Introduction
Computer Vision

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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

https://en.wikipedia.org/wiki/Macaque
Cave of Altamira, near Santander, Spain.
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."
Images are highly complex functions of several variables
3D Lego Terracotta Army

Leon Keer, Ruben Poncia, Remko van Schaik and Peter Westerink
Varying SCALES
Varying instances
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

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
Sports
Mapping

Google Streetview

http://www.uavdataprocessing.com/
Autonomous Vehicles

https://www.google.com/selfdrivingcar/
Tesla Self-Driving Demonstration
Games

http://www.robots.ox.ac.uk/~tvg/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
Topics (tentative)

- Camera models, image formation
- Filtering, image features and image matching
- Image alignment
- Structure from X
- Optical flow and stereo
- Tracking and detection
Prerequisites

- Data structures
- Working knowledge of programming: C, C++ or Python
- Vector calculus
- Linear algebra

Does not assume prior knowledge of computer vision, image processing, graphics, etc.
Questions?