Accessible Aerial Autonomy

Cal Poly, Pomona

Nick Berezny '12, Lilian de Greef '12, Brad Jensen '13,
Kim Sheely '12, Malen Sok '13, and Zach Dodds

ARDrone as robot?

RC toy, 802.11b

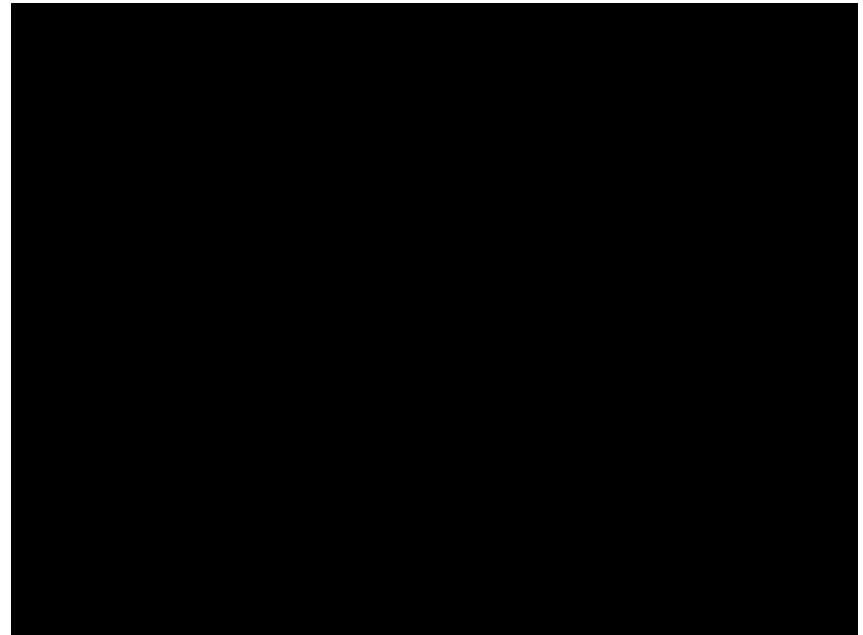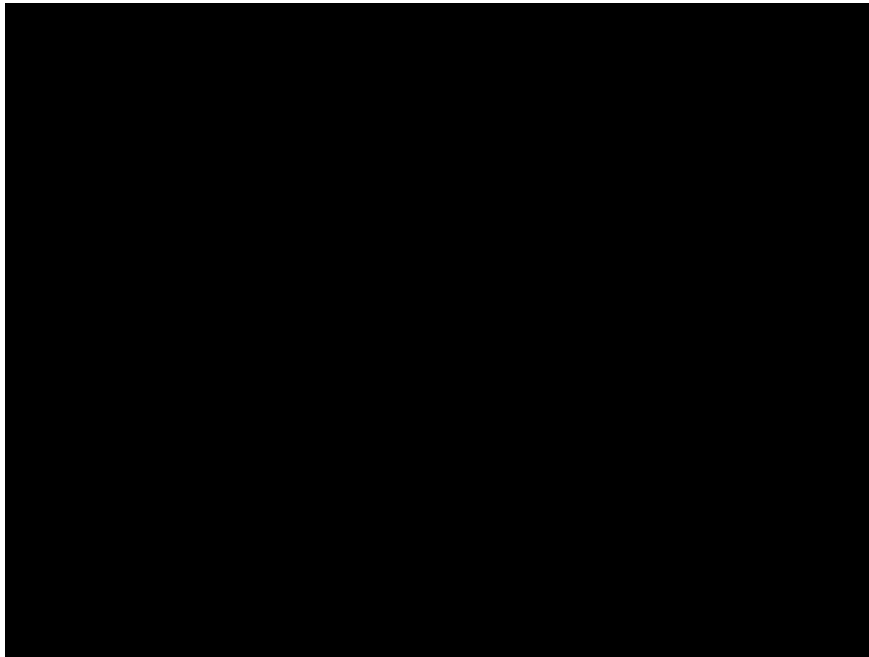Open, ASCII protocol
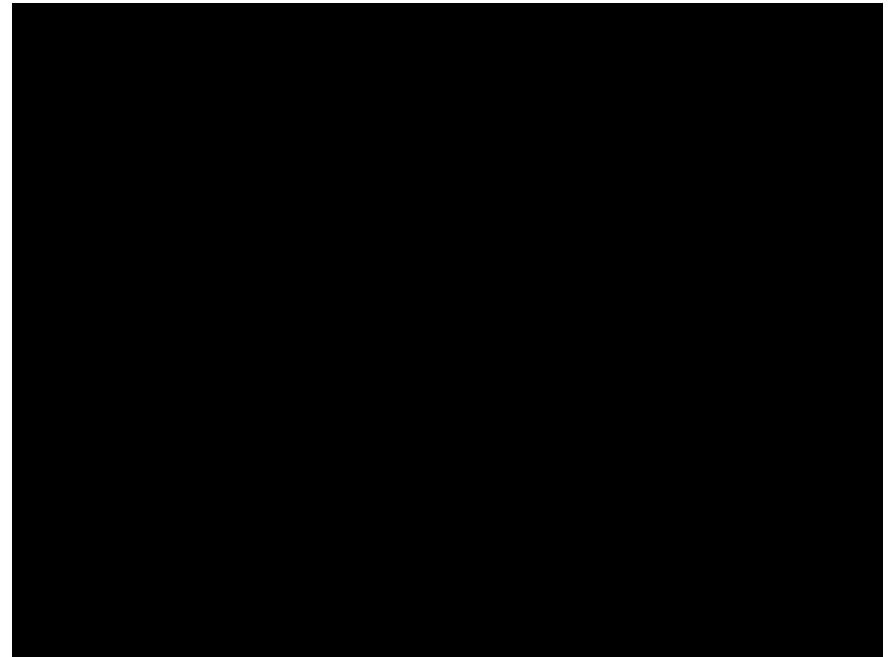
Gyros, diagnostics, forward and downward cameras:

an aerial *Create* ?

