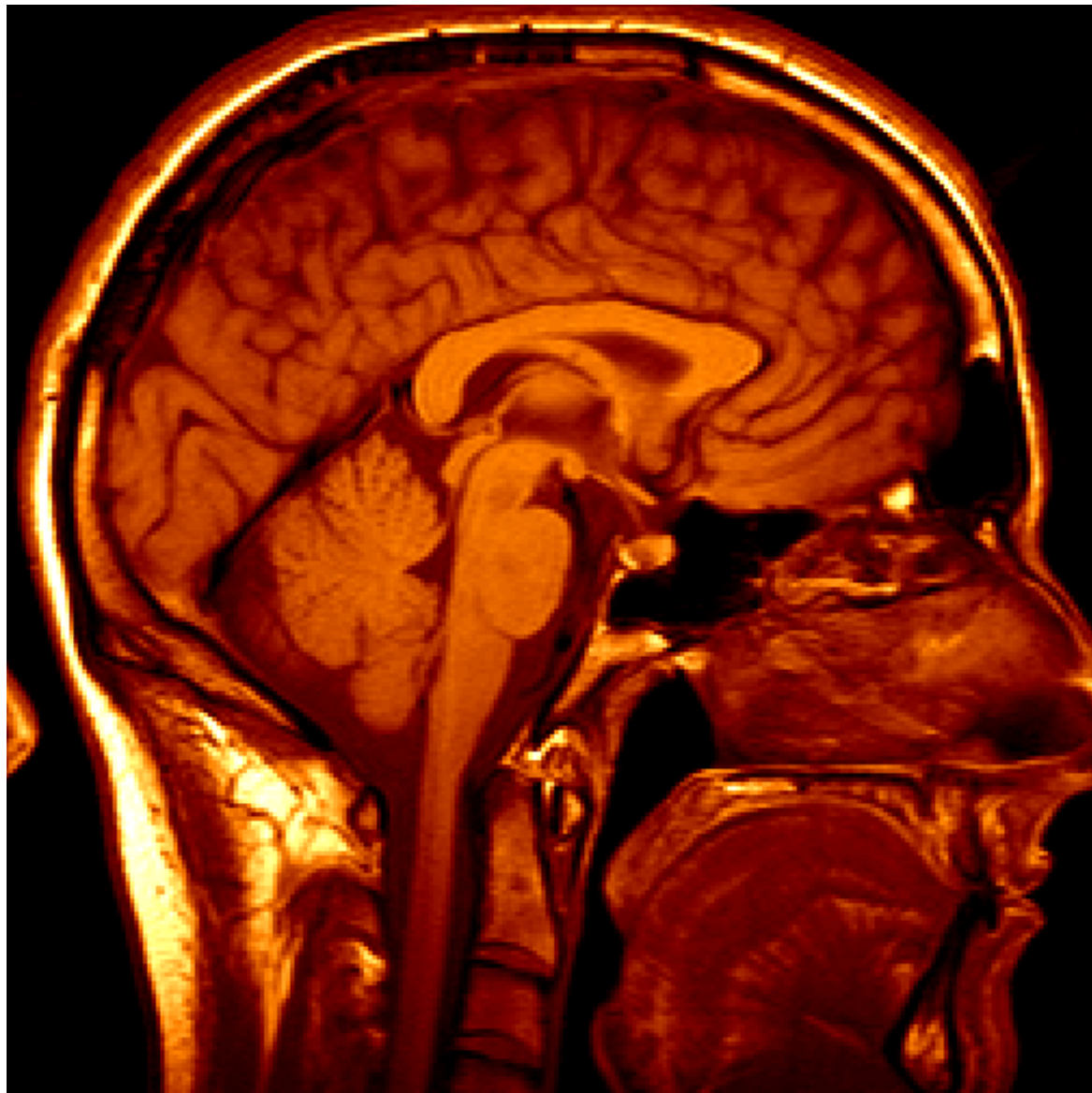
NASA'S Mars Exploration Rover Spirit captured this westward view from atop a low plateau where Spirit spent the closing months of 2007.



Industrial Robotics



Medical Imaging



3D Imaging, MRI, CT



Augmented Reality
Image guided surgery

“Perception starts with the eye.”

–Aristotle

Questions?