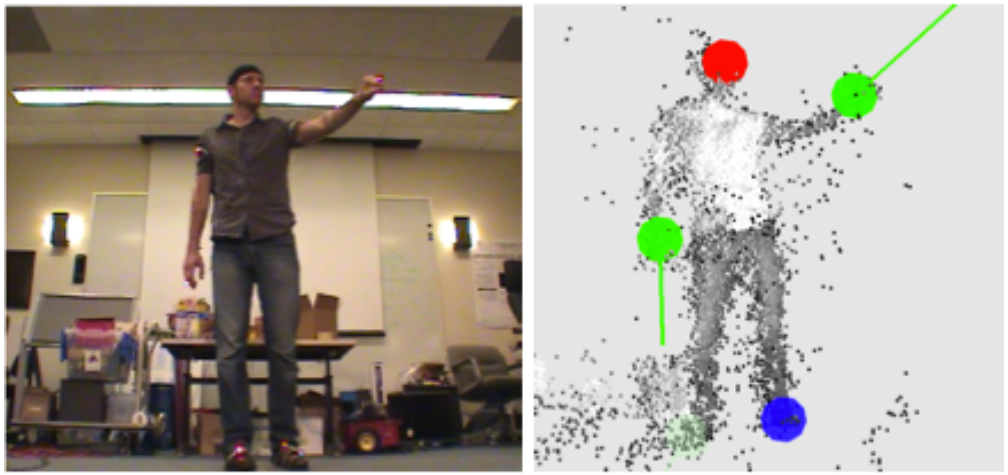
Real-time Identification and Localization of Body Parts from Depth Images

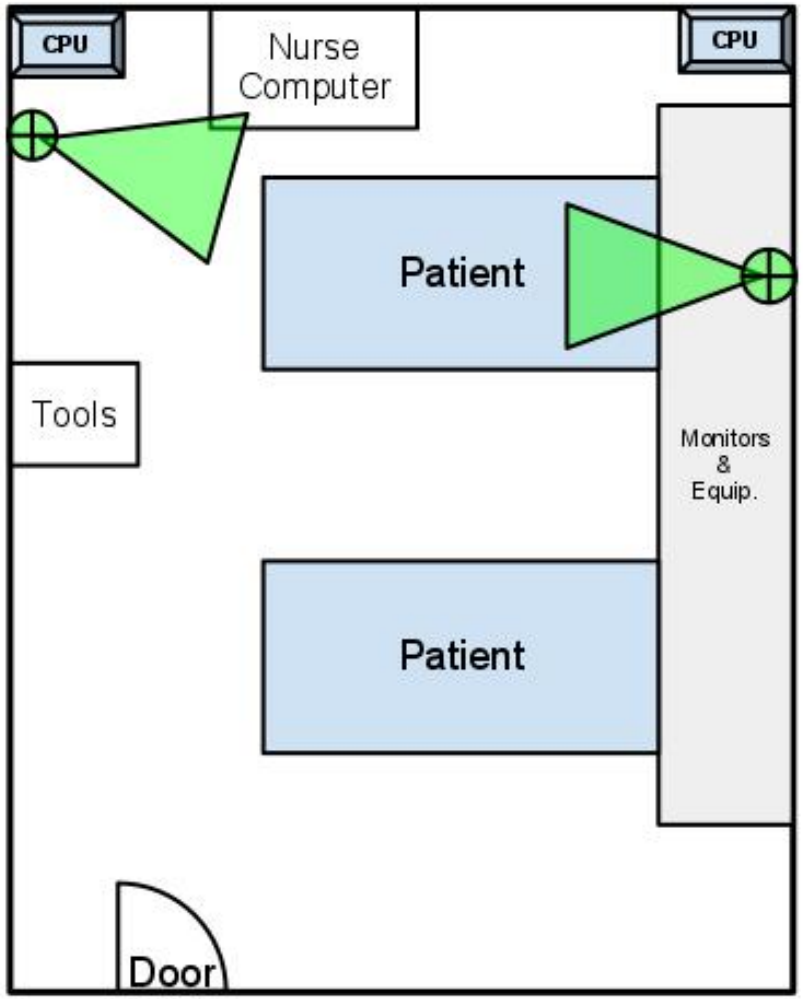


Journal Club – 3/26/2012

Colin Lea

C. Plagemann, V. Ganapathi, D. Koller, S. Thrun. “Real-time Identification and Localization of Body Parts from Depth Images.” ICRA 2010.

