CS415
Human Computer Interaction

Lecture 4 – WIMP and Post WIMP

Assignment Strategy – Useability!

- Assignment #1 – Shells and Command Line Interfaces – Prototype Code
- Assignment #2 – Understanding WIMP and Beyond WIMP – Play with Code
- Assignment #3 – WIMP GUI Building for Interactive Appls – Prototype Code
- EXAM-1
- Assignment #4 – Understanding Pointer Devices and Beyond Touch Screens and Mice – Prototype System (Jetson)
- Assignment #5 – Propose Proof-of-Concept HCI of Your Interest – Design Focus and Design of Experiments
- EXAM-2
- Assignment #6 – Build HCI Proof-of-Concept, Test
- FINAL EXAM - Present Results from Assignment #6

[Harder Programming, Easier Programming, Medium Programming]

WIMP and Post WIMP

- Post WIMP Discussion
- 3D Graphics and VR
- Computer Vision and Active Depth Mappers
- Introduction to Design Methods for HCI Next Week
- Quiz on Chapters 1 to 3 in http://www.hcibook.com/ and Class Notes for First 3 Weeks

Post WIMP

- Integration of Computer Vision, Natural Language Processing and 3D Projection – Augmented Reality
- MagicLeap – 3D imagery
- MS HoloLens – Holography

http://www.magicleap.com

- Other Forms of 3D Display and Projection
- Wearable Immersive VR [Issues with Proprioception and Vestibular Comfort]
  - https://www.oculus.com/en-us/
  - http://www.samsung.com/global/microsite/gearvr/

Not Ready for Post WIMP - Discussion

- Build Better WIMP Applications and Systems
  - Tasking and Task Flow [Concurrency]
  - Integration of Applications, Data Sharing, and Embedding
  - Human Factors and Ergonomics
  - Improved Look and Feel
  - Haptic Feedback?
- Is Web (2D) [VRML] Holding us Back?
- Is Mobile [OpenGL ES] Holding us Back?
- Is Lack of a Convincing 3D Display Holding us Back?
- 3D Interaction?
- Cost?

Advanced Interaction

- Active and Passive Depth Mappers
- Scene Recognition
- Augmented Reality

- Introduced this Week

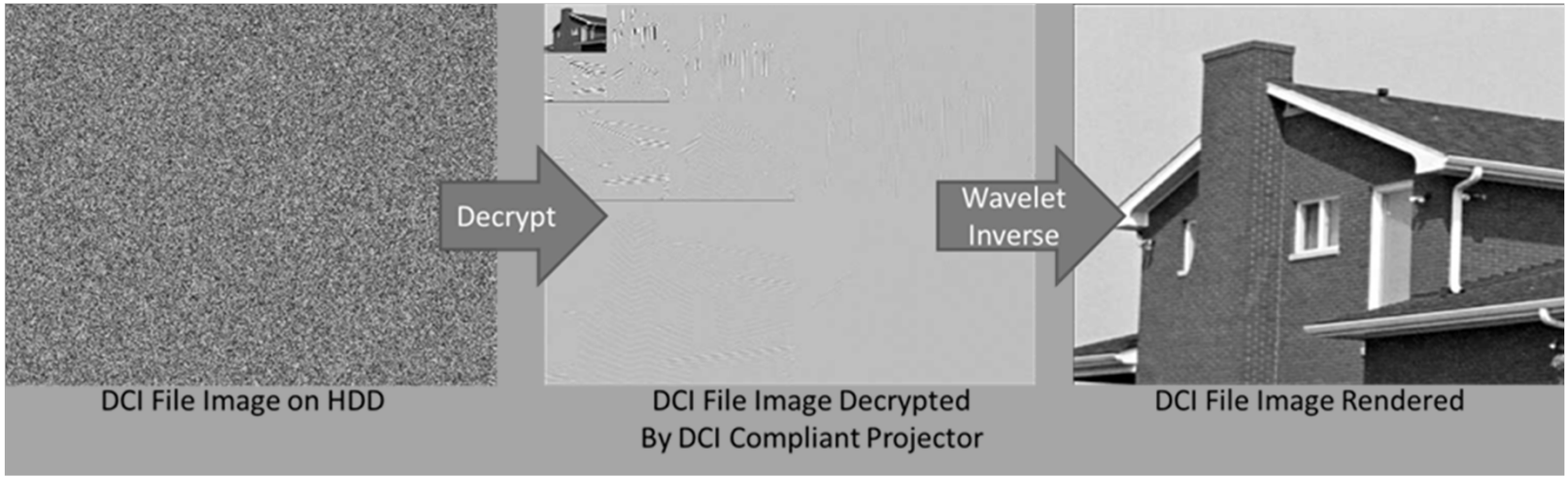
- Go Back to WIMP in Assignment #3

- Re-visit in Assignment #4

Transformational Example(s)

