The Telluride Neuromorphic Workshop 2011: Our Experience

Ching L. Teo (and everyone in Yiannis' Group)

Welcome to CVSS!

What is this talk about?

- The 2011 Neuromorphic Workshop @ Telluride, CO

- Challenges, modules, results

- Get you interested in our group's research:

  - Robotics

  - Computer Vision

  - Language

- Demos (?): AVW 4470

# The Neuromorphic Workshop

- NSF funded for 19 years – going to its 20th year

- Various universities: Stanford, UCB, UCLA, UCSD, ETHZ, JHU, UMD

- Neuromorphic: re-creating biological processes on chips.

  - Stanford – NN on a chip

  - ETHZ/JHU – Retina/Cochlea on a chip

  - UMD – .... Robot

- Essentially a workshop where you 'work' for 3 weeks...

So where is Telluride?
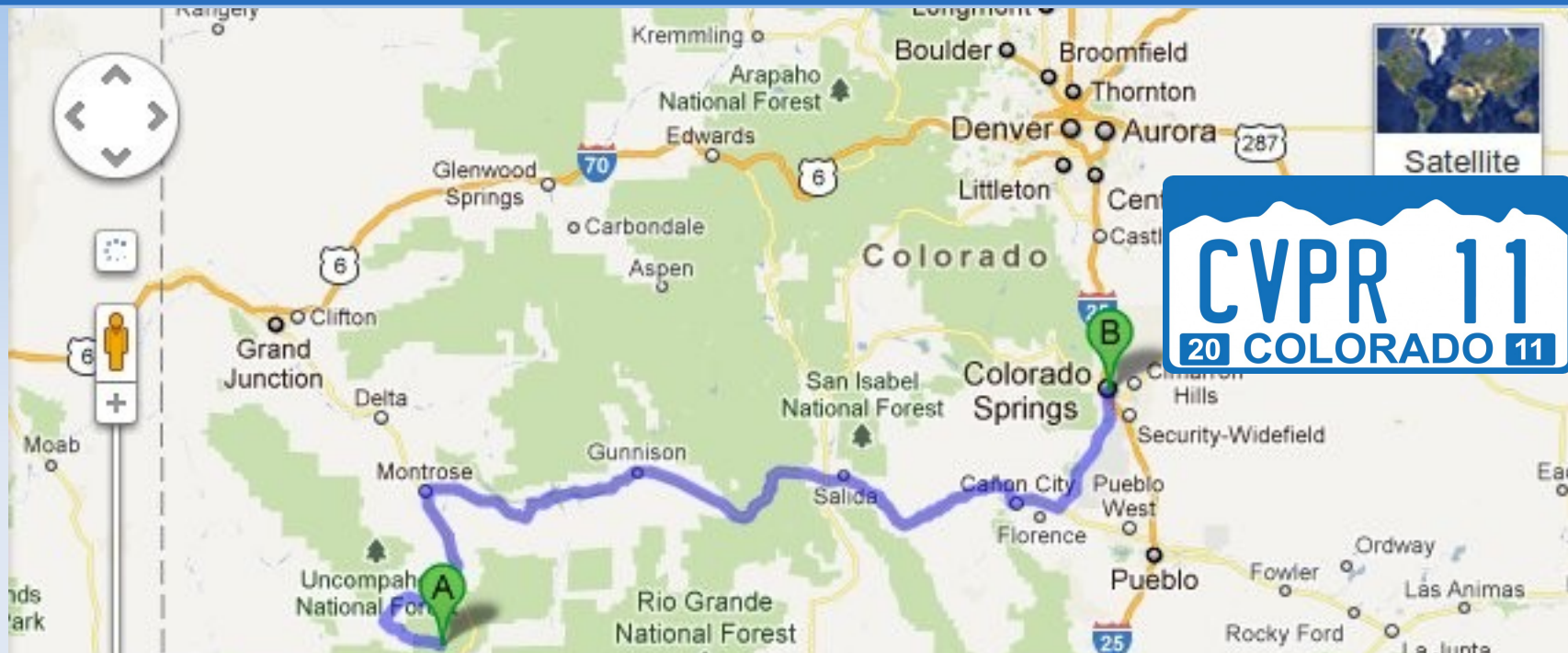
neuromorphs.net - Telluride Neuromorphic Cognition Engineering Workshop
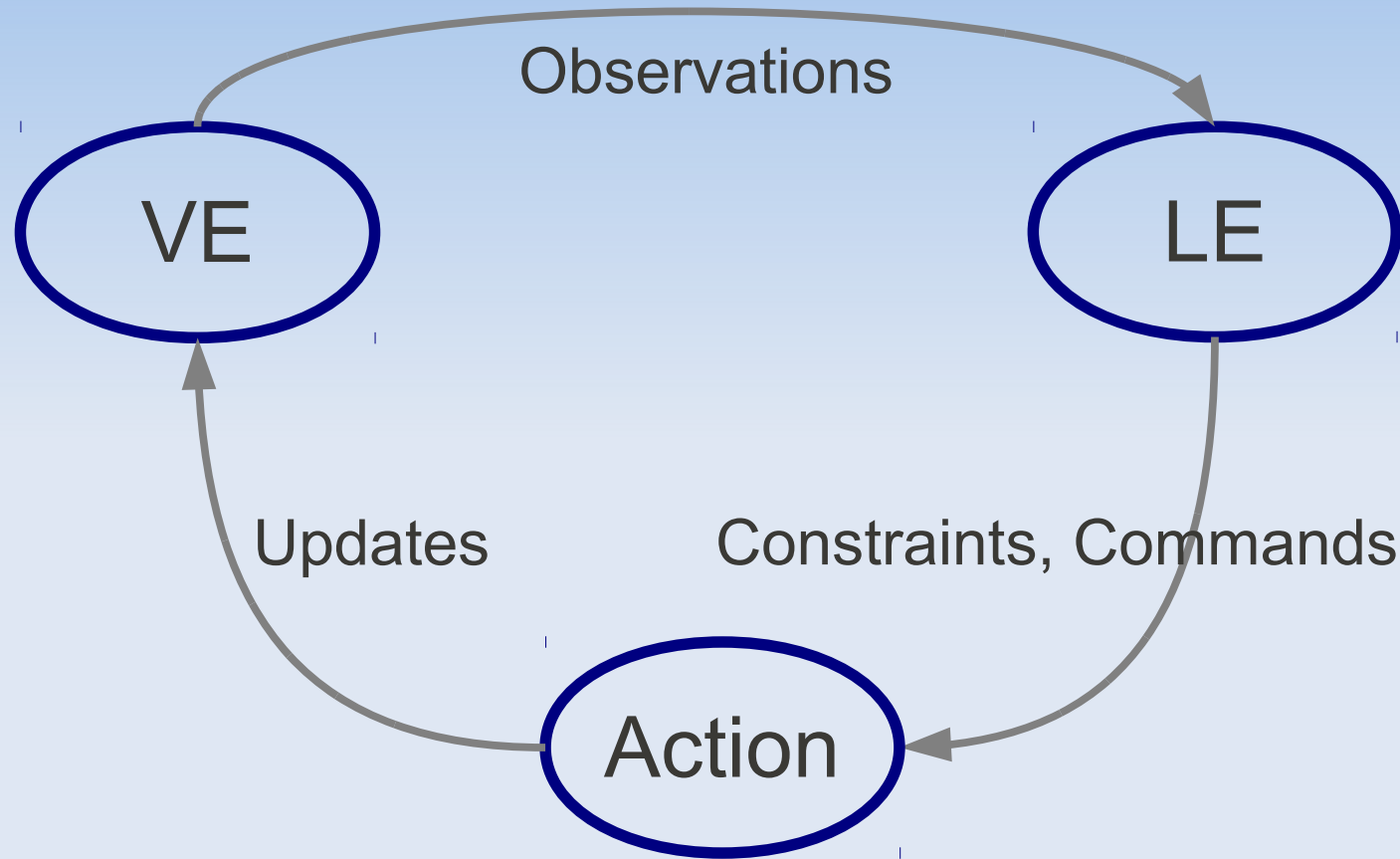
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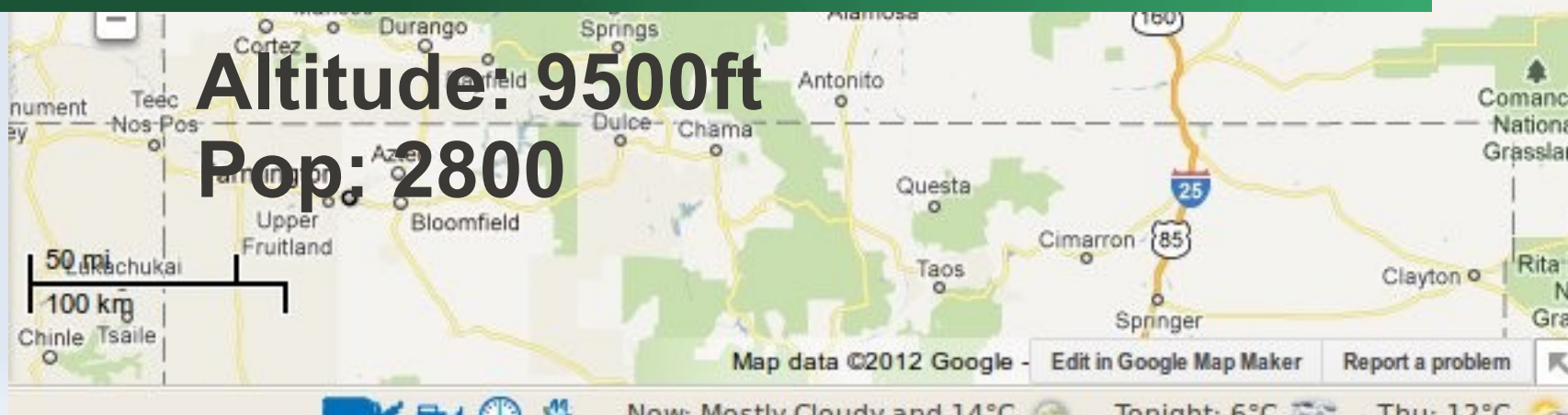
Telluride...

