



Sony's Aibo

Dual-Coding

Robotics Seminar CSI445/660
Spring 2009, MW 4:15-5:35
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Administrative

- HW3 due today
- No HW4, just a recommended exercise!
- Midterm on Monday
- Give me your MAC address



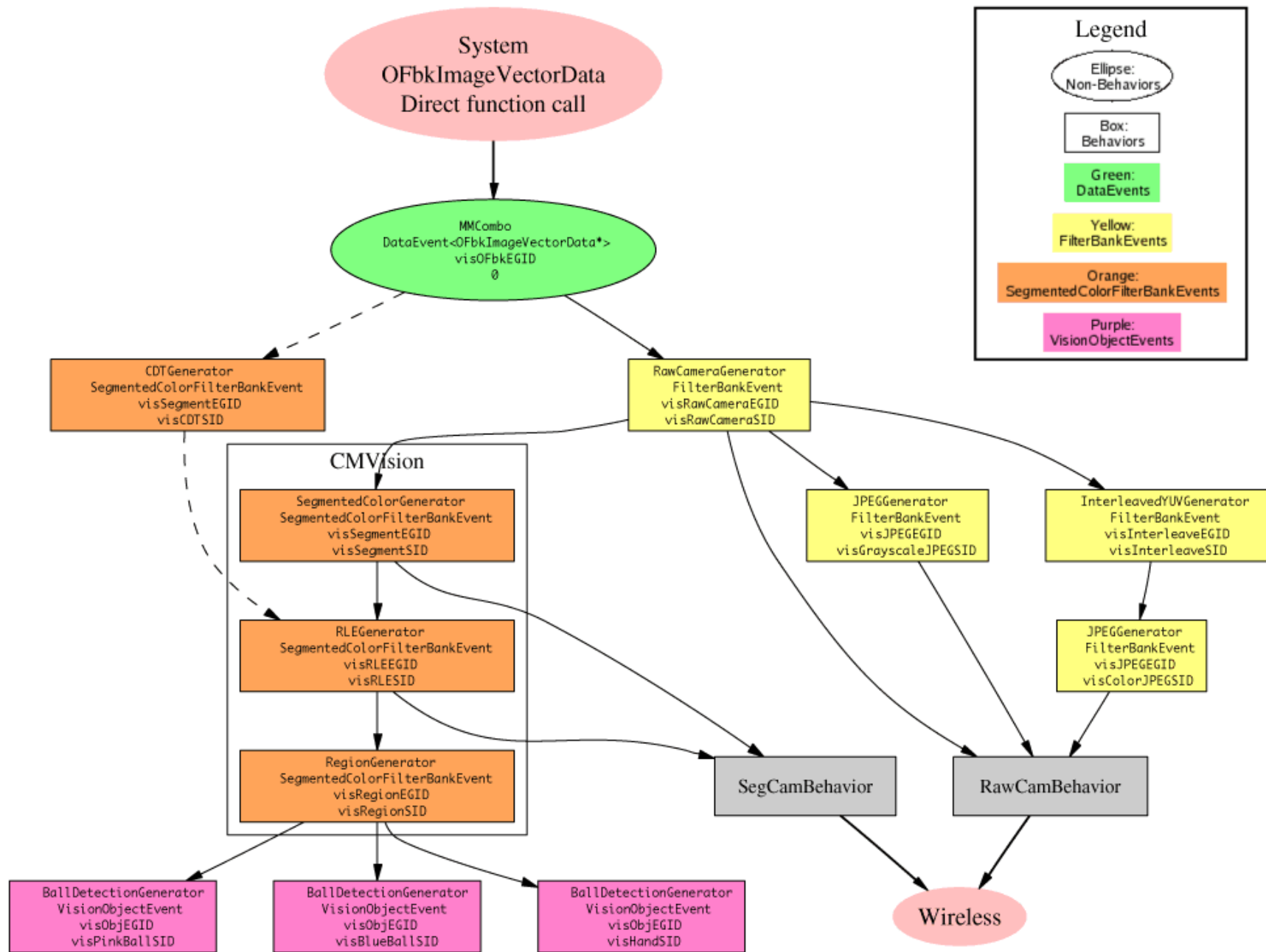
Overview of Today

- Review Vision Pipeline
- Basics of Sketches, Shapes
- Tekkotsu Summary



Vision Pipeline

- Segment image into usable colors (we already did this part)
- Find objects that are usable
 - Under traditional architecture we use vision event generators, such as ball detection generators.
