

اصول پردازش تصویر

*Principles of Image Processing*

مصطفی کمالی تبریزی

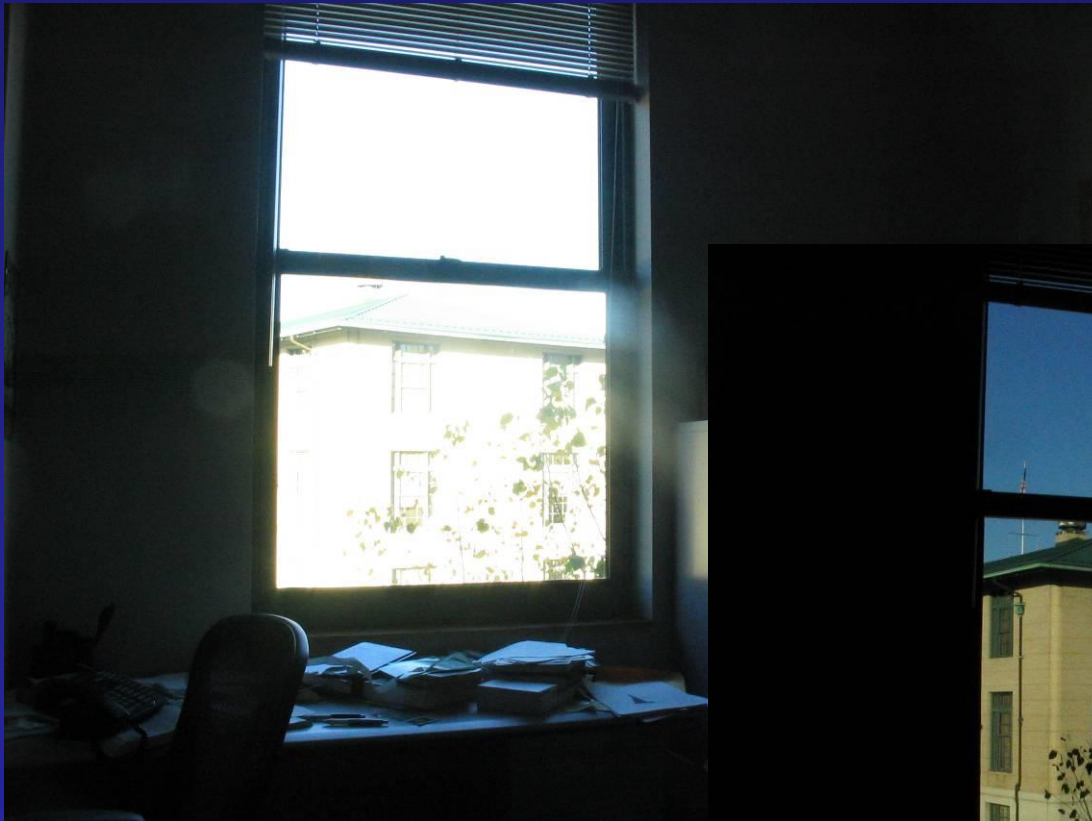
۱۳ دی ۱۳۹۹

جلسه سیم

