



INDIANA UNIVERSITY

SCHOOL OF INFORMATICS AND COMPUTING

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Electronic Privacy is getting Physical

Soon we will need to worry much more about our **physical privacy**

Narrative Clip



<http://www.getnarrative.com>

Google Glass



<http://www.google.com/glass>

Vuzix



<http://www.vuzix.com>

Autographer



<http://www.autographer.com>

Gear



<http://www.samsung.com/global/microsite/galaxynote3-gear/>

Soon we will need to worry much more about our **physical privacy**

Narrative Clip

iON SnapCam

Google Glass

Narrative Clip 2

Vuzix

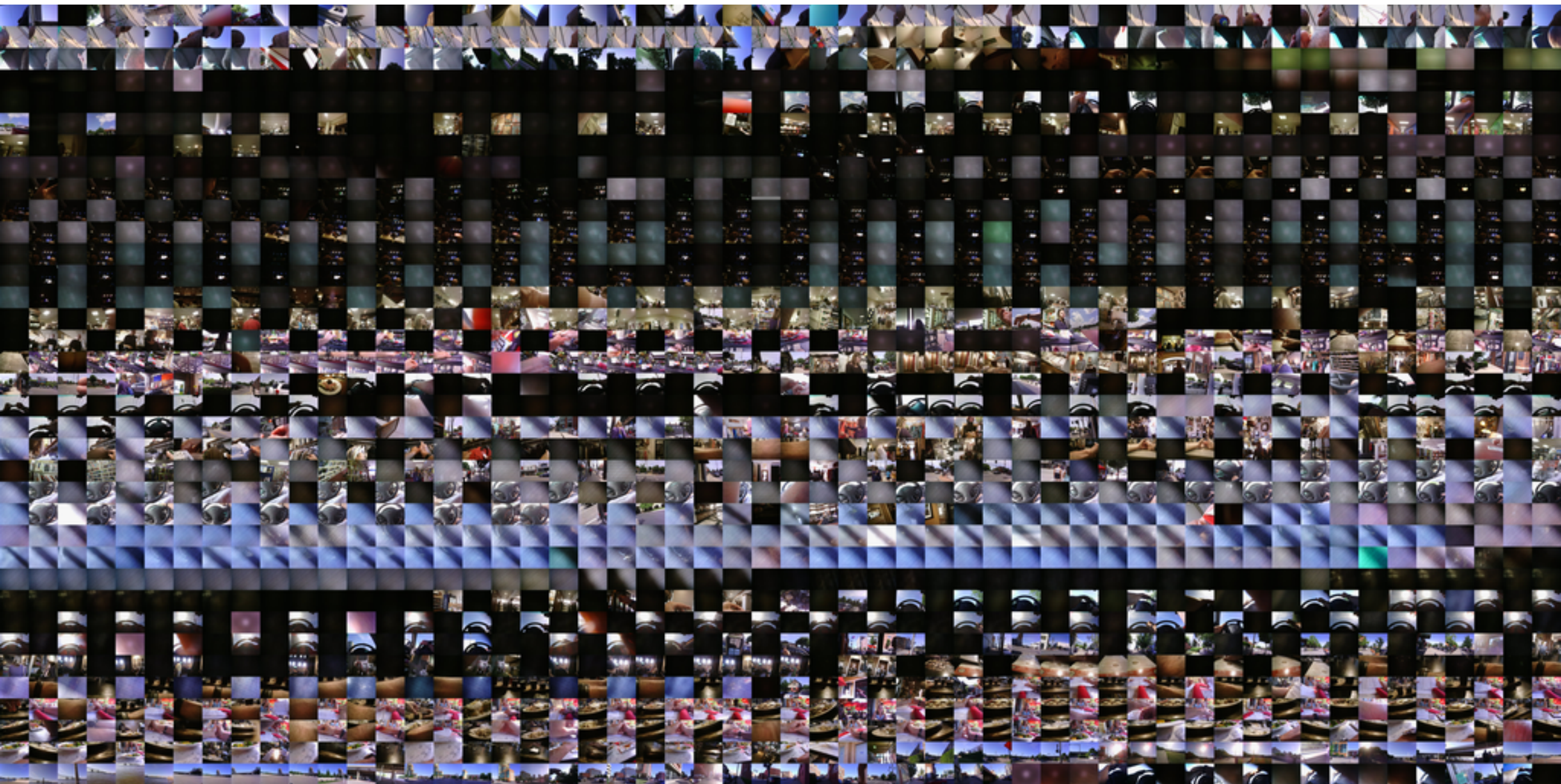


<http://www.vuzix.com>

<http://www.autographer.com>

<http://www.samsung.com/global/microsite/galaxynote3-gear/>

'Tivo'/DVR your life



Meanwhile in 2015



Cameras in GPS units



Phones always listening



Privacy behaviors and preferences of lifeloggers

Roberto Hoyle, Robert Templeman, Steven Armes, Denise Anthony, David Crandall, and Apu Kapadia, "**Privacy Behaviors** of Lifeloggers using Wearable Cameras," To appear in The ACM International Joint Conference on Pervasive and Ubiquitous Computing (**UbiComp '14**)

Roberto Hoyle, Robert Templeman, Denise Anthony, David Crandall, and Apu Kapadia, "Sensitive Lifelogs: A **Privacy Analysis of Photos** from Wearable Cameras," To appear in The ACM SIGCHI Conference on Human Factors in Computing Systems (**CHI '15**)

User Study