 - Under Dual-Coding, we use sketches and shapes.
- Do something with what was seen (in your behavior or FSM)





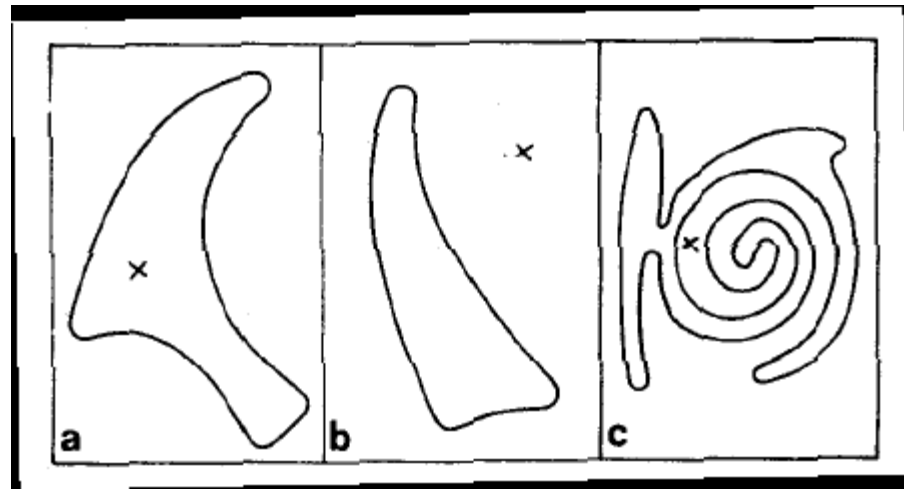
Detection Generators

- Subclass of EventGeneratorBase
- Listen for specific visObjEvent(s)
- Run some math, to find things they like
- Create a new event and send it out:
 erouter->postEvent(VisionObjectEvent)
- Standard ones like *BallDetectionGenerator*, but we can create new ones
- Generators post events of type visObjEvent, but use different sourceIDs



Advanced Visual Processing

- Cognitive Vision: how does the mind do it?
- Is the X inside the loop or not?