Motivation: AWARE@ICU

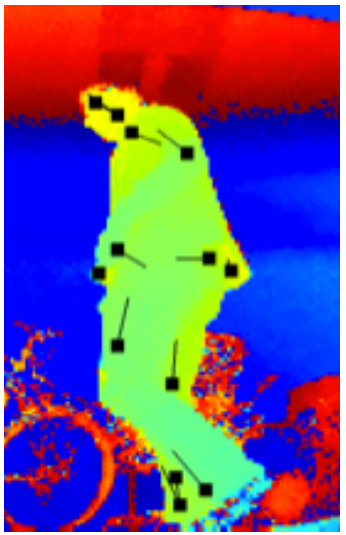


(+) = location :: skeleton = joints positions :: green = correct :: red = wrong

Methods

- Novel interest point detector
- Multi-class boosting classification

1) Construct a set of connected surfaces meshes from the point cloud
2) Identify interest points on each of these meshes
3) Extract local descriptors for the interest points
4) Classify the descriptors to body part classes
5) Sort patches by classifier confidence



Accumulative Geodesic EXtrema (AGEX)

Algorithm:

1. Find mesh centroid (Vc)

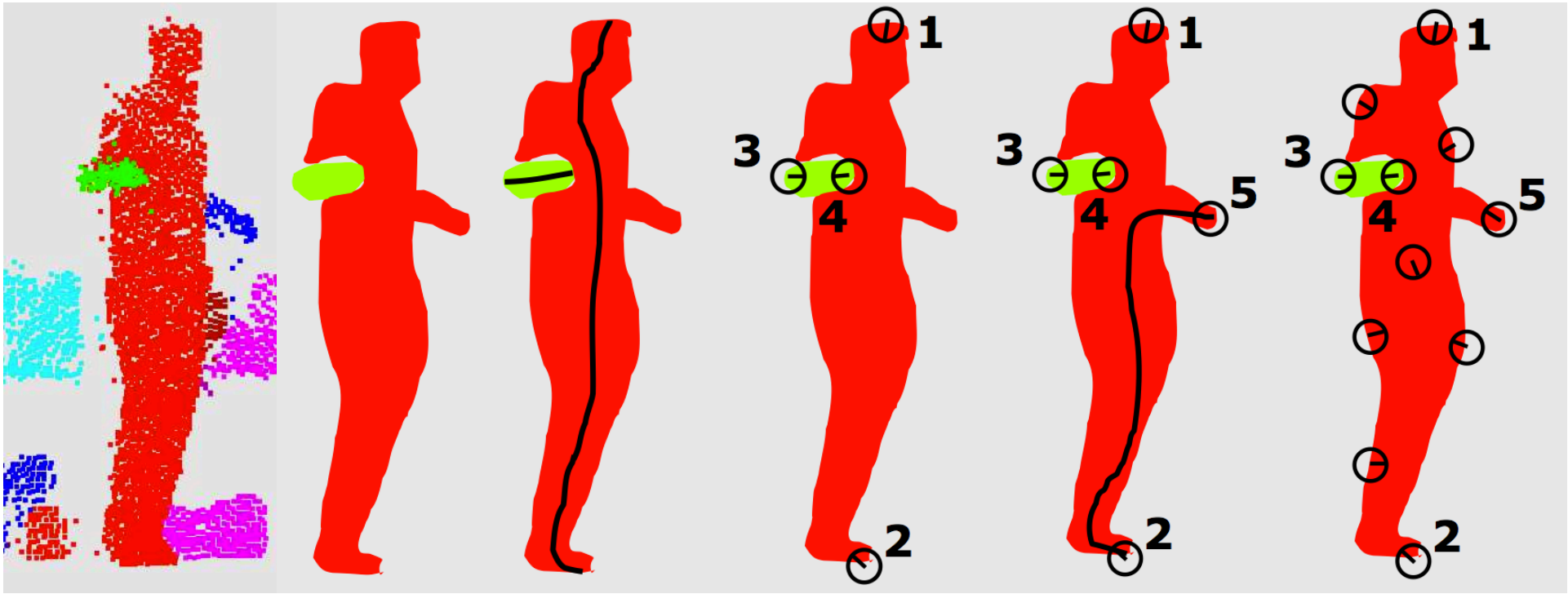
Repeat

2. Find shortest path for each point to Vc
3. Choose longest path, label as Vs
4. Set the edge of Vs -> Vc as zero

Invariance:

– Mesh deformations, translations, rotations, noise

Example

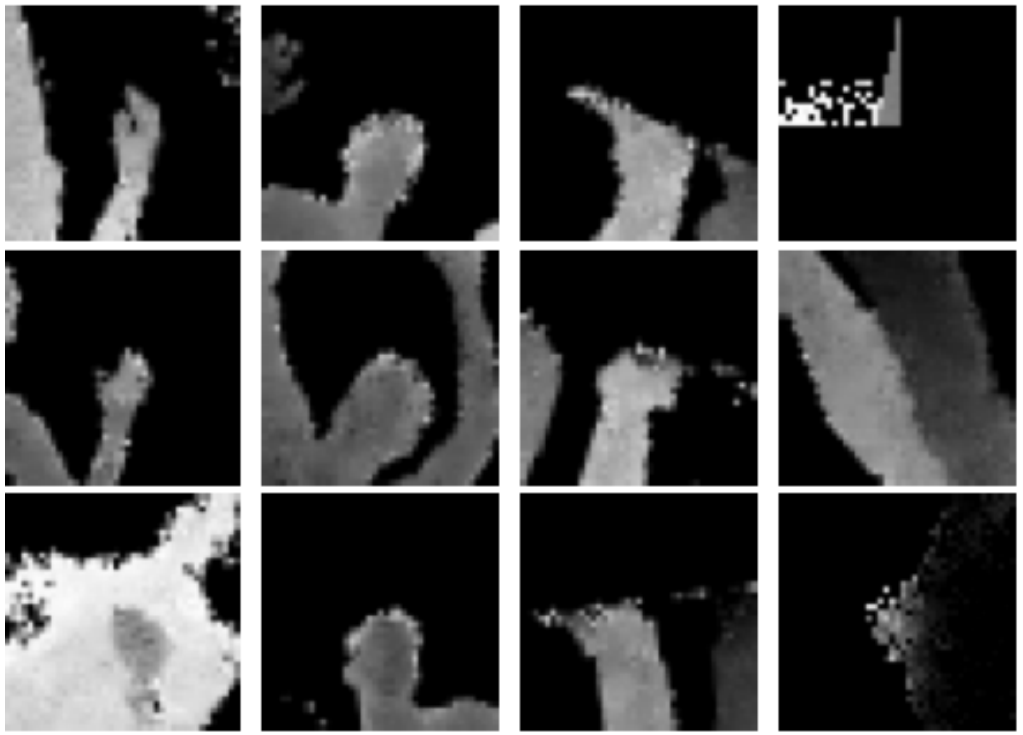


Feature window

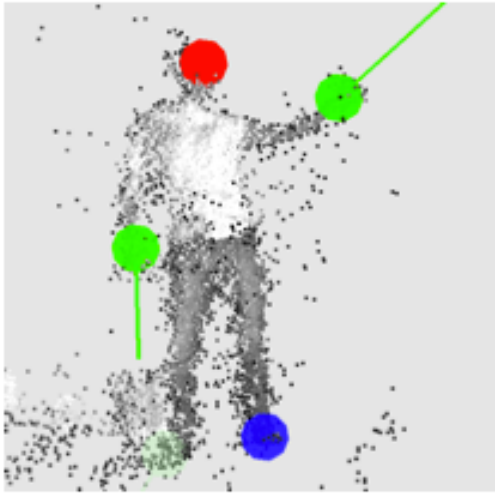
Pose: Trace shortest path

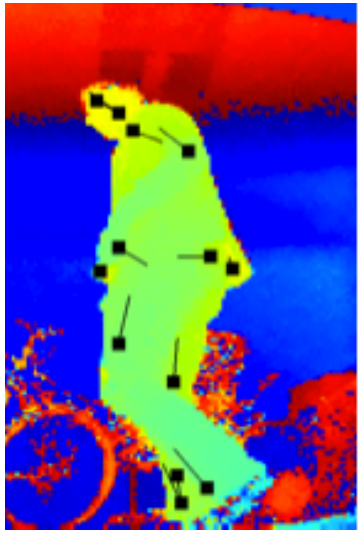
Classification:

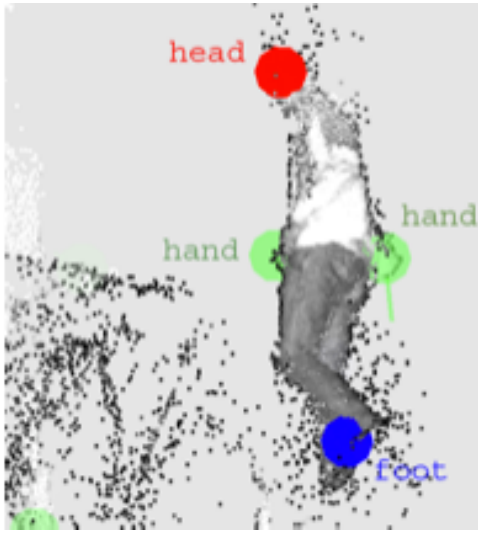
- Haar classifier
- Multi-class boosting