Understanding Privacy Behaviors

Lifelogging User study (N = 36)

photos captured every 5 min, 3 days

~15,000 images captured

Research questions

What makes an image 'sensitive'?

How do people share such images?

Privacy-enhancing behaviors?

Bystander reactions/acceptance?



Reasons not to share photos

| | Reason | Responses |
|---|---|-----------|
| | Objects (other than people) in the photo | 30.7% |
| | Where this photo was taken | 22.6% |
| | People within the photo | 18.4% |
| | Participant was in the photo | 11.5% |
| ? | It had private information | 11.5% |
| ? | It would have been embarrassing to share it | 5.4% |
| ! | It would have violated someone else's privacy | 3.8% |
| ? | It was a bad photo | 1.5% |

ScreenAvoider

PlaceAvoider



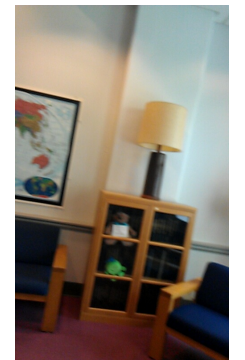
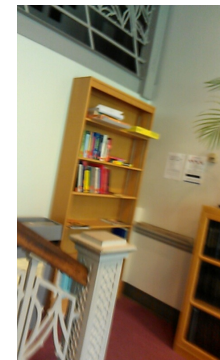
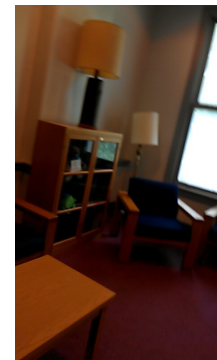
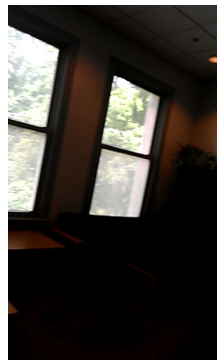
Detecting sensitive spaces with **PlaceAvoider**

Robert Templeman, Mohammed Korayem, David Crandall, and Apu Kapadia,
"PlaceAvoider: Steering First-Person Cameras away from Sensitive Spaces,"
The 21st Annual Network & Distributed System Security Symposium (**NDSS '14**)

Control images dissemination based on scene location

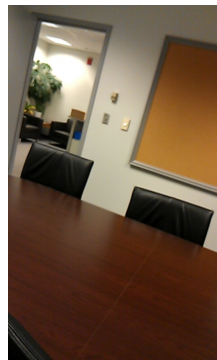
Share

student lounge



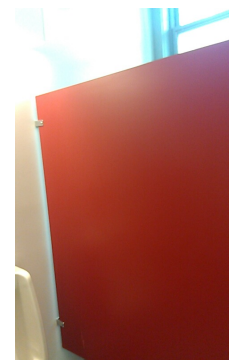
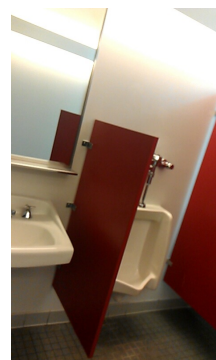
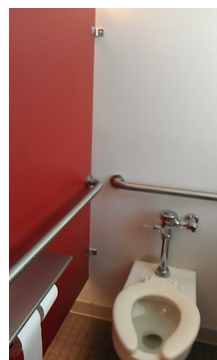
Don't Share