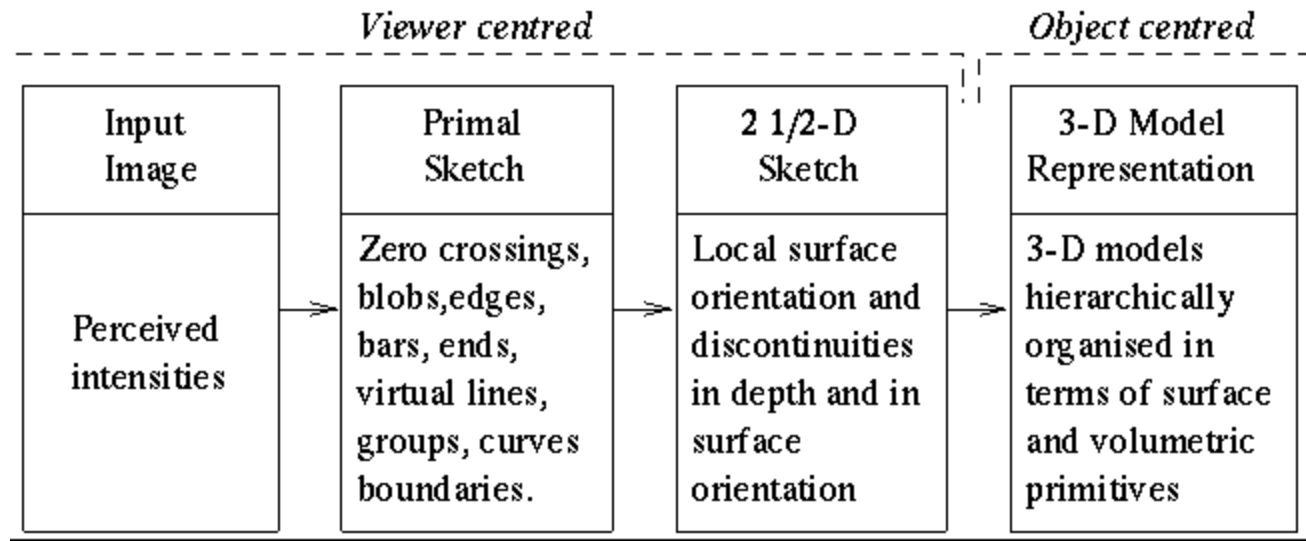


Visual Routines (Ullman 1984)

- Set of composable operators
- Wired into our brains
- Operate on “base representations” to create “incremental representations”
- For us, base representations = color (intensity)
- Can also operate on incremental representations



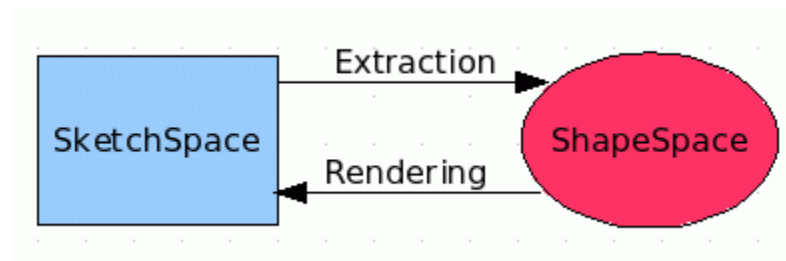
Without too much theory...





Dual Coding

- Tekkotsu uses dual coding.
- Generally we go cam->sketch->shape





Sketches

- Pixel-based implementation
- Templated Class
 - uchar can hold a segmented view
 - bool yes/no pixel has property X
 - int useful for area/neighbor count
- Sketches live in a sketch space: camSks



Creating new sketches

- Use macro
 NEW_SKETCH(name, type, value)
- Example:
 NEW_SKETCH(camFrame, uchar,
 sketchFromSeg())
-
-



VisualRoutinesBase

- Subclass of behaviorBase
- This allows you to view output with sketch viewer
- An example now (and how to simulate!)



Common visops::

- Colormask
- Edge
- skel
- sreaCC
- max



A few fun exercises

- Find the green letter:

X X X X X X X X X X X
X X X X X X X X X X X
X X X X X X X X X X X
X X X X X X X X X X X



A few fun exercises

- Find the O:

X X X X X X X X X X X
X X X X X X X X X X X
X X X X O X X X X X X
X X X X X X X X X X X



A few fun exercises

- Find the green O:

X X O X X X X X O X X
X O X X X X X O X X X
X X X X O O X X X X X
X O X X X X X X X X X

- What does this tell us about our visual routines?



Shapes

- Basic Shapes: PointData, LineData, EllipseData
- Complex: BlobData, PolygonData
- Most are returned as vectors of shapes
- `NEW_SHAPEVEC(name, class, data)`