- Very Common Engineering Architecture
- OpenCV PoC – Hough Linear or Circular Transform
- C code PoC – Image Enhancement, Sharpen, Brighten/Contrast, Encrypt/Decrypt, Compress/Decompress
- Batch or Continuous Real-Time

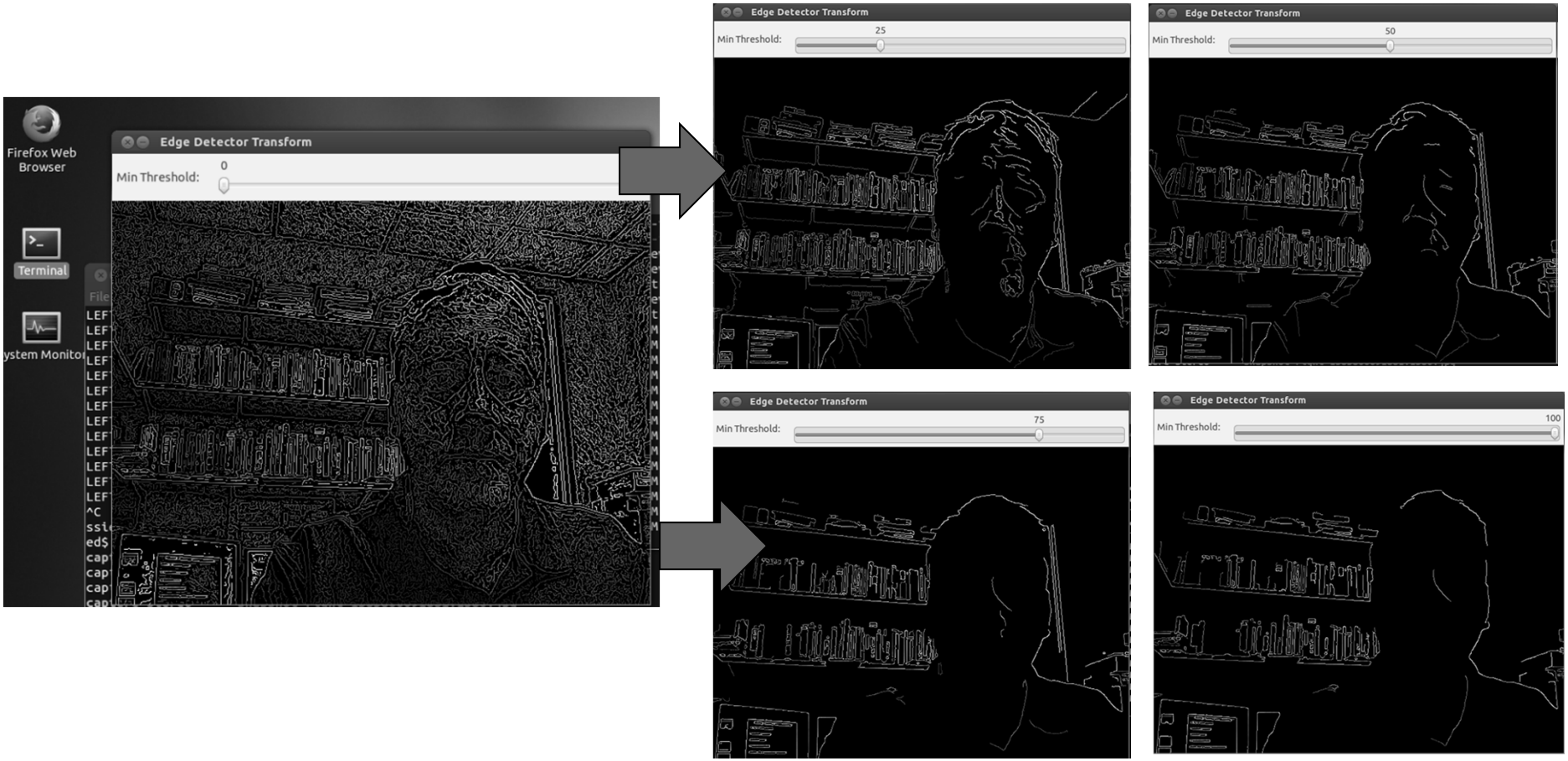