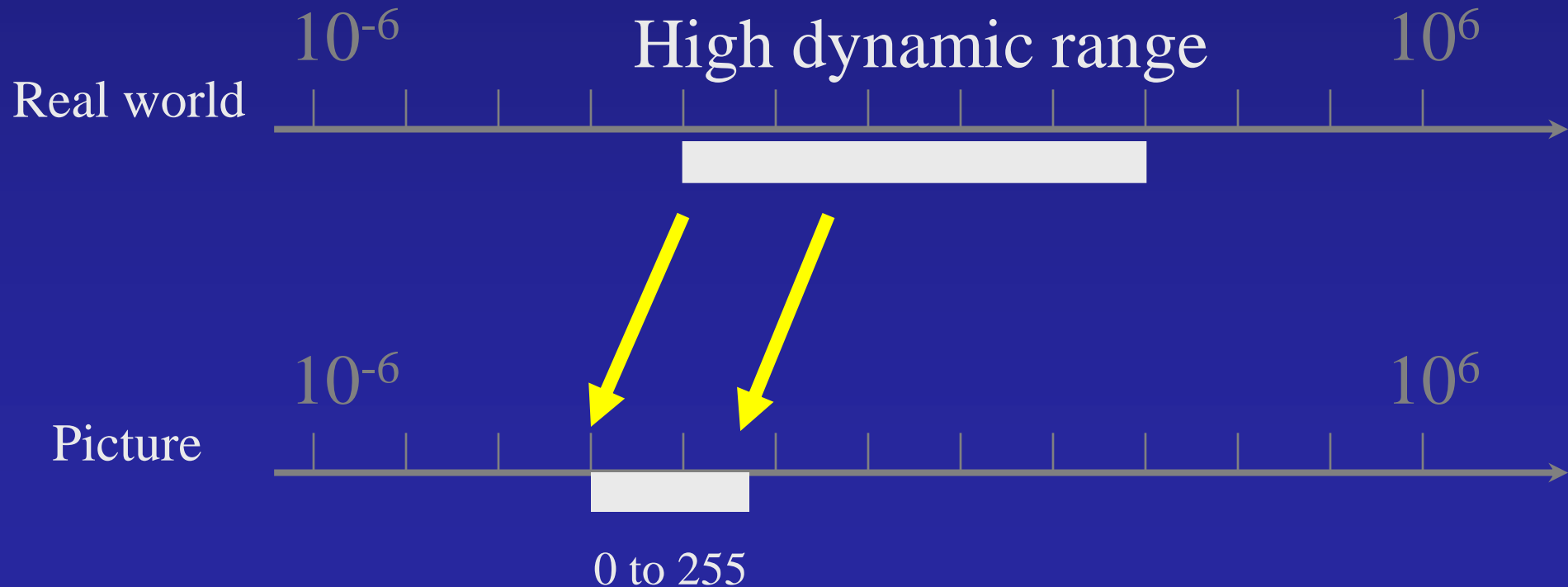
# More Topics

# High Dynamic Range Imaging (HDR)

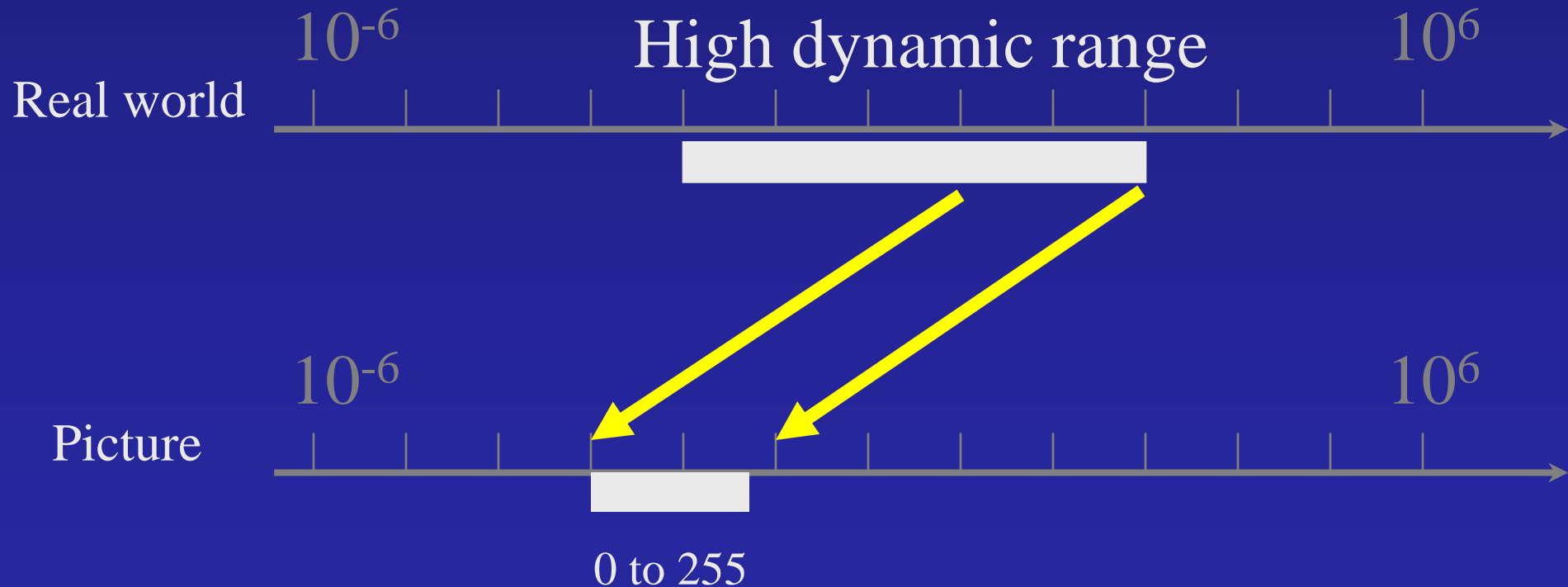
# Why HDR?



