

## **Automated Workflow and Activity Recognition at the Pediatric Intensive Care Unit**

Computer Integrated Surgery II - Spring 2012

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### **Accomplishments**

All work on this project was done by Colin with advice from mentors Dr. Jim Fackler, Dr. Greg Hager, and Dr. Russ Taylor. The following is a list of software modules and activities done.

**IRB** - We obtained approval to do the study in the pediatric ICU

**Recorder** - A dynamic frame rate Kinect recorder was written using C++ with the OpenNI device drivers to capture depth and color footage.

**Data collection** - We recorded two sets of data at the Pediatric ICU. The first one was done as an "improvement study" without IRB approval. This means that the data is not publishable. After getting IRB approval we collected data once.

#### **Derived data**

The following modules were used as the basis of our activity recognition. All code is written in Python.

- *Person segmentation* - Two methods of background subtraction were explored. The first was using a nonparametric spectral clustering method and the second using simple background subtraction.
- *Person tracker* - a module to track the individual segments was created.
- *Summary statistics* - Features gathered from the tracked people include the arc-length of their path through time, the average velocity, and average center of mass.
- *Orientation histogram* - I found that using Principal Components Analysis on the segments gives an estimate of a person's orientation. I calculate the histogram of one of these orientation vectors to use as a feature
- *Interaction angles* - Using the orientations I look at the correlation between the different people in the room. The rationale is that you can tell if people are interacting based on if they are looking at each other.

#### **Activity recognition**

We explored different manifold techniques for data exploration and use Support Vector Machines and Decision Forests for classification.