Digital Media Security & Transport



Computer Vision

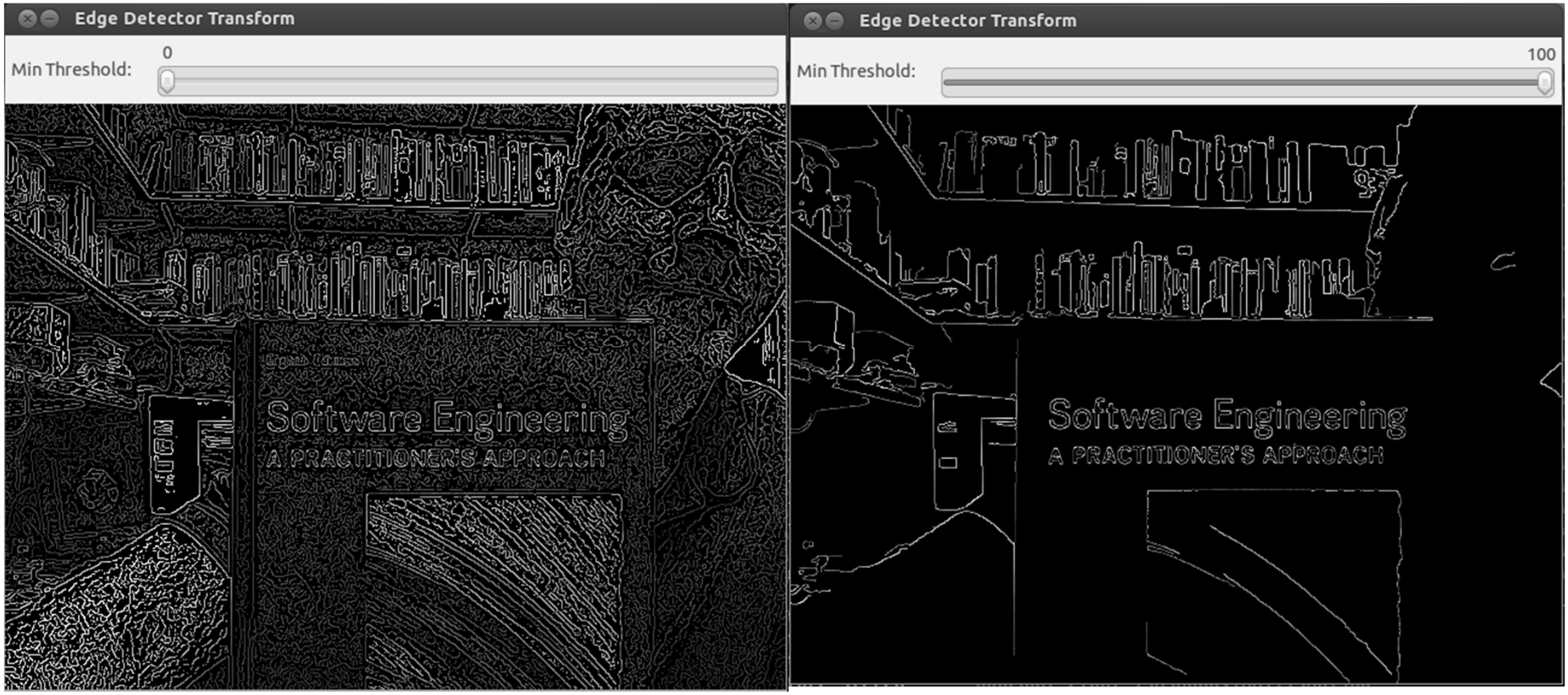
Canny Edge Finder – Threshold Control

- Consider a Transformation – Continuous Image Processing with a Simple Control Added