Forward camera feed from a
Kinect-controlled (RC) flight

Beyond RC?
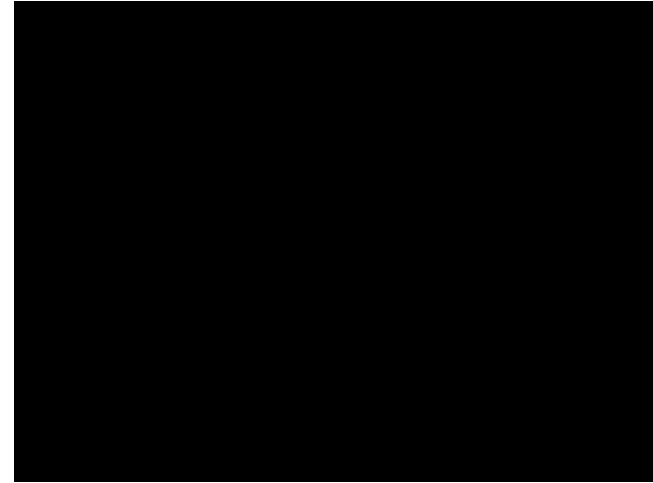
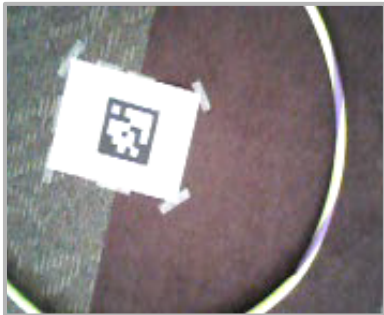Visions of
quadrotor
perching

Reality of
quadrotor
perching

ROS drivers

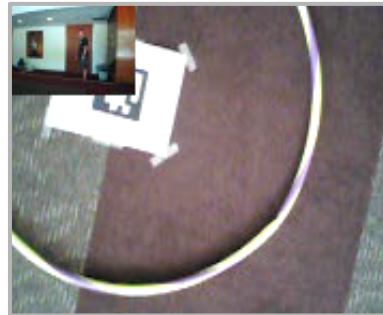We adapted a community-
contributed Python interface

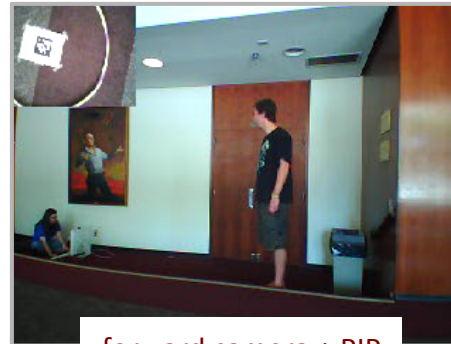Including learning ROS, it took
< a week to integrate the drone!

