

CS 525M Mobile and Ubiquitous Computing

TagSense: A Smartphone-based Approach to Automatic Image Tagging

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Introduction/motivation:

What was the main problem addressed?



- How to automatically tag pictures with people and activities using smartphones and related sensors.
- -----
- Smartphones/mobile devices/sensors
- 2.5 billion per month (2011)

Introduction/motivation:

Why is this problem solved important?



- Proof of concept
- First image tagging system that leverages smartphones sensors
- Rich set of metadata describing photos
- Advantages over facial recognition
- Sets foundation for what might be possible



Introduction/motivation:

- How will the solution be used eventually? How will this new approach save time, resources, inconvenience, etc?
 - Could save humans from the task of manually tagging photos
 - Could be paired with facial recognition to make a robust solution.

Related Work:

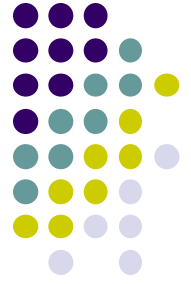
What else done to solve problem?



- **Image tagging** (lots of research, out-of-band)
 - **Mobile Media Metadata** (location data, landmarks, compare similar pictures)
 - **ContextCam** (video tagging, extra sensors)
 - **Mobile sensing** (smartphone sensors, people-centric sensing)
 - **Activity recognition** (time and environment)
 - **Image processing** (optical flow, Goggle Goggles)

Related Work:

How is this approach different or novel?



- First smartphone-to-smartphone adhoc WiFi communication
- Data mining from phones and sensors
- Combined three areas of research:
 - Mobile sensing
 - Activity recognition
 - Image processing

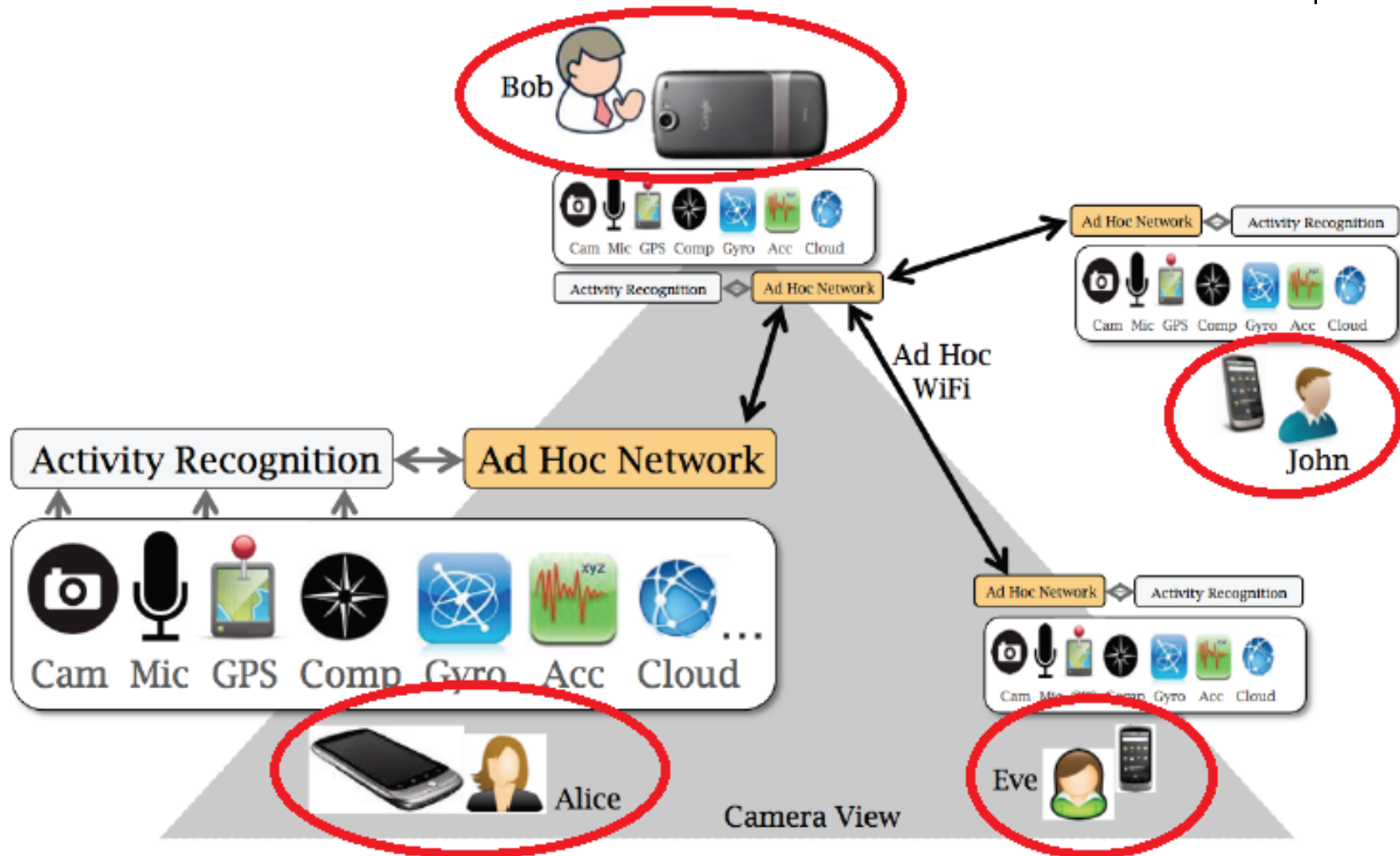
Methodology:

Summarize the approach/design



- Phone to phone by WiFi ad hoc mode
- Password as shared session key
- Collect data from surrounding phones
- 8 Google Nexus One phones (1:7)
- 200 pictures
- When, Where, What, Who?