# Long Exposure



# Short Exposure



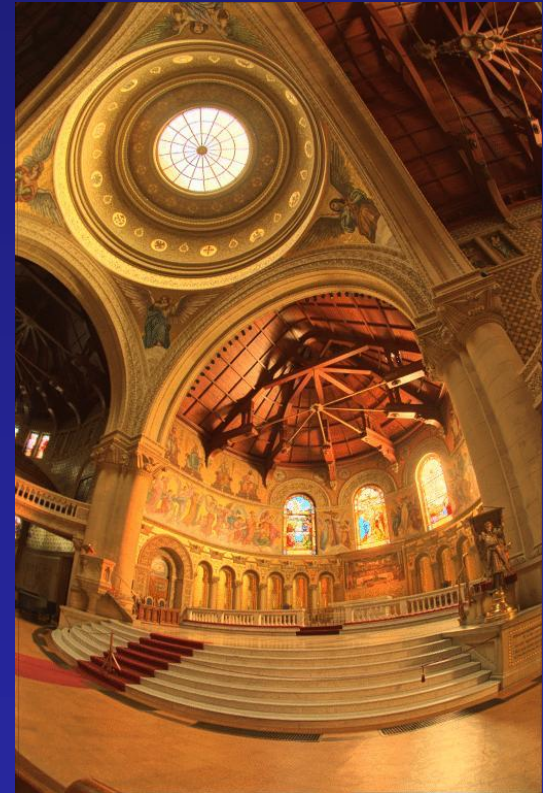
# Varying Exposure



# What do we see?



Vs.





# Deblurring and Deconvolution

# Different types of blur

- Camera shake
  - User moving hands
- Scene motion
  - Objects in the scene moving
- Defocus blur [NEXT WEEK]
  - Depth of field effects



Slide: Rob Fergus



Slide: Rob Fergus

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# Removing Camera Shake from a Single Photograph

Rob Fergus, Barun Singh, Aaron Hertzmann,  
Sam T. Roweis and William T. Freeman

Massachusetts Institute of Technology  
and  
University of Toronto



# Overview

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Joint work with B. Singh, A. Hertzmann, S.T. Roweis & W.T. Freeman

Original



Our algorithm



# Close-up

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Original



Naïve sharpening



Our algorithm



# Detecting Fakes



# Video Magnification

# Imperceptible Motions and Changes



[Liu et al. 2005]



[Wu et al. 2012]