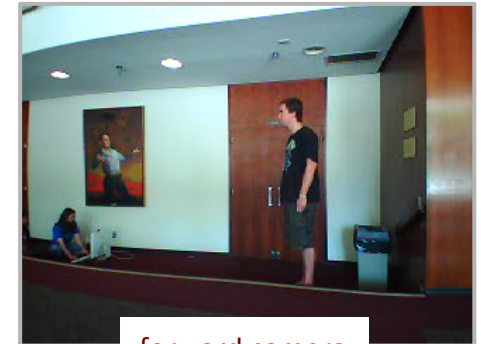ROS-based flight test, human-controlled

downward camera

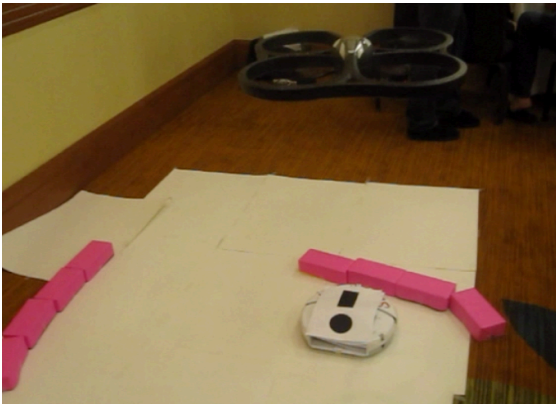downward camera + PIP

forward camera + PIP
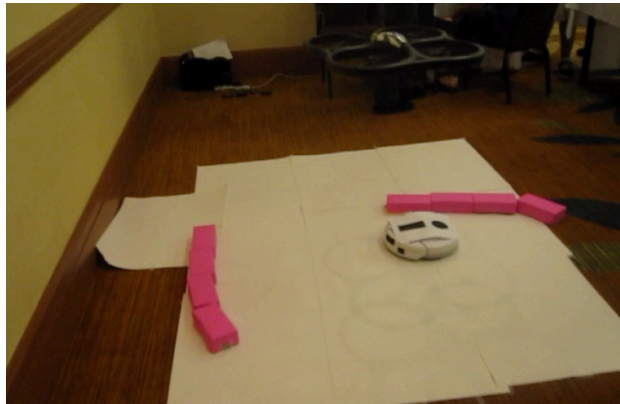

forward camera

Four video options are accessible. Psycho helps.
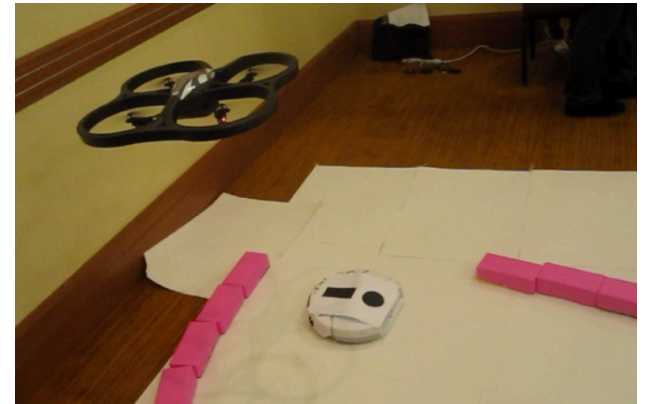
Flying's Advantage
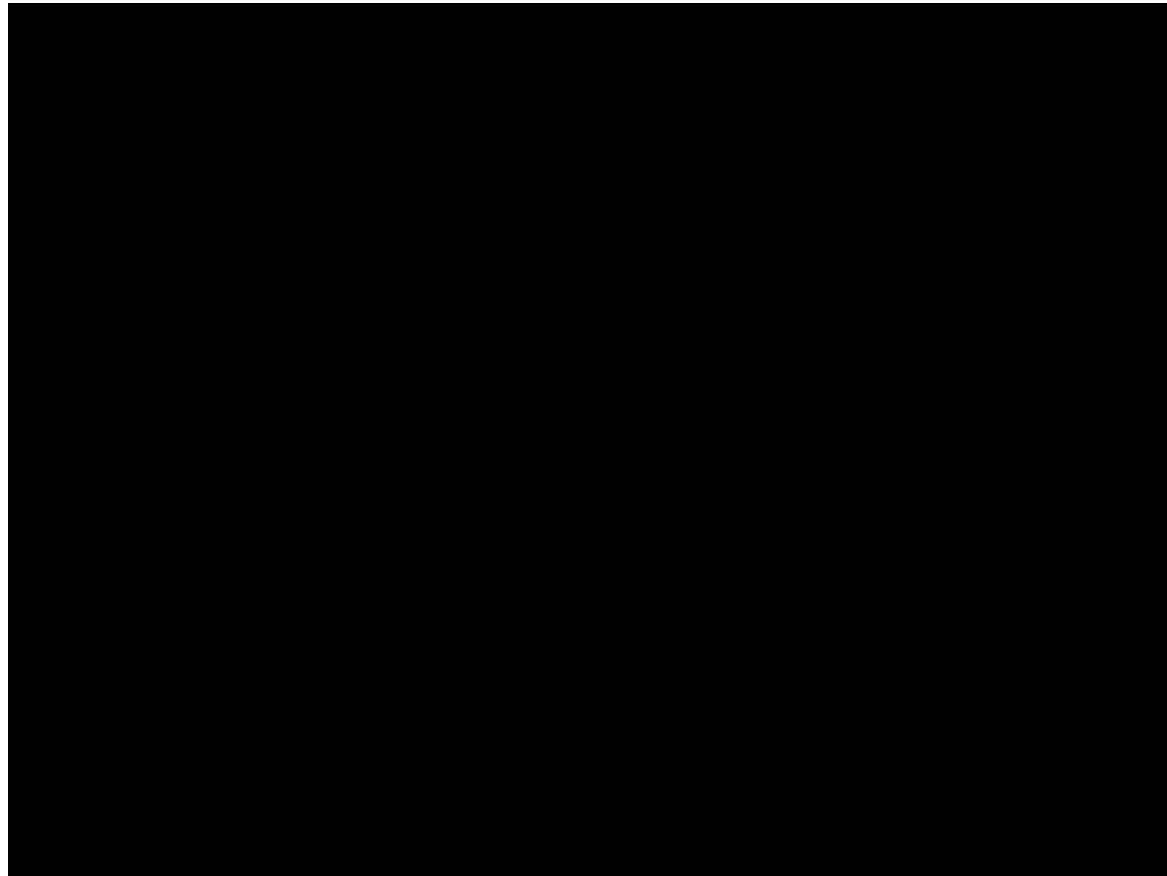