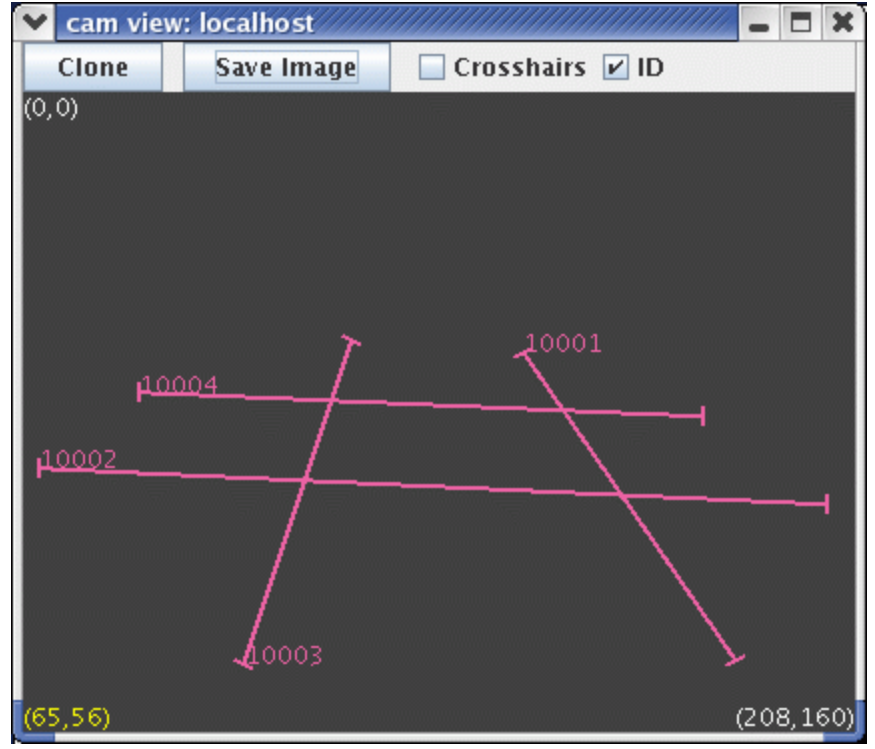
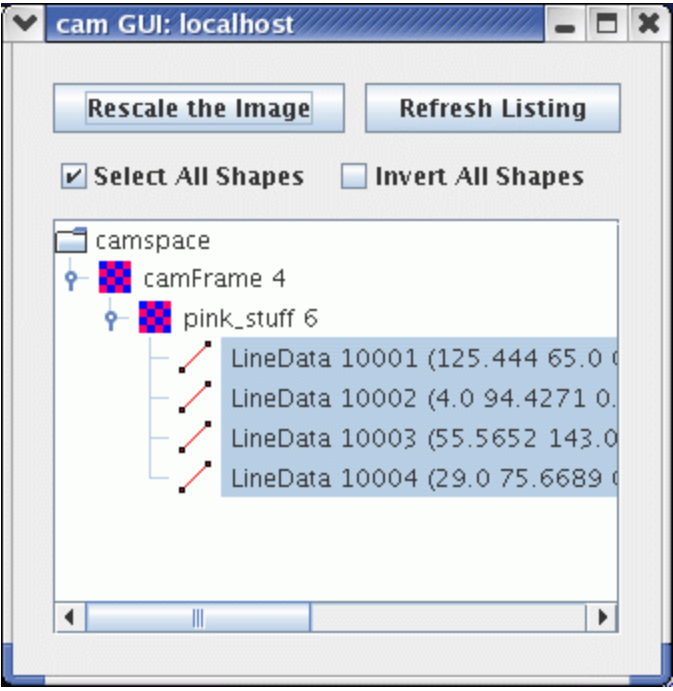
Example

```
void DoStart(){  
    NEW_SKETCH(camFrame, uchar, sketchFromSeg());  
    NEW_SKETCH(pink_stuff, bool,  
        visops::colormask(camFrame,"pink"));  
    NEW_SHAPEVEC(lines, LineData,  
        LineData::extractLines(pink_stuff));  
}
```





Example: Results





Other things Shapes can do

- End points of lines
- What is above, below a line
- Follow a line (solve mazes?)



Tekkotsu Summary

- **2 ways to create behaviors:**
 - Behaviors – using event router
 - FSM – abstraction of nodes+transitions
- **2 ways to do vision (both use segmenting)**
 - Detection Generators
 - Dual Coding Shapes/Sketches



PROJECT IDEAS!!!!!!1!!!!ONE!