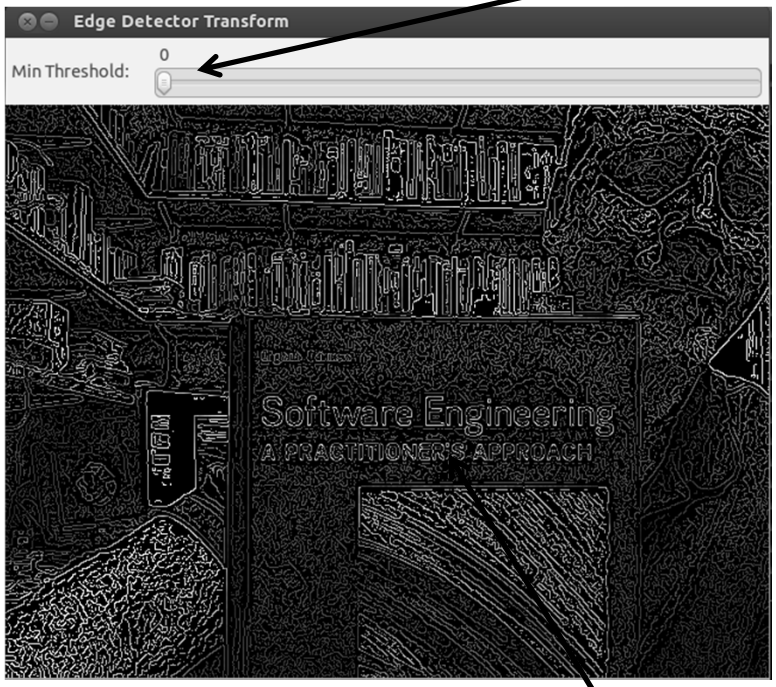
License Plate or Sign OCR

- MATLAB Example – Reading a Sign
- Canny is Fundamental Step – Transformational Capability in a Larger Application (OCR)
- Correct Threshold for Intensity Gradient to Segment Image



Interactive Example(s)

- OpenCV PoC – Interactive Edge Finder, OCR
- C/C++ Allegro Games - http://alleg.sourceforge.net/
- Also Transformational (Ok to be Hybrid)
- Display + Slider = Interactive

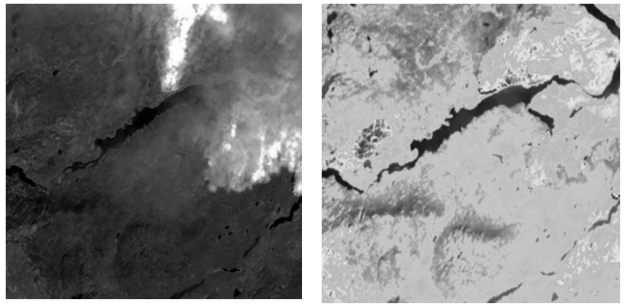


Interactive Control(s)

Visual Feedback (Interactive)

SmartCam – Computational Photometry

- Low-cost, software-defined, smart “Go-Pro” style device with visible and multi-spectral image fusion
  - Efficient energy use with image analysis on the device itself
  - Emphasis on software intelligence for automatic detection, tracking, and data fusion analysis
- Examples



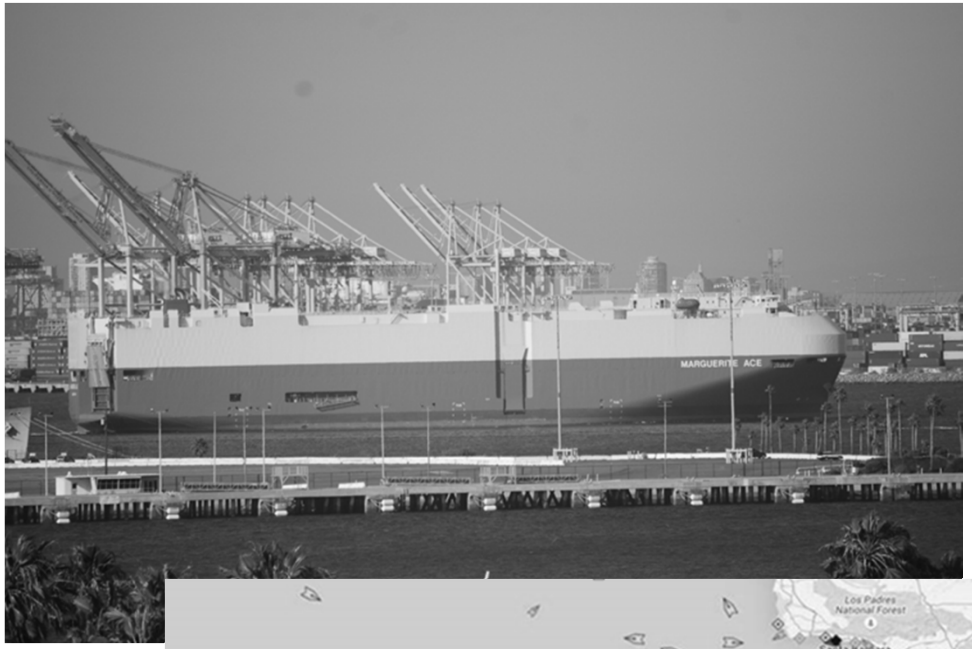
Visible image of a forest fire obscured by smoke (left), while a thermal satellite image indicates hot spots (right), leading to calculation of Normalized Burn Ratio (SWIR, NIR) [O’Connor, Exelis]. SmartCam on a UAV could provide higher resolution, real-time data for situational awareness.