detect + decide   follow   repeat…

Our task: cooperation between a Create and the drone

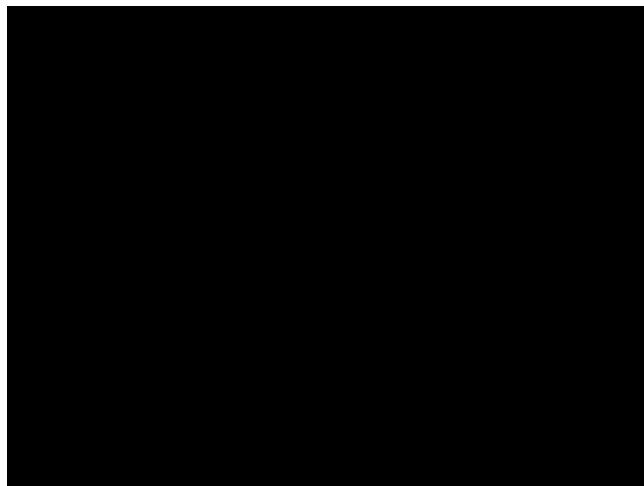Sliding-scale autonomy is crucial, especially in development
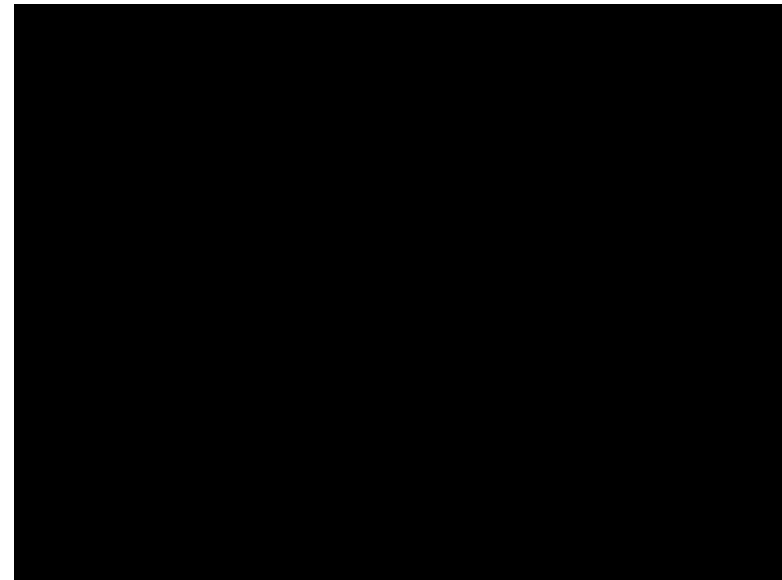
Flying's Advantage

2x speed

Our task: cooperation between a Create and the drone

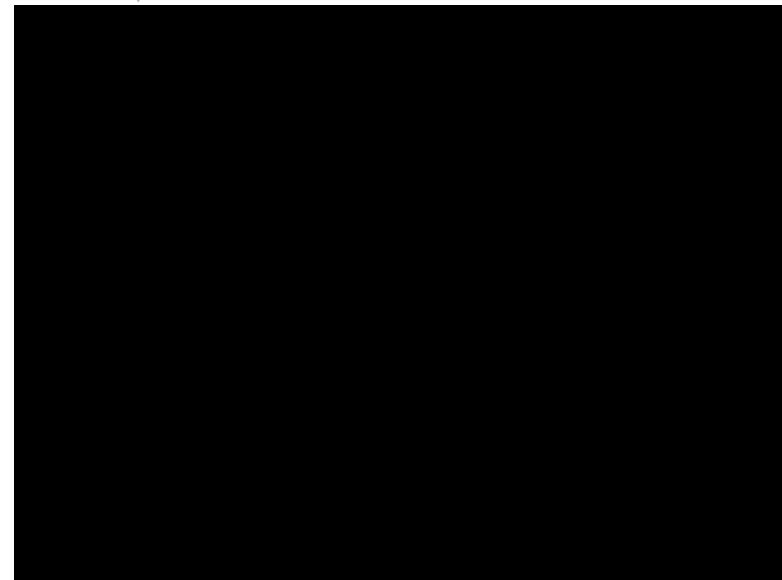Sliding-scale autonomy is crucial, especially in development
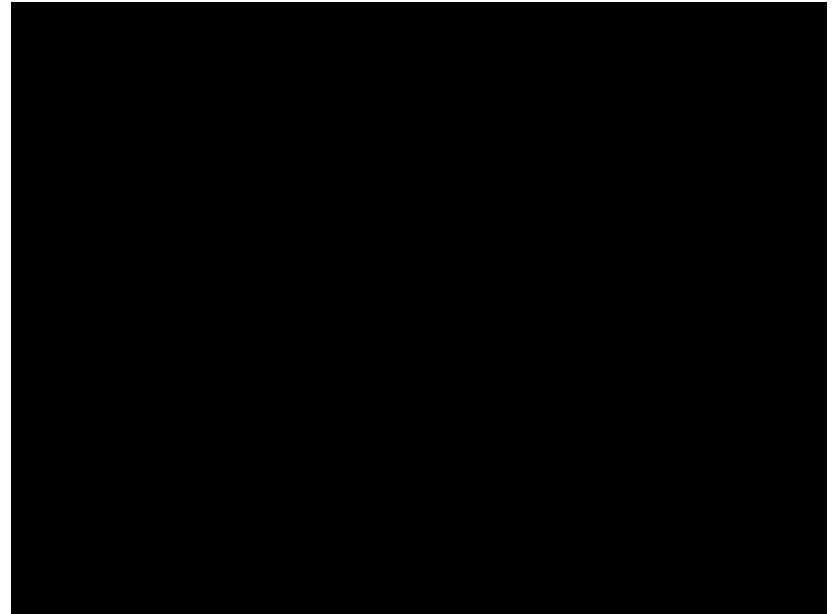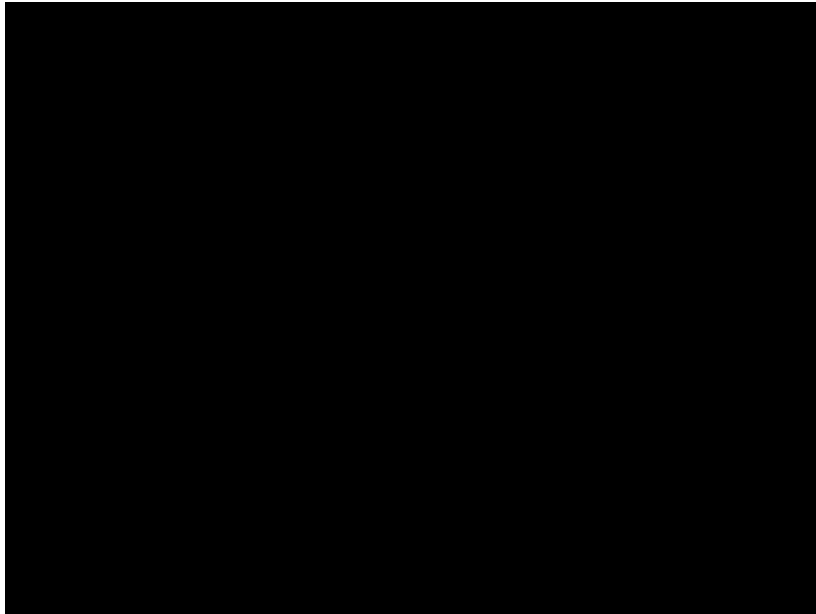
Sensing