# MAGNIFIED Imperceptible Motions and Changes

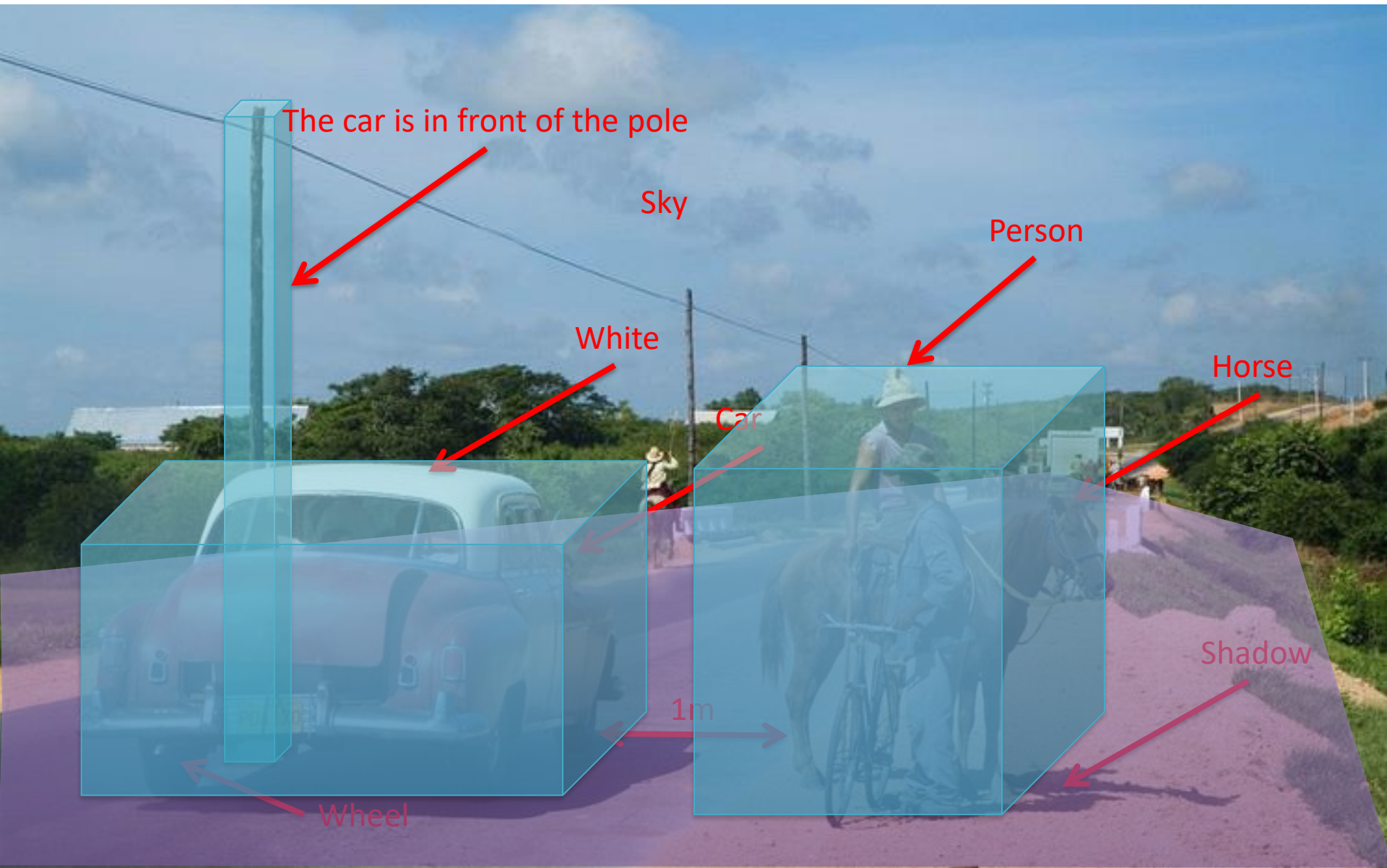


[Liu et al. 2005]



[Wu et al. 2012]