Workshop

Background: Cognitive Dialog

Observations

VE   LE

Updates   Constraints, Commands

Action

- Visual Executive (VE): visual processing

- Language Executive (LE): language (knowledge base)

Some Realizations of VE-LE

- Active Scene Recognition (ICCV 2011)
  - VE: extracts features, detect objects
  - LE: guides selection of next object, update scene prediction

- Sentence Generation (EMNLP 2011)
  - VE: detects objects, detect scenes
  - LE: predicts actions (verbs) and prepositions, select optimal nouns-verbs-preposition-scenes.

- Action-Tool prediction (ICRA 2012)
  - VE: detects objects, extract action features
 - LE: predicts action labels, update clusters

Telluride Task: Kitchen Activities

- First realization of VE-LE on robot
  - VE: <tool, object, action> detection
  - LE: Language Reasoner determines plausibilty, suggests possible alternatives
- Erratic Robot
  - Running ROS (robot operating system)

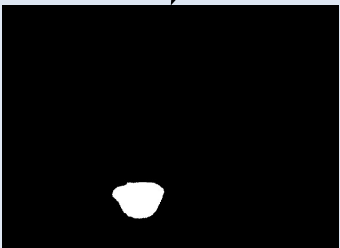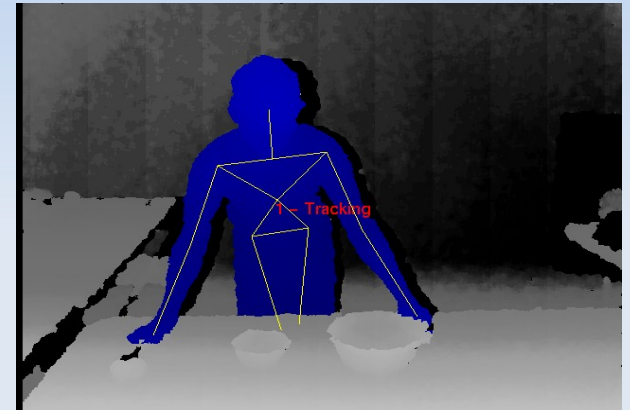Kinect