original marker

OpenCV + ROS

Vision *required*

In-hand + flight tests

contours

segmentation

Sensing, sensibly!
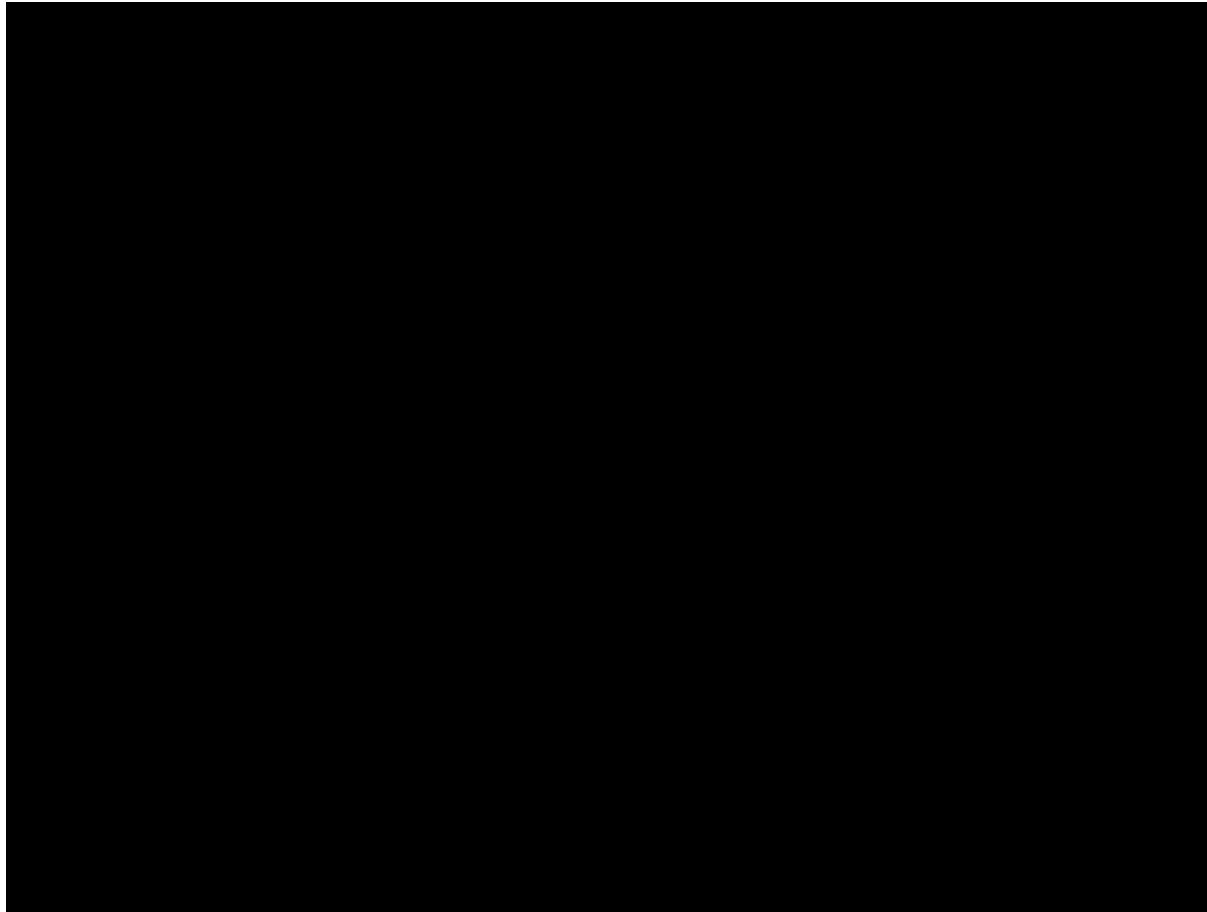
Incorporating April Tags