conference room

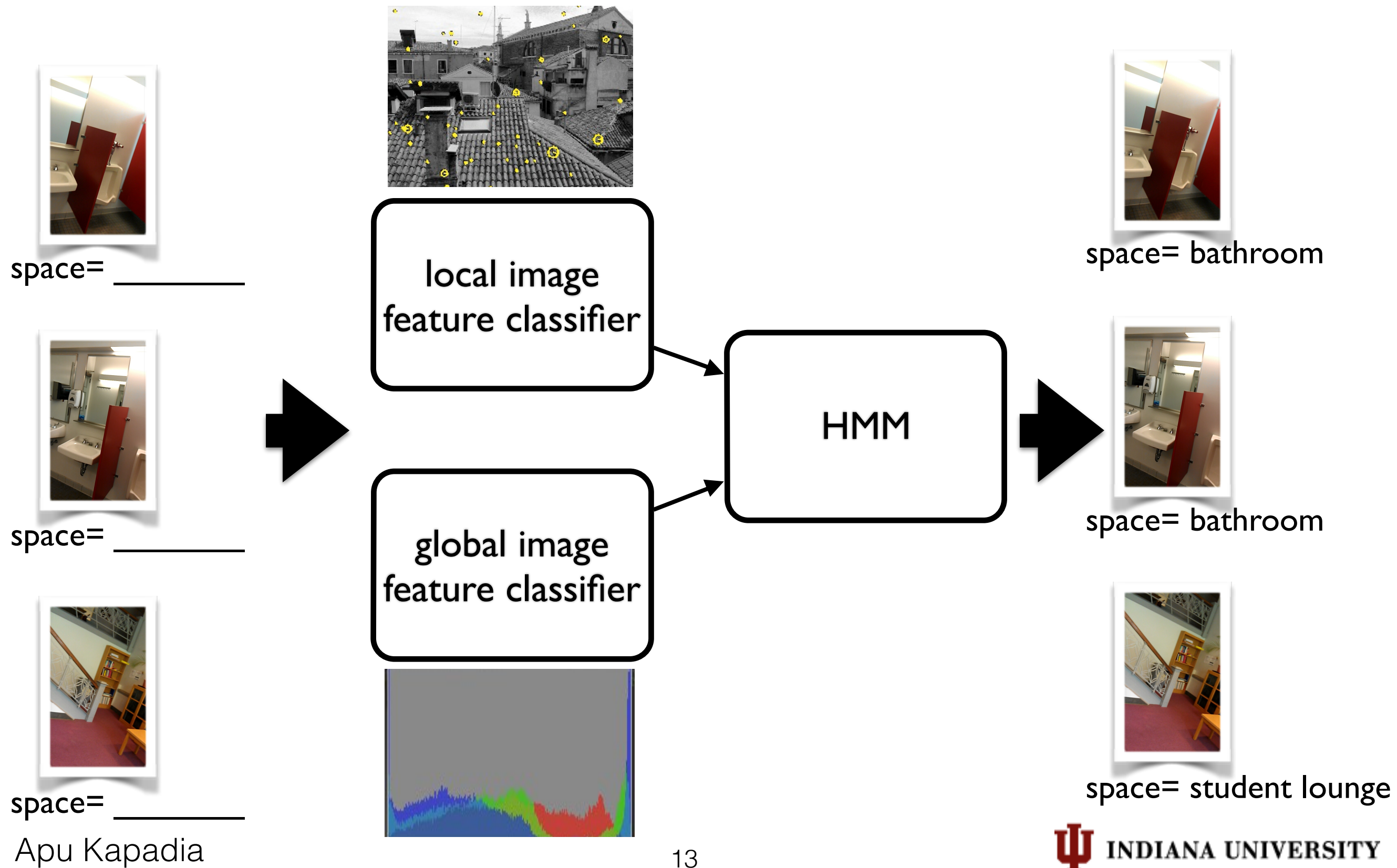


Delete

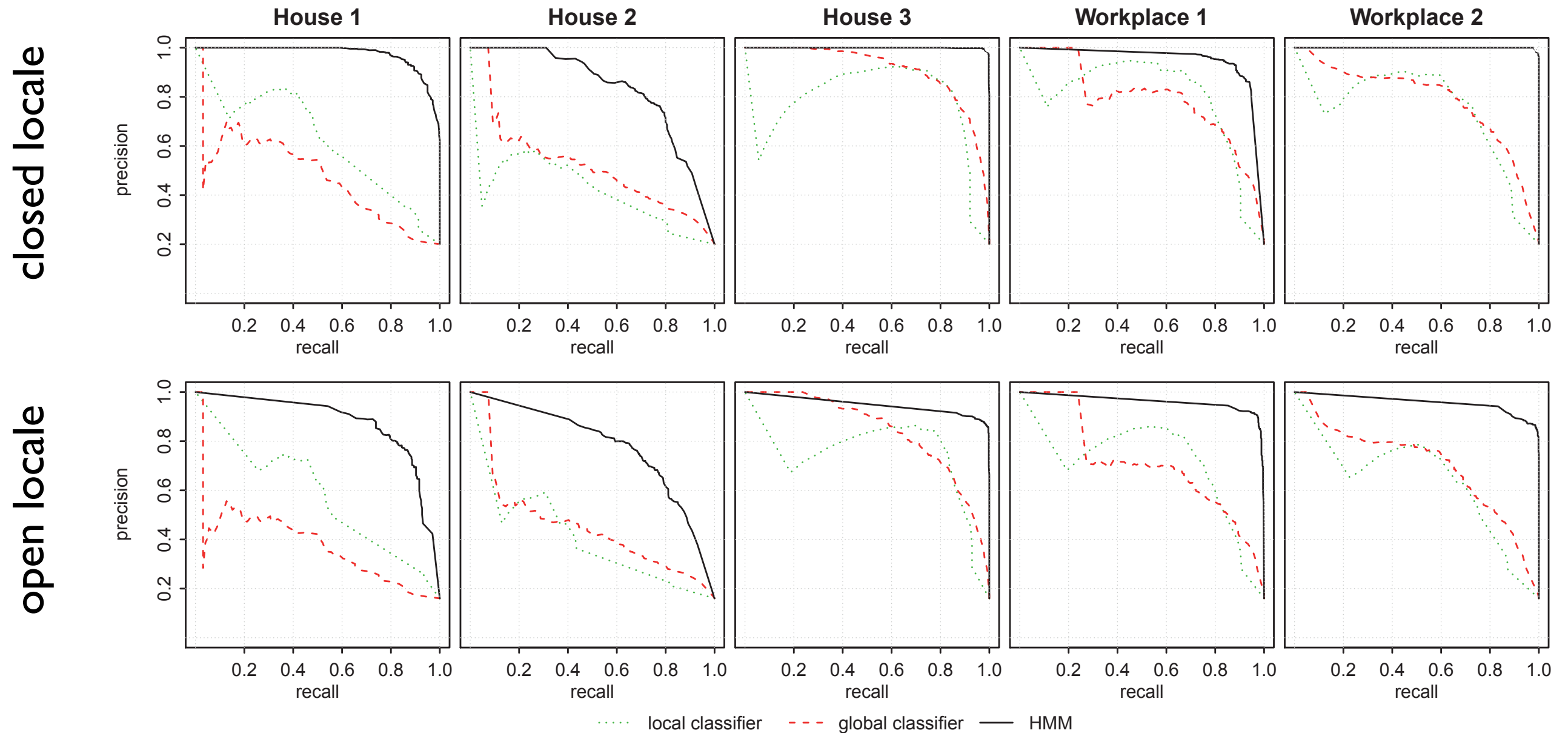
