



Objectives

1. Create a system to monitor room usage intensity, primarily focusing on student kitchens.
2. The system needs to be cheap and easy to install and maintain.
3. The system should provide real-time information about room usage intensity.

Introduction ??

- ▶ The Linköping University IT department wants to be able to measure room usage intensity, primarily the student kitchens, but also other spaces. In order enable informed decisions to be made on where to invest in e.g. a new kitchen

The system

- ▶ Hardware setup.
 - ▷ Stuff about the setup.
- ▶ Portability.
 - ▷ Stuff about supported sensors and platforms.
- ▶ Performance requirements.
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 - ▷ Walla.

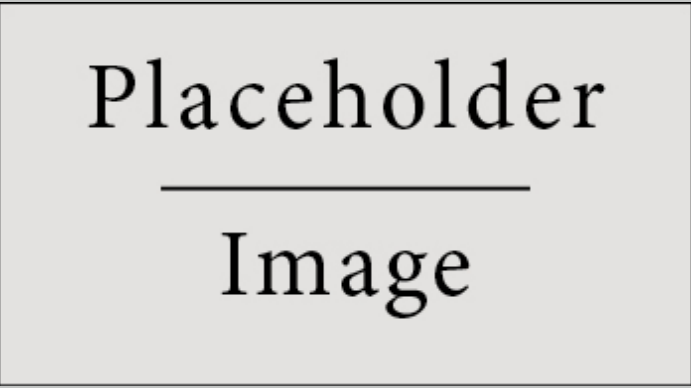


Figure 1: Figure caption

Software

- ▶ The software pipeline
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- ▶ Configuration
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Image Processing

- ▶ The depth images.
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- $$X \rightarrow r(X) = \arg \max_c \left\{ \max_n \left\{ \sum_{x_i \in X} \delta(x_i, Y_{n,c}) \right\} \right\}$$
- ▷ Cras faucibus scelerisque cursus. Proin ut vestibulum augue. $\delta(x_i, Y_{n,c})$
 - ▶ Tracking and counting.
 - ▷ The tracker pairs objects with each other from previous frame to the next. Pairs closest matching objects. Handles occlution, outliers and noise.
 - ▷ Counting is done using user specified checkpoint lines and a door area.
 - ▶ Queue detection.
 - ▷ detecting queues

Results: Table

- ▶ Final system performance

$$A_{in} = 1 - \left| \frac{\sum_{frames} in_{Est} - \sum_{frames} in_{GT}}{\sum_{frames} in_{GT}} \right| \quad (1)$$

$$A_{out} = 1 - \left| \frac{\sum_{frames} out_{Est} - \sum_{frames} out_{GT}}{\sum_{frames} out_{GT}} \right| \quad (2)$$

Sequence Name	Total entered (GT)	A_{in}	Total exited (GT)	A_{out}
Data seq. 1	108 (108) people	99 %	101 (104) people	97 %
Data seq. 2	122 (141) people	87 %	77 (91) people	85 %

Table 1: System performance in the two evaluation sequences

- ▶ Data seq. 1 & Data seq. 2 are two data sequences of 30 minutes each.

Results: Figure

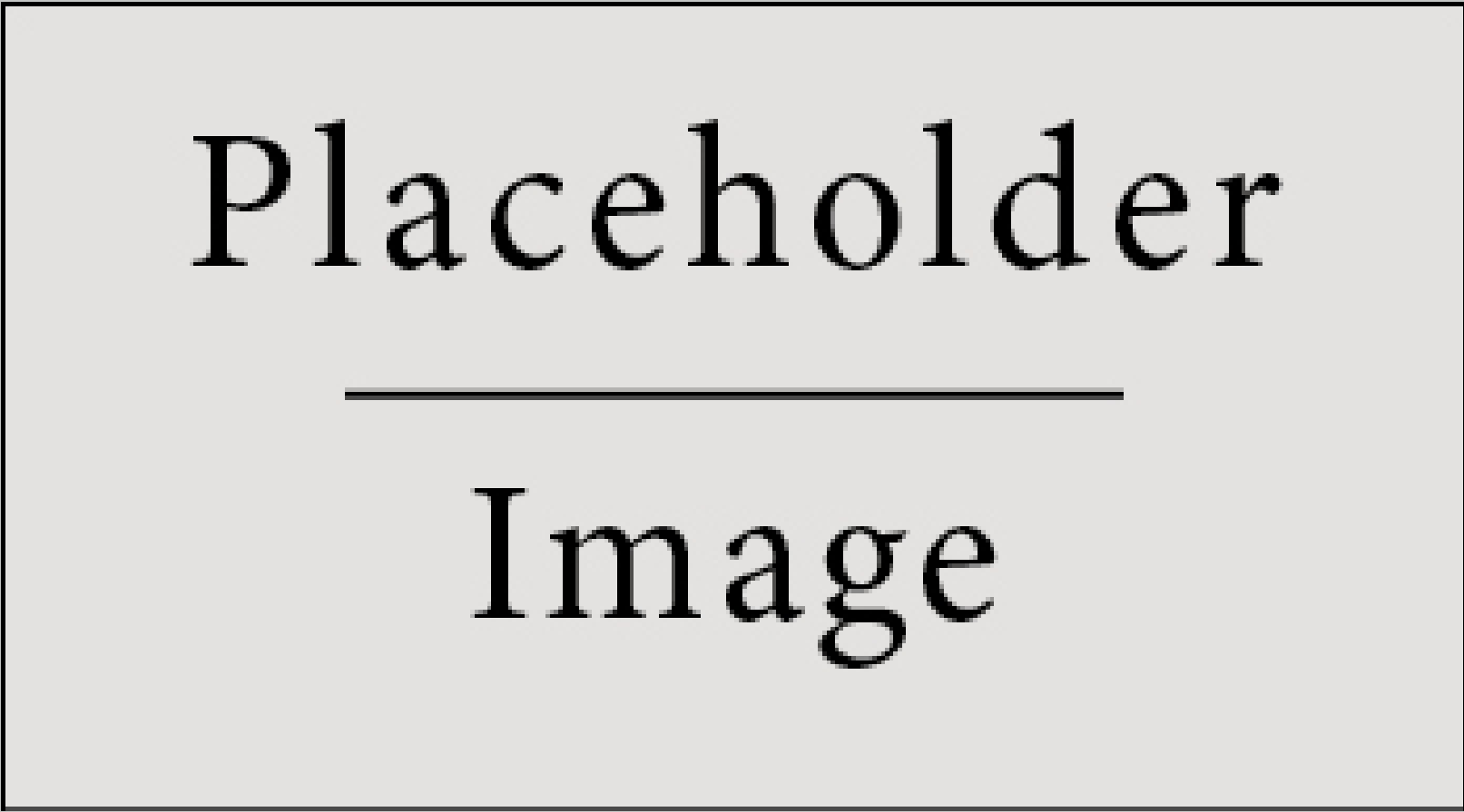


Figure 2: Resulting accuracy

Conclusion

- ▶ The system provides high-precision people counting using the Microsoft Kinect sensors.
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