OpenCV + ROS + *anything*

Vision *required*

In-hand + flight tests

all selling points
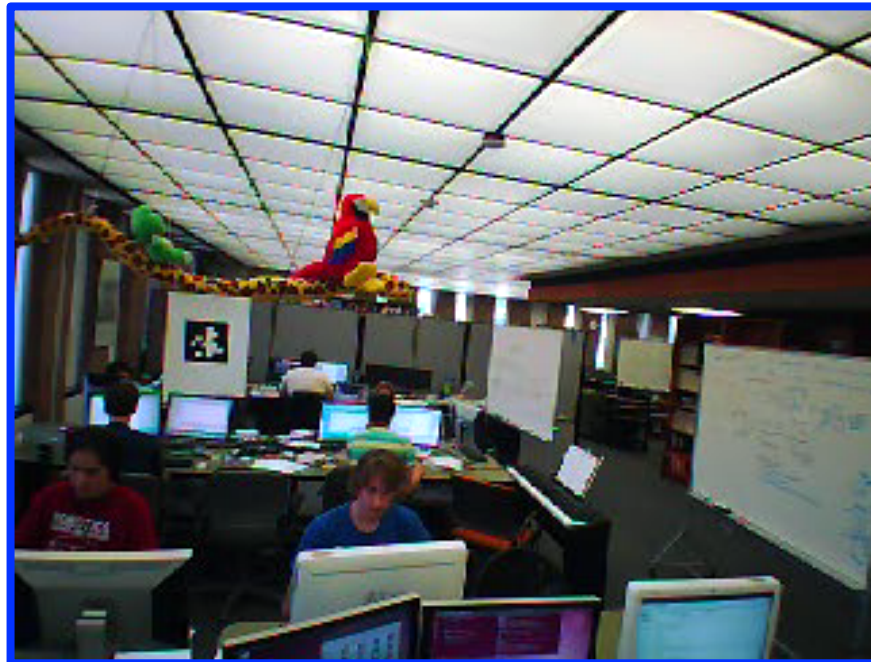
Hula Hopping

2x speed
autonomous sensing +
state-transitions
but human-controlled

task: navigate within a graph of locations
(hula hoops are for visualization)
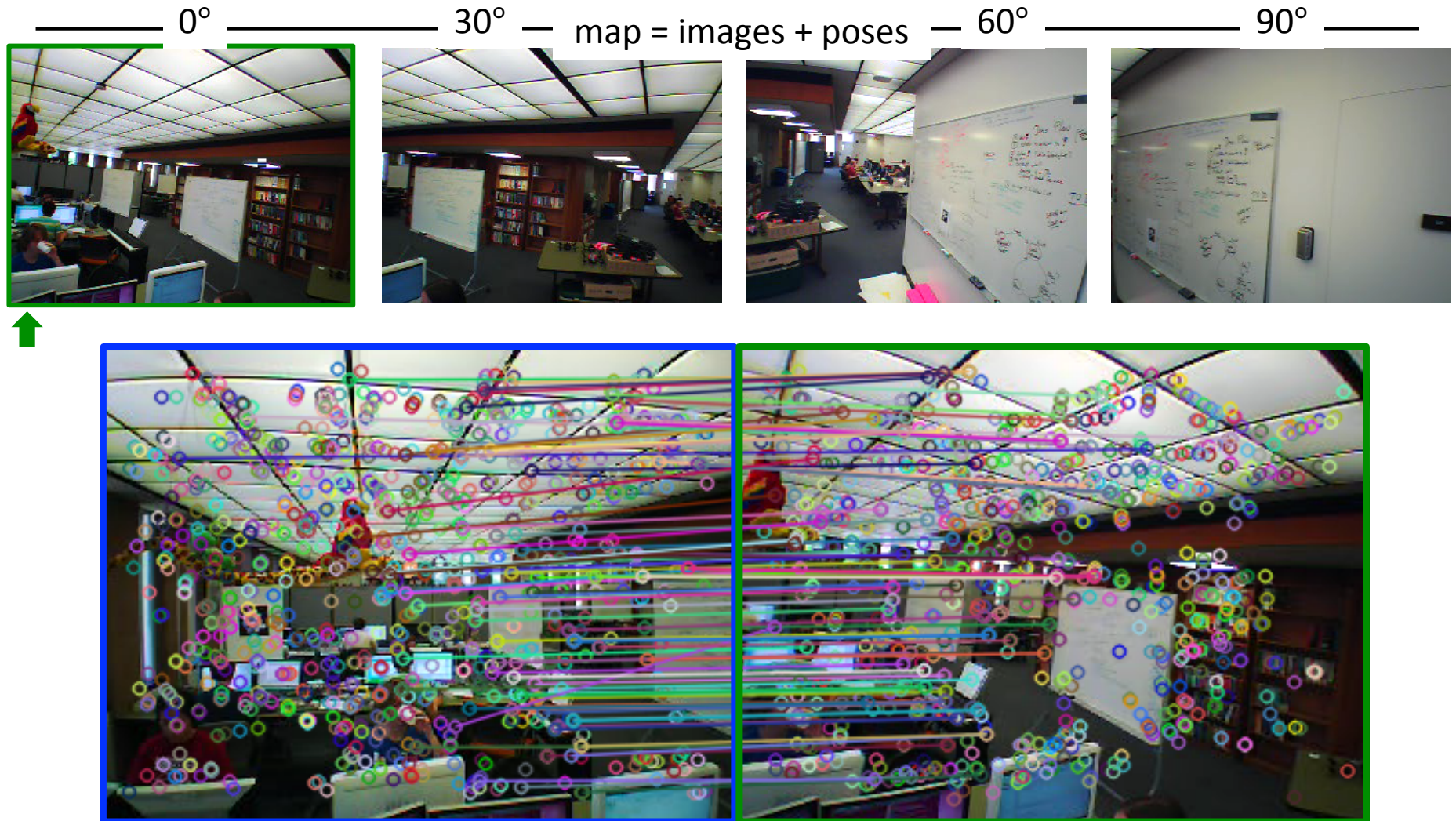
Tagless localization