# Computer Vision

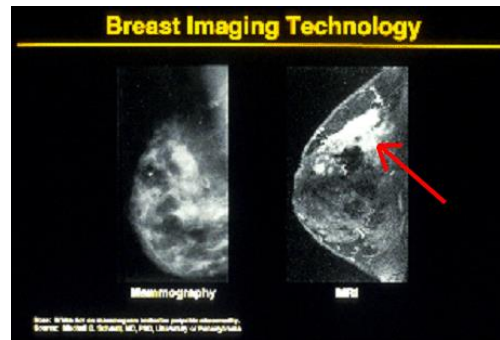




# Computer Vision Matters



Safety



Health



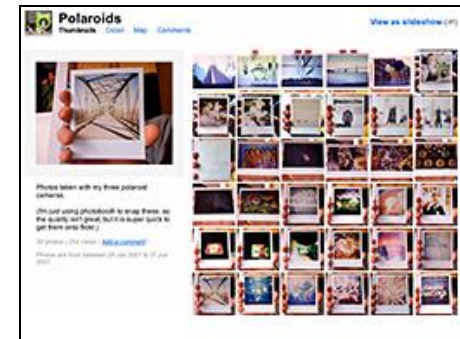
Security



Comfort



Fun



Access

# How vision is used now

- Examples of state-of-the-art

# Earth viewers (3D modeling)

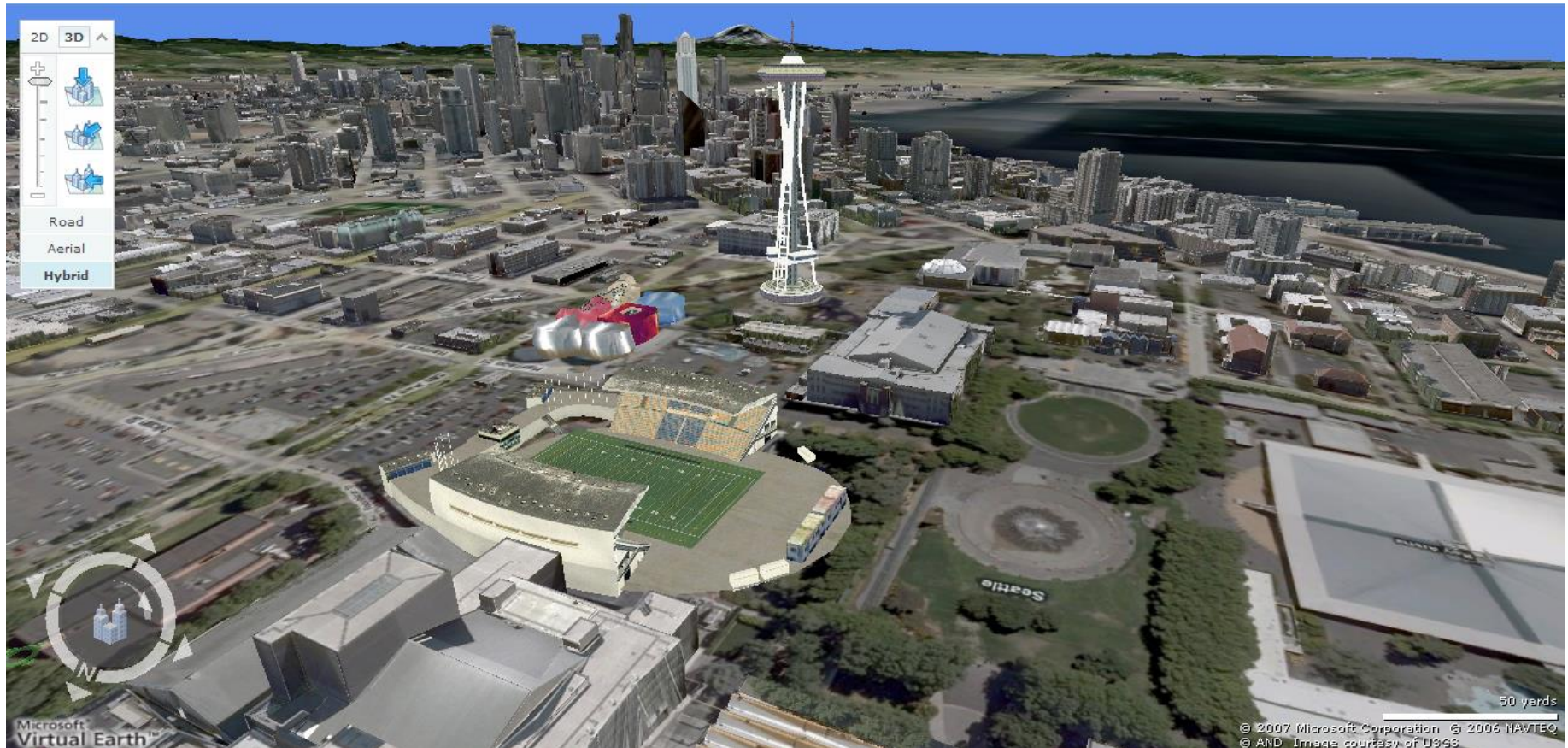
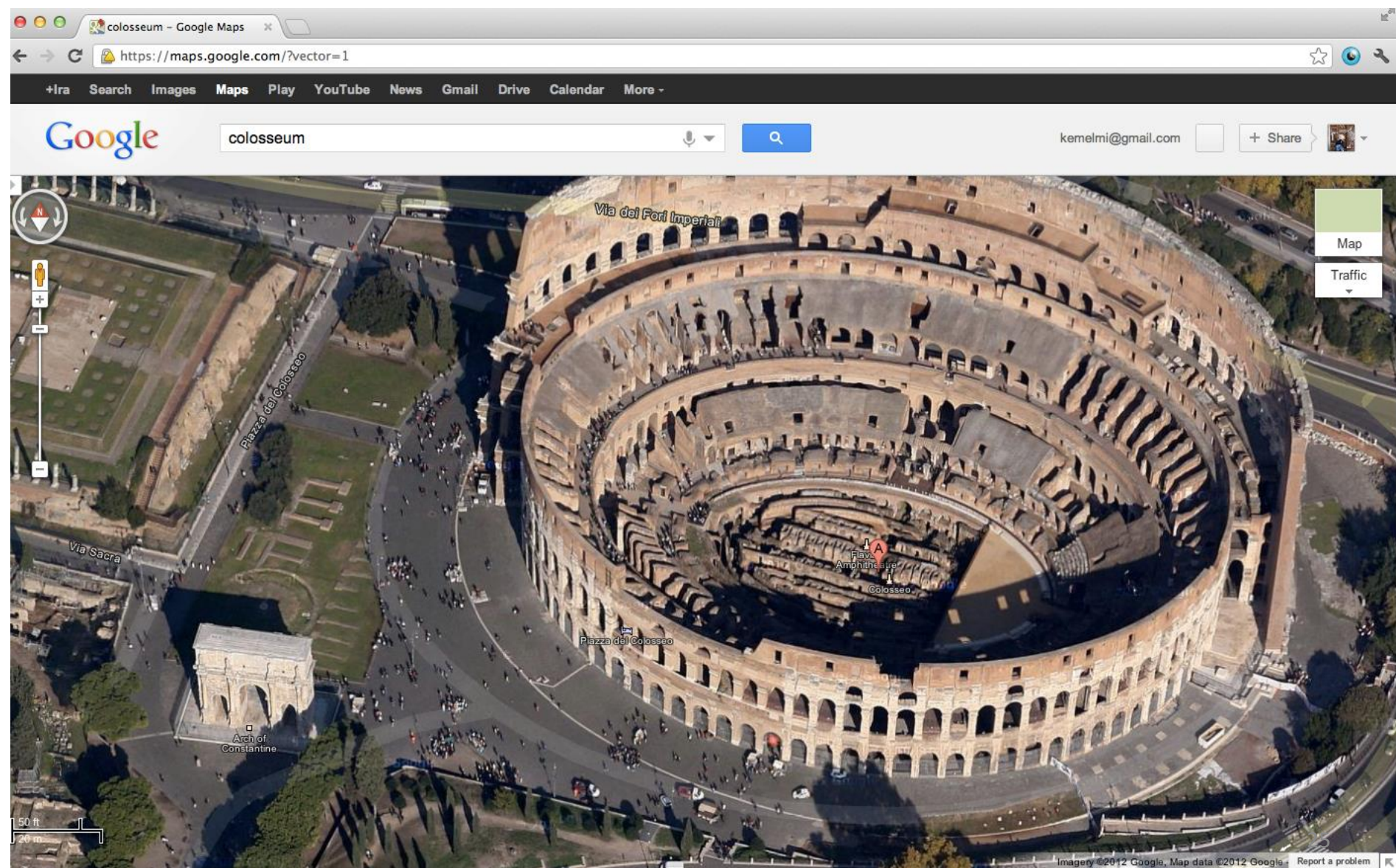