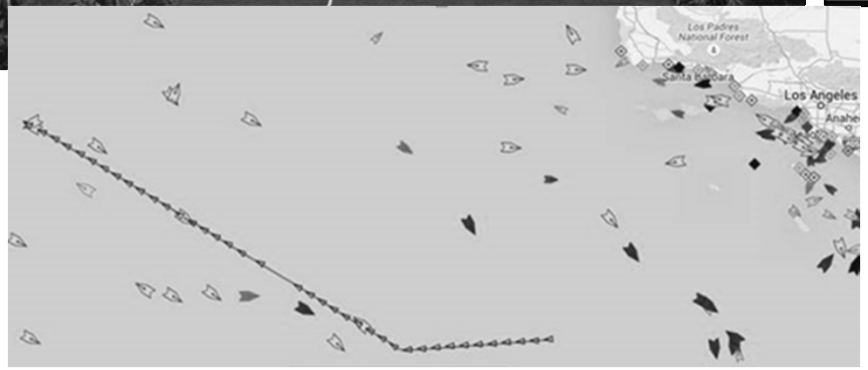
Bergy bits may be difficult to detect with a search light (left) but could be automatically detected by SmartCam software with a thermal camera (right) using machine learning [FLIR].

Automatic hazard and threat identification and annotation from a car [nVidia PX] could be adapted by SmartCam for marine environments.

Feasibility Testing in Marine Domain

- Basic Vessel Detection, Tracking, Identification
- At Ports Light Stations, and In Straits (E.g. Unimak Strait – Great Circle Route to Asia, Bering Strait)
- Big Data Analytics Combined with Sensor Networks (Potential To Enhance Situational Awareness)