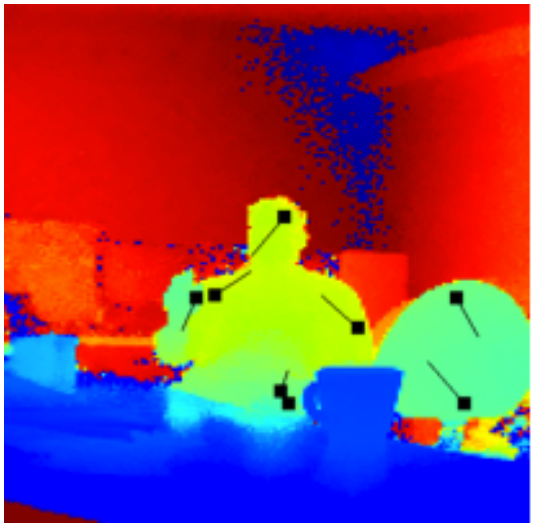


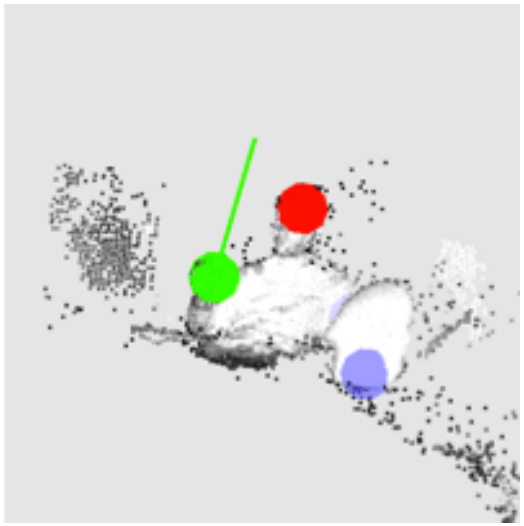
Examples



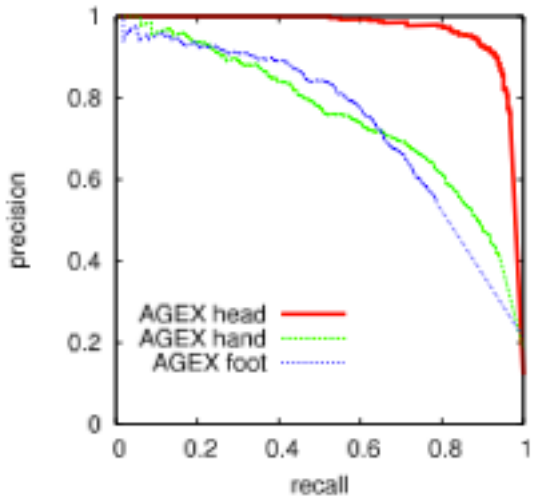


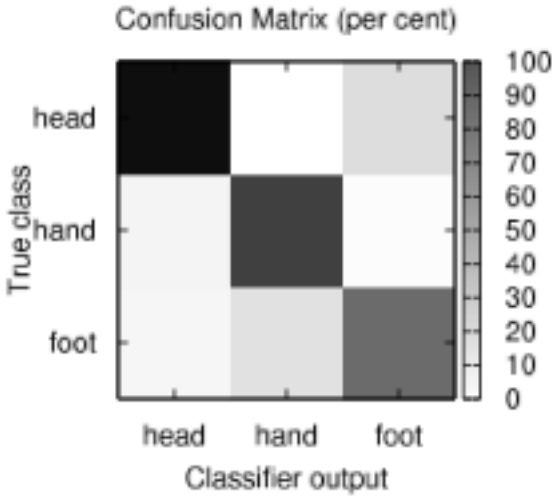


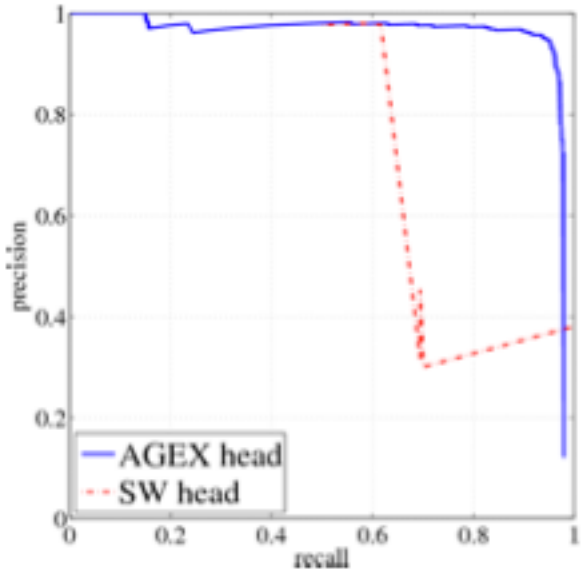


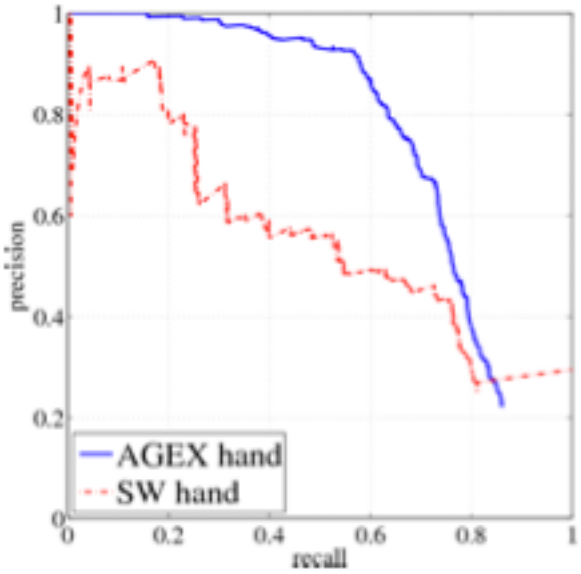


Results


precision
recall
AGEX head
AGEX hand
AGEX foot


Confusion Matrix (per cent)
True class
head
hand
foot
Classifier output
100
90
80
70
60
50
40
30
20
10
0


precision
recall
AGEX head
SW head


precision
recall
AGEX hand
SW hand

Additional Material

Paper slides:

http://stanford.edu/~plagem/publ/icra10/ICRA10_slides.pdf

Video:

http://stanford.edu/~plagem/publ/icra10/