Image from Microsoft's [Virtual Earth](#)  
(see also: [Google Earth](#))



# Google's 3D Maps

## Structure Estimation from Tourist Photos





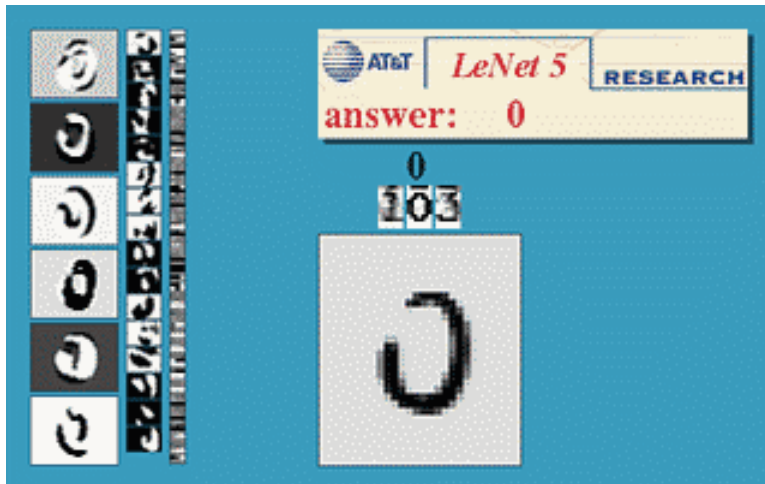
# *Apple's 3D Maps*



# Optical Character Recognition (OCR)

Technology to convert scanned docs to text

- If you have a scanner, it probably came with OCR software



Digit recognition, AT&T labs



License plate readers

[http://en.wikipedia.org/wiki/Automatic\\_number\\_plate\\_recognition](http://en.wikipedia.org/wiki/Automatic_number_plate_recognition)

# Face detection



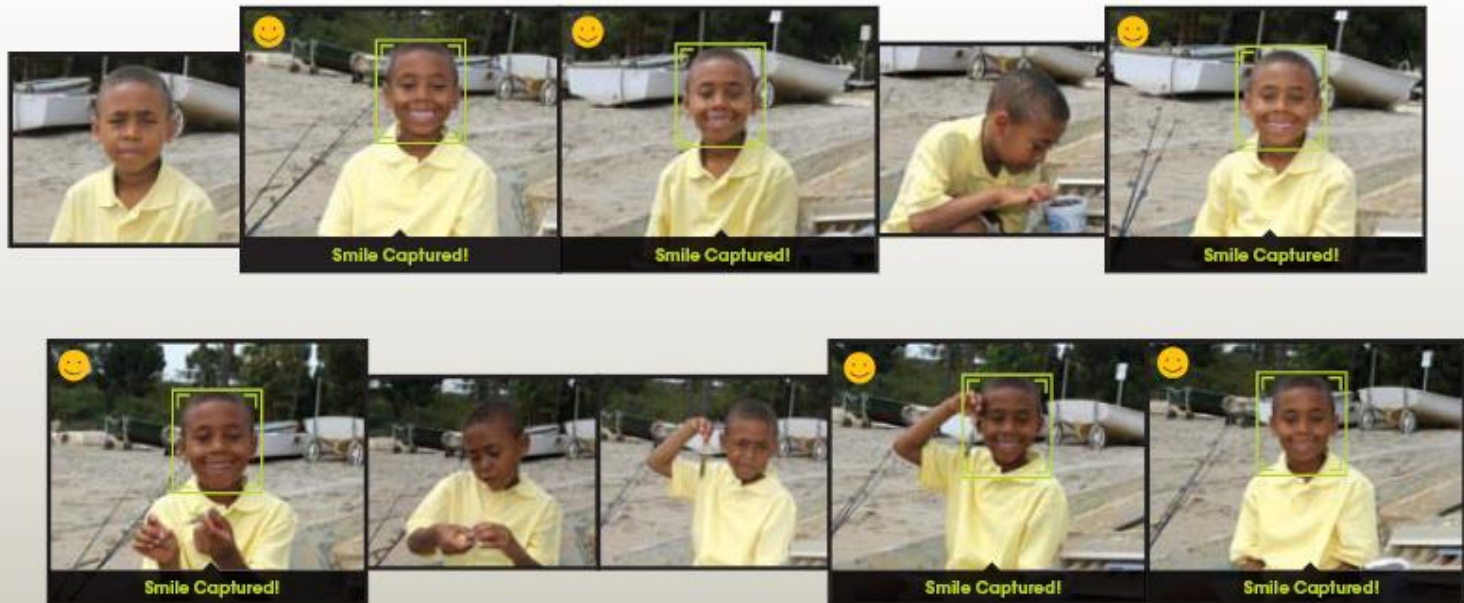
- Most digital cameras detect faces (and more)
  - Canon, Sony, Fuji, ...