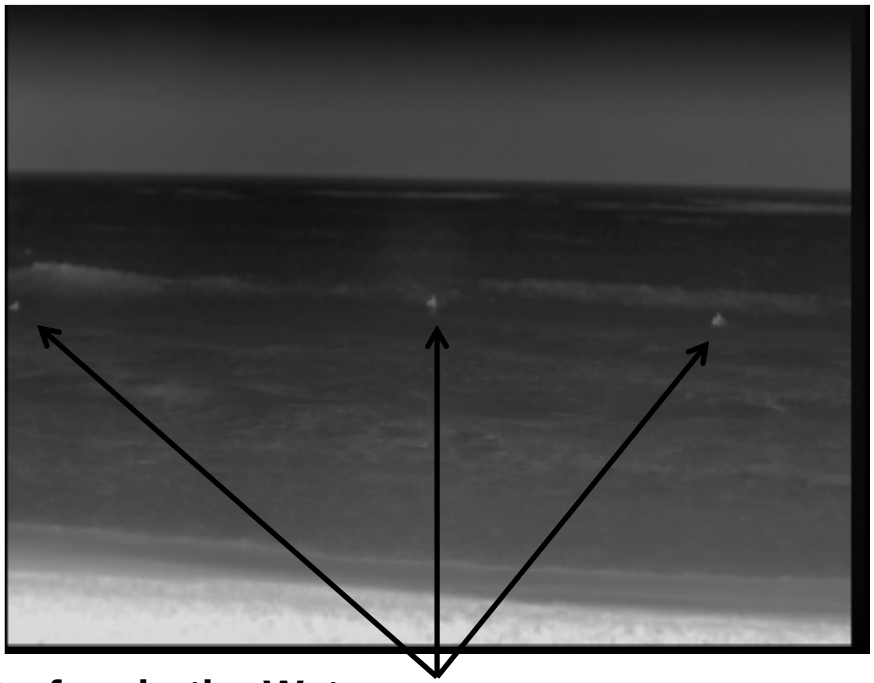




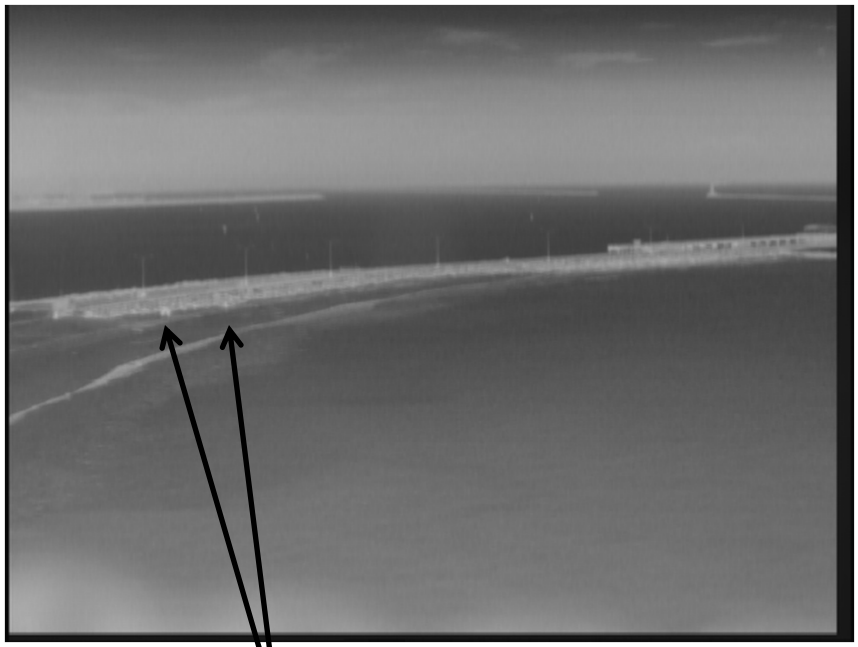
- **Marguerite Ace Leaves Long Beach**
- HD visible imaging of departures
- And transits with ID
- LWIR night/fog detection and tracking
- Correlation to S-AIS and DBMS
- (Field Test – June 2015, Long Beach)

Feasibility for SAR Ops / Port Security

- Add camera systems to Cutters (around, mast)
- Detect bodies in the water, Port trespassing, Complements Aircraft FLIR



Surfers in the Water
Hand-held, Cutter Mounted, Buoys
Complements Existing Helicopter and C130 FLIR
(Field Test – June 2015, Malibu)



Trespassers at Night Shown on Jetty
Hand-held, Port Drop-in-Place, Buoys
Complements Existing Security
Off-Grid Installations
(Field Test – June 2015, San Pedro)

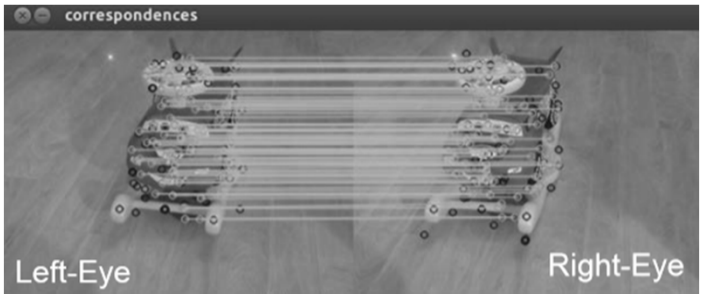
Accomplishments

- Milestones Achieved
  - Testing power consumption
    - Low power (0.6W) to normal (6W at 3000mAh → 2-3 hours); need sleep and wakeup with periodic sense if off the grid
    - Couple with hybrid power, OTS leveraging
  - Testing LWIR range and Night/Fog Conditions
    - Can see vessels **2 to 13 kilometers** with out with 25 degree field of view (25mm lens)
    - Can see vessels **TBD** miles with out with 9.6 degree field of view (65mm lens) – Next Planned Test
    - Can identify Vessels with HD Visible (200mm lens)
    - Visible + IR Fusion Feasibility Testing (Night, Day)

Anchored Vessels Over Night Waiting for Long Beach Port Access
(Field Test – June 2015, San Pedro)
Anchor Points Shown on S-AIS in Excess Of 10 Km From Observing Point