1. SURF features
2. Nearest Neighbors
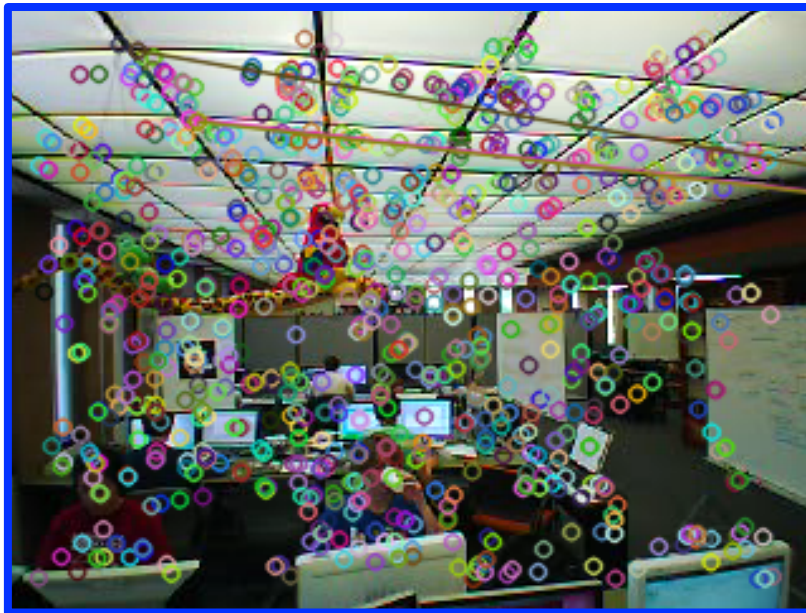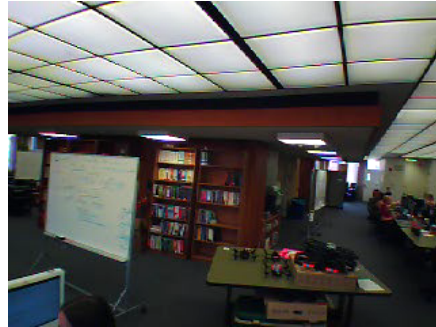3. Score using match number + strength