# Smile detection

## The Smile Shutter flow

Imagine a camera smart enough to catch every smile! In Smile Shutter Mode, your Cyber-shot® camera can automatically trip the shutter at just the right instant to catch the perfect expression.

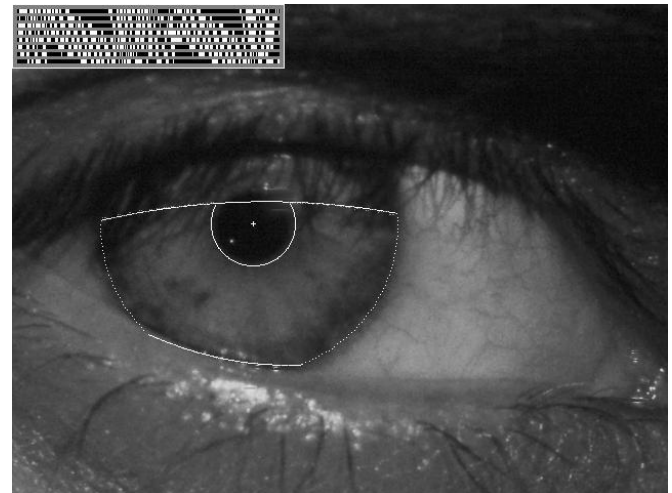
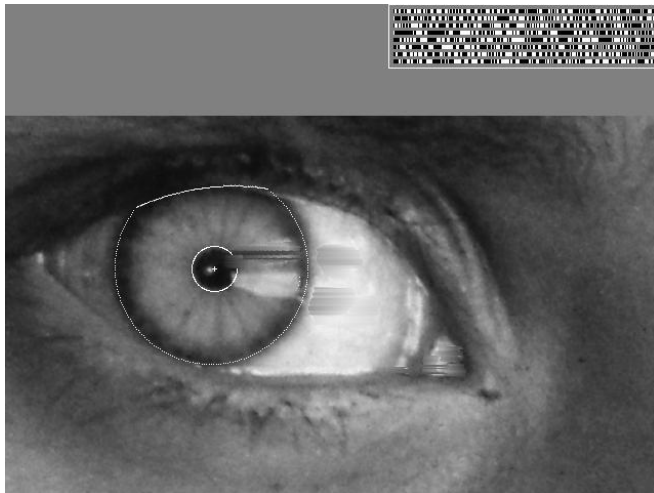


Sony Cyber-shot® T70 Digital Still Camera

# Vision-based biometrics



*“How the Afghan Girl was Identified by Her Iris Patterns”* Read the [story](#)  
[wikipedia](#)



# Shopping without checkout



# Object recognition (in supermarkets)



LaneHawk by Evolution Robotics

“A smart camera is flush-mounted in the checkout lane, continuously watching for items. When an item is detected and recognized, the cashier verifies the quantity of items that were found under the basket, and continues to close the transaction. The item can remain under the basket, and with LaneHawk, you are assured to get paid for it... “



# Object recognition (in mobile phones)



Point & Find, Nokia  
Google Goggles

# Smart cars

The image is a screenshot of the Mobileye website. At the top, there are two navigation tabs: 'manufacturer products' and 'consumer products'. Below them is a large banner with the text 'Our Vision. Your Safety.' and a top-down view of a car. Three yellow cones represent the car's vision fields: 'rear looking camera' at the back, 'side looking camera' on the sides, and 'forward looking camera' at the front. Below the banner are three main product sections: 1. 'EyeQ Vision on a Chip' featuring an image of the EyeQ chip. 2. 'Vision Applications' showing a pedestrian on a crosswalk with the text 'Road, Vehicle, Pedestrian Protection and more'. 3. 'AWS Advance Warning System' showing a car icon on a circular display with the number '0.8'. To the right of these sections is a sidebar with 'News' and 'Events' categories. The 'News' section lists articles like 'Mobileye Advanced Technologies Power Volvo Cars World First Collision Warning With Auto Brake System' and 'Volvo: New Collision Warning with Auto Brake Helps Prevent Rear-end'. The 'Events' section lists 'Mobileye at Equip Auto, Paris, France' and 'Mobileye at SEMA, Las Vegas, NV'. Each section has a '> read more' link.