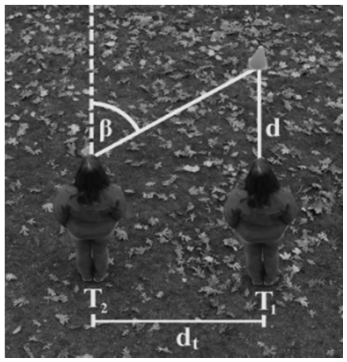
Visual Perception is Complex

- 8 or More Visual Cues for Human Depth Perception
- Relative Importance of Cues (Context Driven)



Binocular disparity

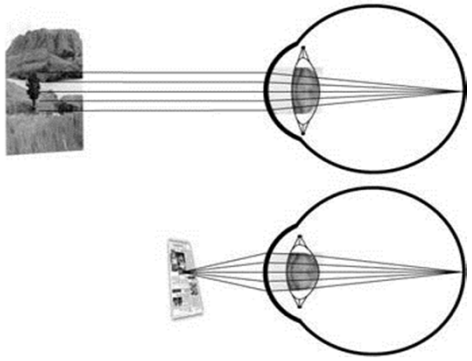
Relative size



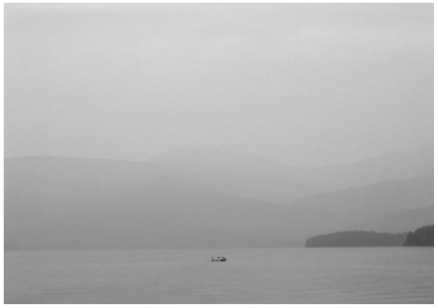
Motion perspective

Height in visual field

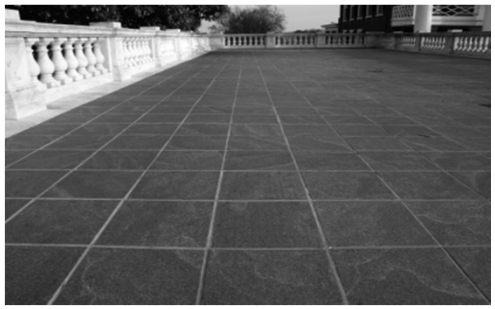
Occlusion



Accommodation



Aerial perspective (Contrast decreases, Rayleigh Scattering)



Texture gradient

Hearing from Experts

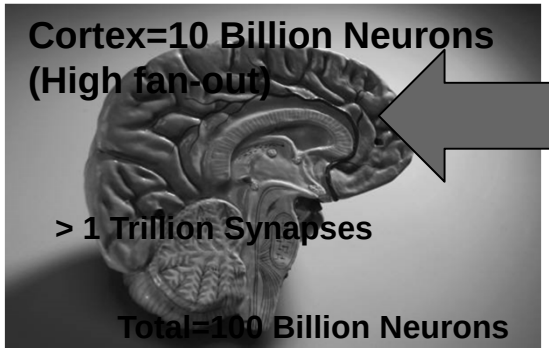
- Fei Fei-Li – Computer Vision, Ted Talk
- David Eagleman – Sensory Substitution and Umwelt
- Chris Melk – Digital Cinema with VR Headsets
- Tony DeRose – Pixar, Math Behind the Movies
- John Lasseter – Pixar, On Early Days of 3D Animation [DVD]
- Future of VR in the Workplace

Fei Fei-Li Discussion Points

- Cognitive Model for Scene Parsing and Semantics
  - Claims that Humans process images at 5 Hz (200 millisec)
  - We know full motion video needs to be 24 Hz or greater
  - Why is there a difference?
  - Visual processing vs. visual capture – Sensing vs. Perception
- Why is the compilation of Millions of Quality Images important? [image-net.org]
- Scene segmentation? Why is it hard?
- What is Amazon Mechanical Turk?
- Comparison of Video ANN to Human Brain? [100K to millions of nodes] – her project uses 24 million nodes, 140 million parameters, 15 billion connections)
  - Human Eye [6-7 million cones, 10x number of rods, about 50 million]
  - Human Brain [10 billion neurons, 1 trillion synapses]
  - Human capability is 400x nodes, 1000x connections
  - Does this explain human superiority in scene description?