bathroom



PlaceAvoider classifier



PlaceAvoider is effective*, especially for lifelogging applications



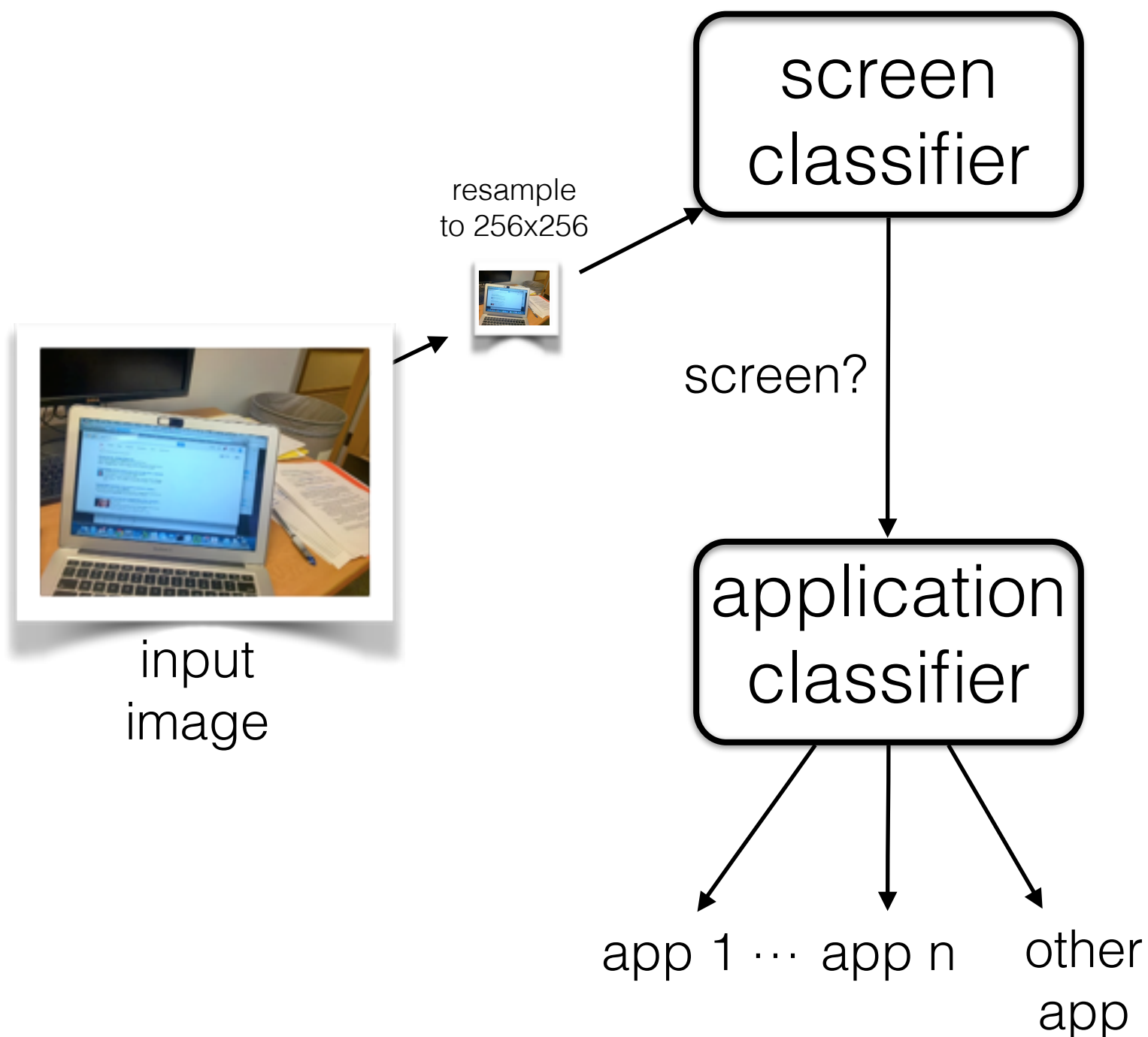
* some conditions may apply ;-)

Detecting screens with...