DragonFly2
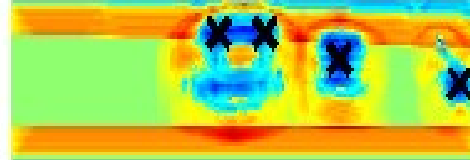
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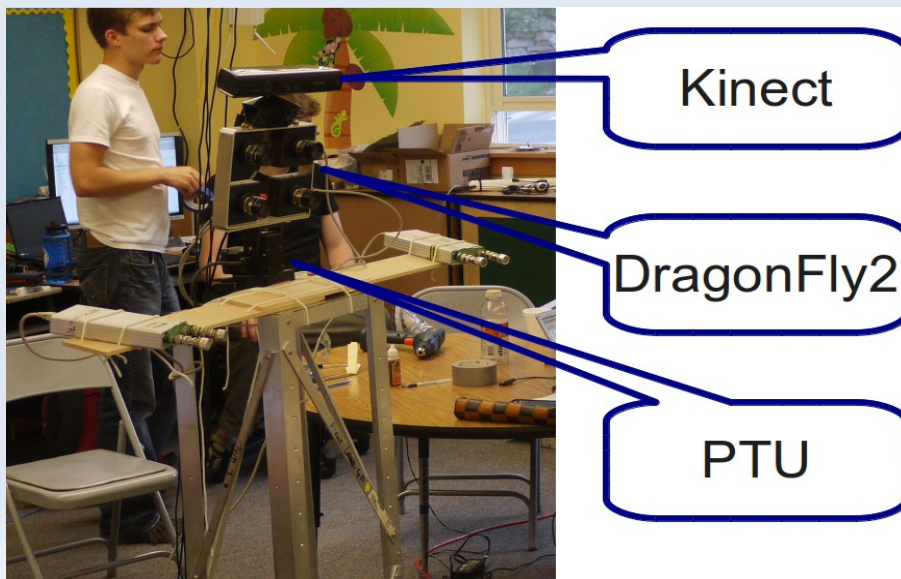
Main Modules

- Input: Kinect RGB-Depth Video

- Output: Verbalization of activity

- Key modules:

  - Kinect pre-processing

  - Action/Object recognition
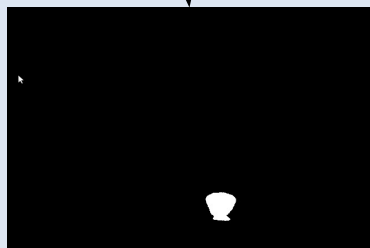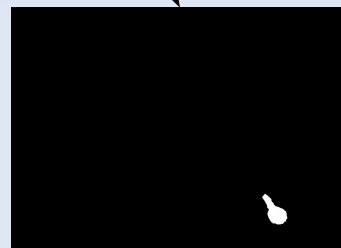
  - Language Reasoner
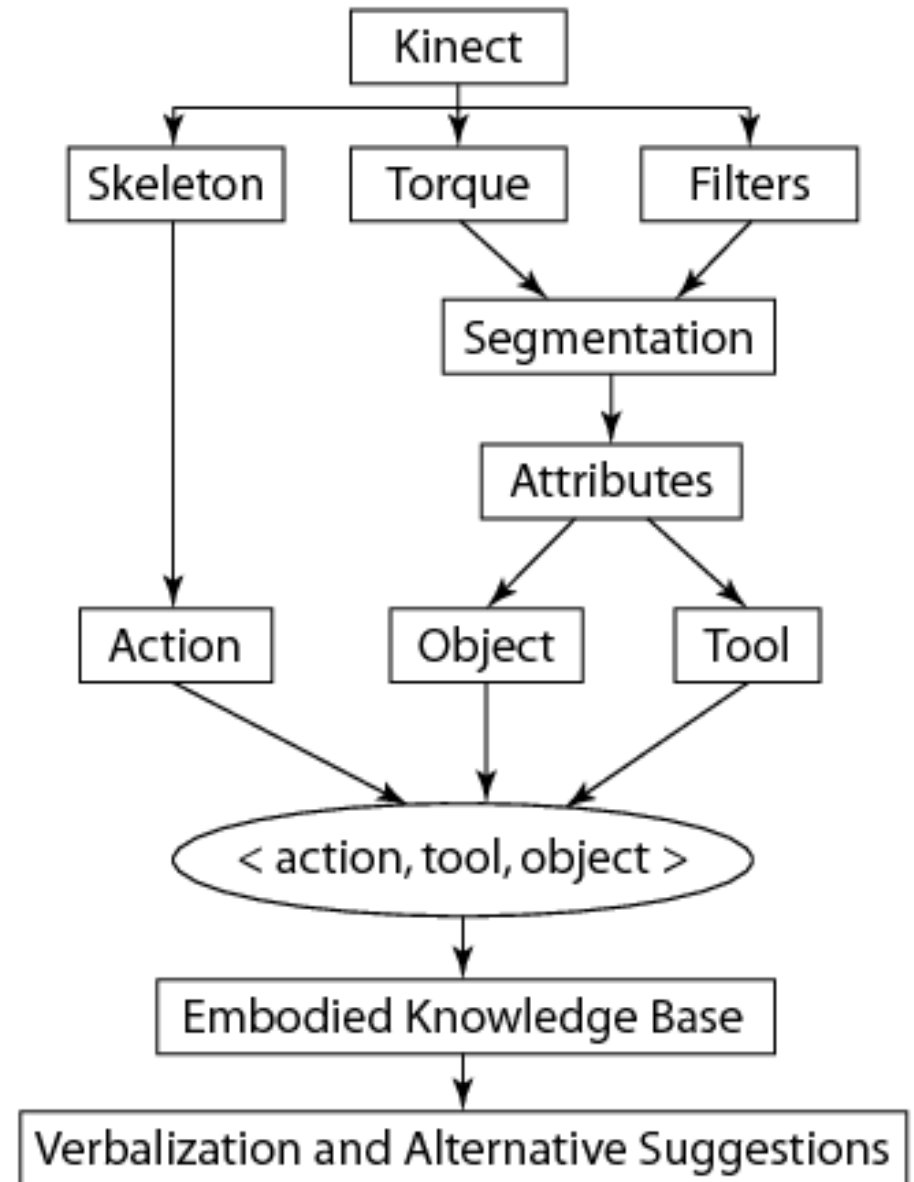
Outputs

A person is using ladle to pour water into the bowl.

Some Details

- Selecting Fixation Points: Image-Torque

- Segmentation: Fixation Segmentation

- Action: Human Detection + Pose Fitting

- Recognition: Features + Attributes, DT, Visual Filters.

- Language Reasoner: Semantic Network of 'concepts' – from WordNet, FrameNet etc...

Challenges

- Hardware:

  - Robot short-circuited multiple times – many parts need to be ordered in advance.

  - Many sensors: Laser, Kinect, PTU, Base, Cameras – power load must be allocated correctly (fuses...)

- Software:

  - ROS drivers needed for hardware interface

  - Interface with Kinect not perfect (OpenNI != ROS..)

  - Some codes run on Matlab, ROS interface with Matlab not officially supported

  - Many modules was developed over 3 weeks (!)

Looking Forward

- New Hardware:

  - Pioneer 3 robot base. Better motor control, and more stable hardware.

  - Event-Based Camera

  - TOF camera (Swissranger)

  - 3D Laser (?)

- Software:

  - Robot logic needs to be refined – when to start? When to stop?

  - Movement changes everything

  - Language capabilities

Videos/Demos