example test image
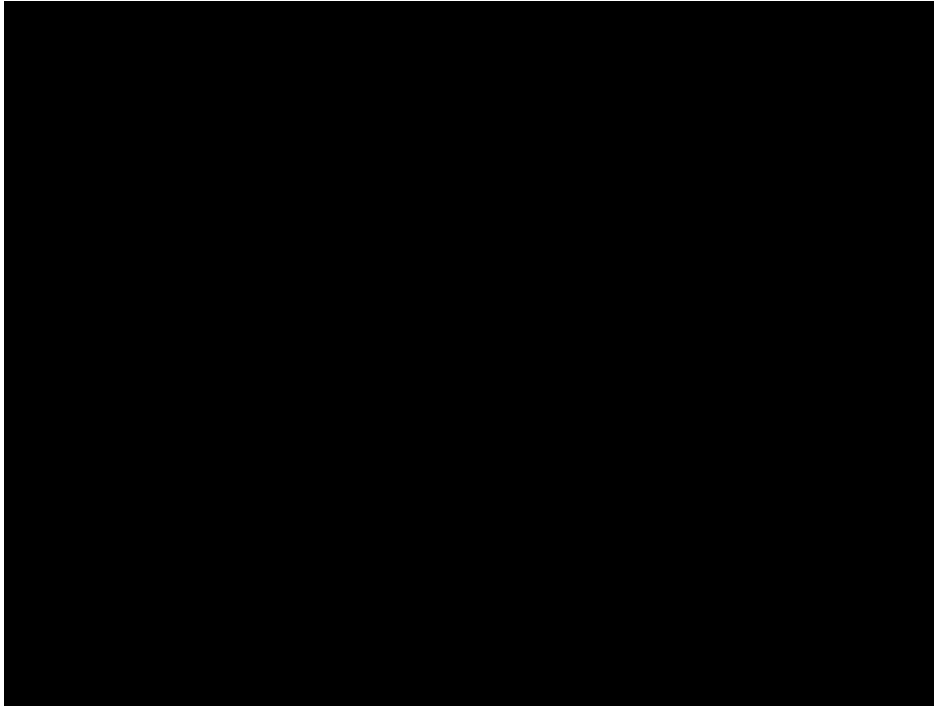
Tagless localization

best match: all features, with lines joining "good" matches
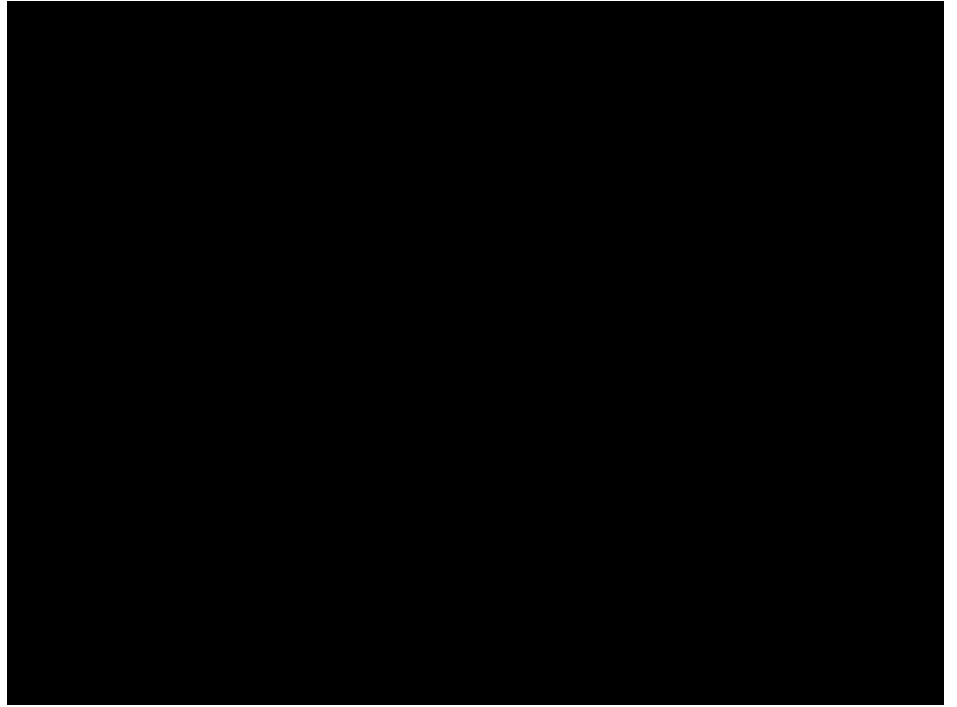
Tagless localization

worst match: all features, with lines joining "good" matches

Ground support

2x speed

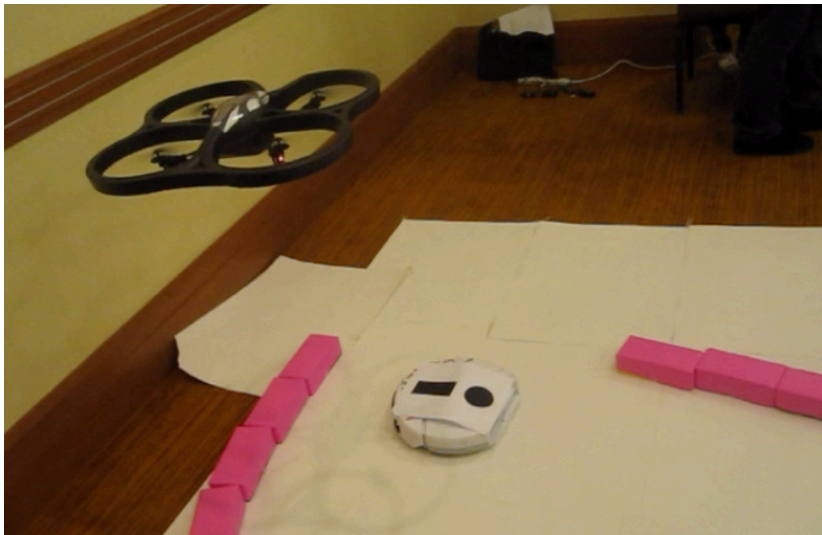4x speed

Alignment and wall-following
using depth images

Pursuing a Roomba using
the RGB image stream

Willow Garage's + Michael Ferguson's *TurtleBot* platform

Verdicts?

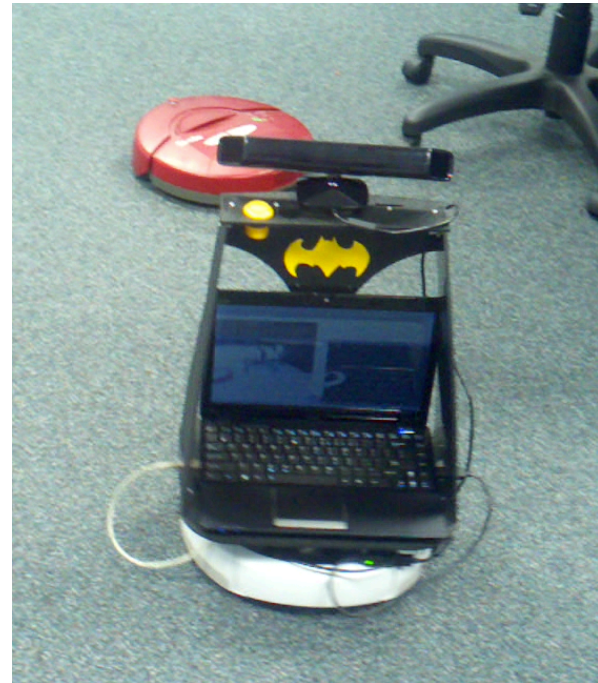**_Yes_** to the drone...

but with **_constrained_** expectations for control

YES to ROS...

in a **_first-year_** lab course? We'll see.