- [Mobileye](http://mobileye.com): vision systems currently in many cars

<http://mobileye.com/technology/applications/vehicle-detection/forward-collision-warning/>  
<http://mobileye.com/technology/applications/pedestrian-detection/pedestrian-collision-warning/>

“Subaru thinks cameras are better than radar cruise”

<http://www.roadandtrack.com/new-cars/news/a6852/subaru-camera-controlled-cruise/>

# Google cars



[Google in talks with Ford, Toyota and Volkswagen to realise driverless cars](http://www.theatlantic.com/technology/archive/2014/05/all-the-world-a-track-the-trick-that-makes-googles-self-driving-cars-work/370871/)

<http://www.theatlantic.com/technology/archive/2014/05/all-the-world-a-track-the-trick-that-makes-googles-self-driving-cars-work/370871/>



# Ford acquires SAIPS for self-driving machine learning and computer vision tech

Posted Aug 16, 2016 by [Darrell Etherington \(@etherington\)](#)



Ford outlined a few of the ways it's aiming to [ship driverless cars by 2021](#), and part of the plan involves acquisitions. CEO Mark Fields revealed at a press event in Palo Alto today that the automaker [acquired SAIPS](#), an Israeli company focusing on machine learning and computer vision. It's also partnering exclusively with Nirenberg Neuroscience, to bring more "humanlike intelligence" to machine learning components of driverless car systems.

SAIPS' technology brings image and video processing algorithms, as well as deep learning tech focused on processing and classifying input signals, all key ingredients in the special sauce that makes up autonomous vehicle tech. This company's expertise should help with on-board interpretation of data captured by sensors on Ford's self-driving cars, and turning that data into usable info for the car's virtual driver system. SAIPS' offerings include detection of anomalies, persistent tracking of objects detected by sensors, and much more. The company's past clients include HP and Trax, but its partner group doesn't appear to have included much in the way of driving-specific applications.

## CrunchBase

### Ford Motor Company

**FOUNDED**  
1903

#### OVERVIEW

Ford is an automotive company that develops, manufactures, distributes, and services vehicles, parts, and accessories worldwide. It operates through two sectors: automotive and financial services. The automotive sector offers vehicles primarily under the Ford and Lincoln brand names. This sector markets cars, trucks, parts, and accessories through retail dealers in North America and distributors ...

#### LOCATION

[Dearborn, MI](#)

#### CATEGORIES

[Automotive](#)

#### WEBSITE

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

[Full profile for Ford Motor Company](#)

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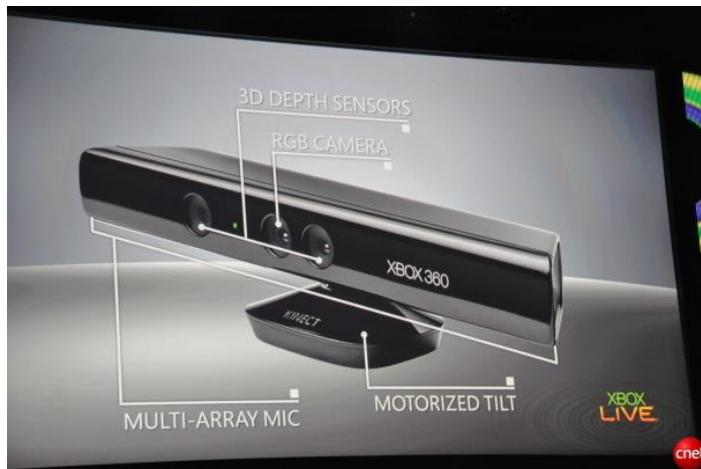
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*Delivered weekly*

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The latest

# Interactive Games: Kinect

- Object Recognition:  
<http://www.youtube.com/watch?feature=iv&v=fQ59dXOo63o>
- Mario: <http://www.youtube.com/watch?v=8CTJL5IUjHg>
- 3D: <http://www.youtube.com/watch?v=7QrnwoO1-8A>
- Robot: <http://www.youtube.com/watch?v=w8BmgtMKFbY>



Any comments?