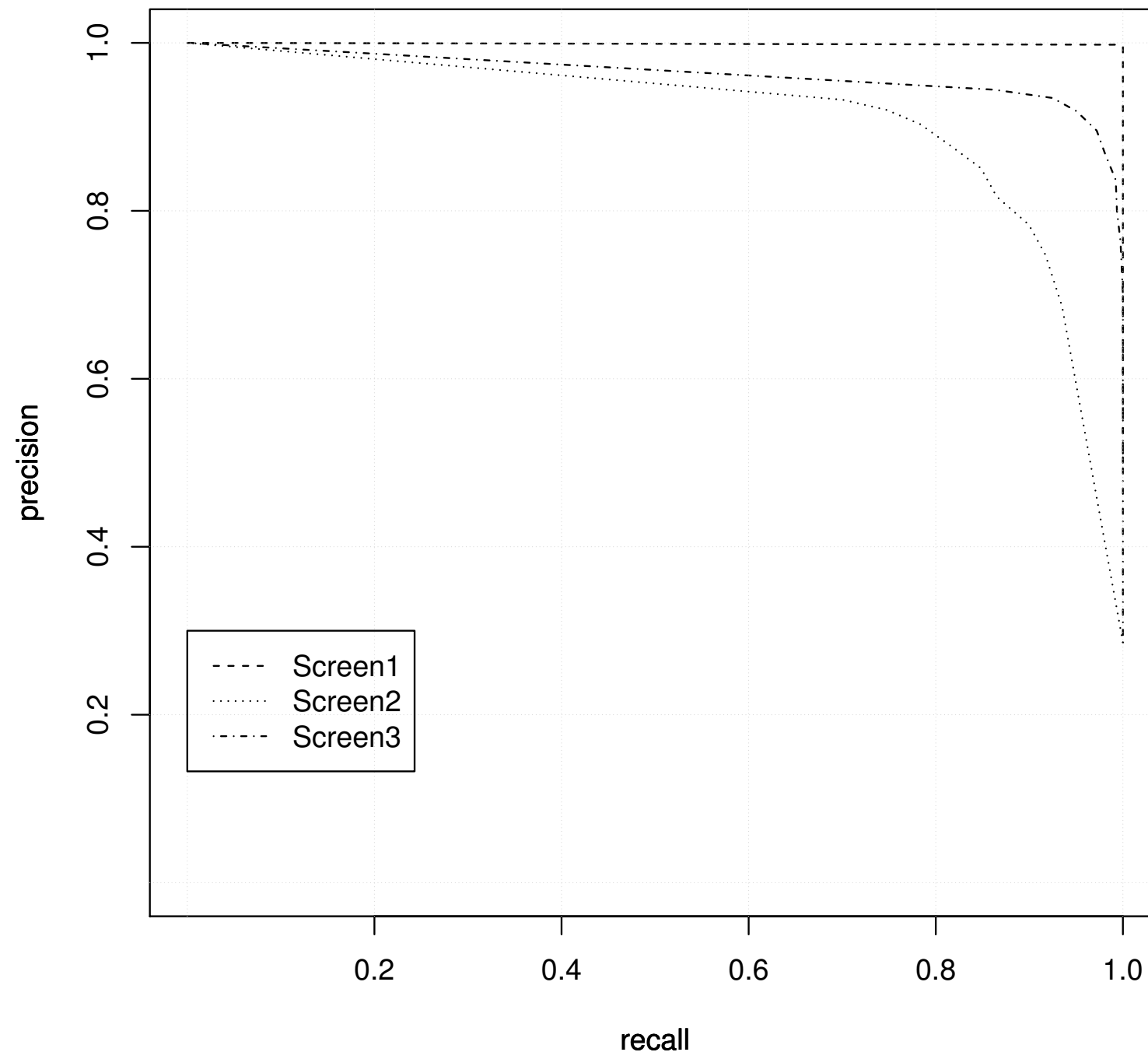
ScreenAvoider

Mohammed Korayem, Robert Templeman, Dennis Chen, David J. Crandall, and Apu Kapadia, "ScreenAvoider: Protecting Computer Screens from Ubiquitous Cameras," CoRR arXiv Technical Report arXiv:1412.0008, November 2014.

Is the screen displaying sensitive content?



Screen detection using Deep Learning



Looking beyond sharing of photos

*Analyze surroundings to **trigger**
privacy and security actions?*

Can we help **visually impaired** people **assess** their privacy?

Tousif Ahmed, Roberto Hoyle, Kay Connelly, David Crandall, and Apu Kapadia,
"Privacy Concerns and Behaviors of **People with Visual Impairments**,"
To appear in The ACM SIGCHI Conference on Human Factors in Computing
Systems (**CHI '15**)

Several unmet privacy needs



Who's around me?



Who's reading my screen?



Can they hear me?



Am I being recorded?

We interviewed 14 people with visual impairments

Research questions

What are the **privacy concerns** of visually impaired people?

How do visually impaired people **manage their privacy**?

Which **new technologies** could offer enhanced privacy for visually impaired users?

Wearable cameras could provide a 'privacy summary' of surroundings

Getting help seen as invasive
(need for independence)

Eavesdropping and shoulder surfing
threats (who's around me?)

Embarrassment (am I talking to a wall?)



Google
Faculty Research Awards



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TWC SBE: Medium: Collaborative: A Socio-Technical Approach to Privacy in a Camera-Rich World

With: David Crandall (IU) and Denise Anthony (Dartmouth)
NSF CNS-1408730, 1407788. \$1.2M

CAREER: Sensible Privacy: Pragmatic Privacy Controls in an Era of Sensor-Enabled Computing

NSF CNS-1252697. \$559K

Privacy-Enhanced Life-Logging with Wearable Cameras

With: David Crandall (IU)
Google Research Award. \$46K

FRSP Type II: Vision for Privacy: Privacy-Aware Crowd Sensing Using Opportunistic Imagery

With: David Crandall (IU)
Office of the Vice Provost of Research at Indiana University Bloomington. \$50K

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