Human Aspects of HCI

- James Cutting & Peter Vishton – Perceiving Layout



Approximately
100+ Mega-Pixel
(Rod/Cone Count)
6-7M Cones

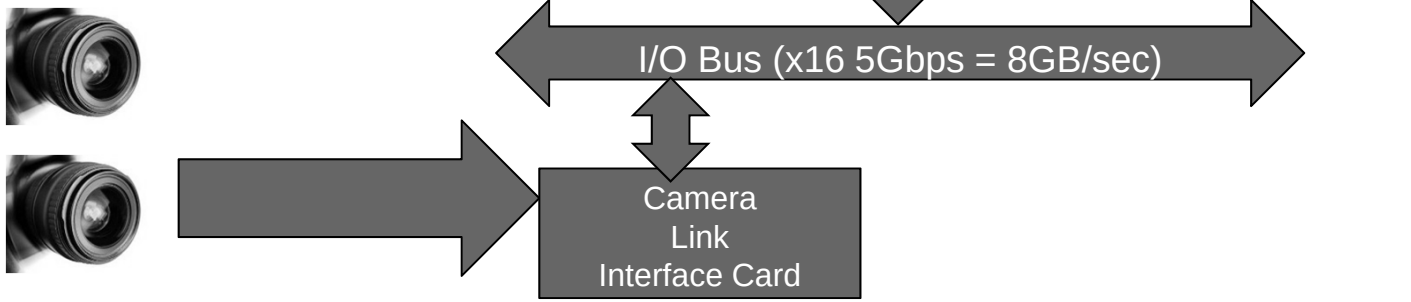
Computer Vision ANN:
24 million nodes,
140 million parameters,
15 billion connections
(Fei Fei-Li – Ted Talk)

Neuroscience. 2nd edition.
Purves D, Augustine GJ, Fitzpatrick D, et al., editors.
Sunderland (MA): Sinauer Associates; 2001.
http://www.ncbi.nlm.nih.gov/books/NBK10848/

1. Neuron > Transistor
2. Better Programming? ROM?
3. More Richly Interconnected
4. Storage + Processing

5 To 15 billion transistors

Red Epic 645
63 Mega-Pixel



Interactive Quiz #1

Use iClicker to Take Quiz in Class

Understanding Humans and Interaction in HCI/HMI

- In the Early Days of Computing [1950's – 70's] Computer Time was more Valuable than Human time
  A. TRUE
  B. FALSE

- We have not Yet Moved Beyond WIMP, We've instead expanded its use to Mobile and Web Interfaces
  A. TRUE
  B. FALSE

- Post-WIMP is Generally Envisioned as a Direct Neural Interface rather than 3D, VR, AR or Natural Language Interaction
  A. TRUE
  B. FALSE

Understanding Humans and Interaction in HCI/HMI

- 3D rendering has not had any success
  A. TRUE
  B. FALSE

- 3D rendering has had broad user and market success in
  A. Desktop interaction
  B. Digital Cinema and Games
  C. Scientific visualization
  D. Mobile systems

- Augmented Reality integrates a first person view with computer vision and graphics
  A. TRUE
  B. FALSE

Understanding Humans and Interaction in HCI/HMI

- There are only 5 human senses
  A. TRUE
  B. FALSE

- Proprioception, vestibular and chronoception are important considerations in VR systems
  A. TRUE
  B. FALSE

- 8 bits allocated per RGB color channel results in a palette of 16 million colors
  A. TRUE
  B. FALSE

Understanding Humans and Interaction in HCI/HMI

- Absolute joysticks are more common than isometric
  A. TRUE
  B. FALSE

- Both a mouse driven GUI and a touch-screen GUI are considered WIMP interaction
  A. TRUE
  B. FALSE

- Human short-term memory degrades in less than 1 second
  A. TRUE
  B. FALSE

Understanding Humans and Interaction in HCI/HMI

- Long-term human memory is aided by stories and visualization
  A. TRUE
  B. FALSE

- Use of stories and visualization appeals to our semantic memory
  A. TRUE
  B. FALSE

- The Shell or CLI has been rendered obsolete by WIMP
  A. TRUE
  B. FALSE

Understanding Humans and Interaction in HCI/HMI

- Multi-programming, which has enabled WIMP multi-tasking interaction was invented to deal with slow disk drives
  A. TRUE
  B. FALSE

- Gamers talk about “lag” which is synonymous with network transport latency
  A. TRUE
  B. FALSE

- Humans perceive gray levels in an intensity map linearly
  A. TRUE
  B. FALSE

Understanding Humans and Interaction in HCI/HMI

- WIMP means
  A. Windows, Images, Messages, Pointers
  B. Windows, Icons, Messages, Pointers
  C. Windows, Icons , Menus, Pointers
  D. None of the Above

- The RGB color model includes a color gamut and white point that requires no adjustment based on background lighting
  A. TRUE
  B. FALSE