Methodology: Summarize the approach/design



Methodology:

Describe the implementation used



- When is the picture taken?
 - Time and date
 - Time of day (afternoon, evening, night ...)
 - Weather
- Where is the picture taken?
 - GPS - Reverse lookup
 - Light sensor (indoor/outdoor)
 - Compass (which way is camera facing)

Methodology:

Describe the implementation used



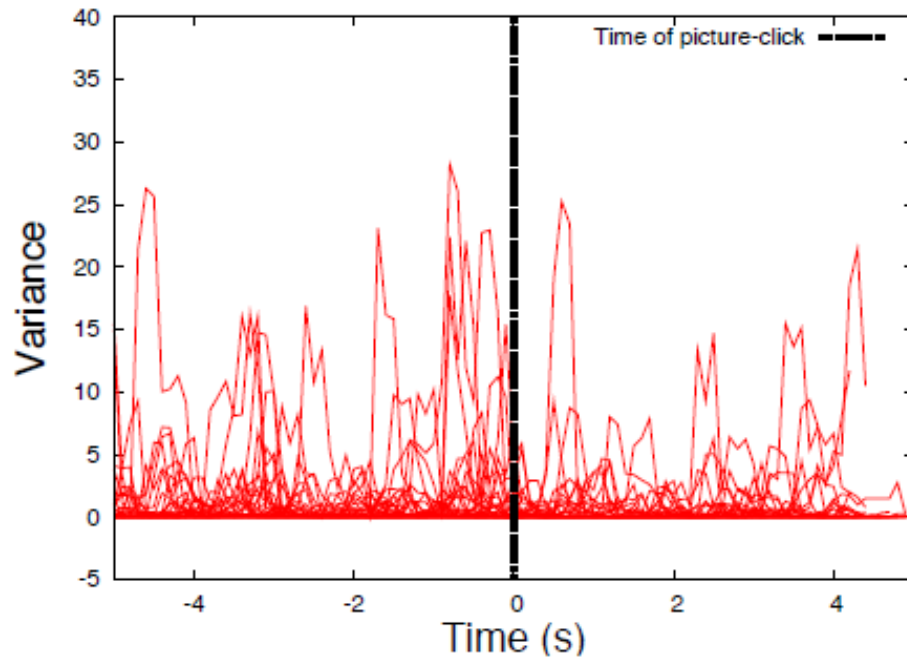
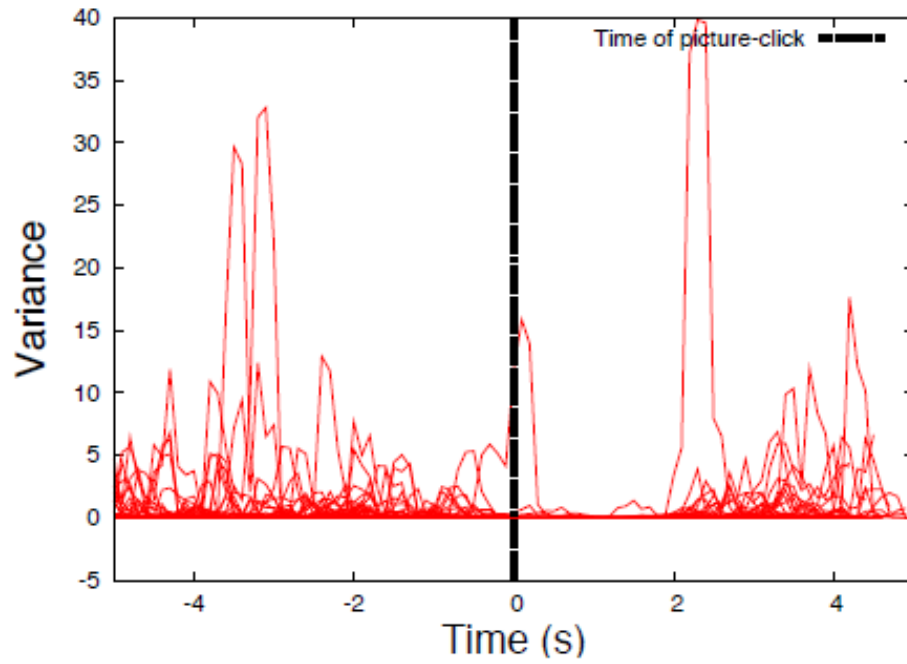
- What are they doing?
 - Accelerometer
 - Acoustic
 - Vocabulary of activities recognized by phone sensors (standing, walking, talking ...)

Methodology:

Describe the implementation used



- Who is in the picture?
 - Accelerometer based signatures (posing for picture)
 - Complementary Compass directions
 - Moving subjects – optical analysis (Optical Flow)



Methodology:

Assumptions and limitations of this work



- Need smartphone
- Need the TagSense app
- Agree and enter common password
- Limited vocabulary of activities (30)

Methodology:

What are the design tradeoffs?



- No phone? No tag.
 - Example: children, babies often focus of pictures
- Detects other phones around
- Who is in the picture?
- Doesn't know who is who



Results:

- Do the presented results back up the claims of the authors?
 - Yes. POC.
 - Information retrieval metrics
- Analysis:
 - Tagging people
 - Tagging activities and context
 - Allowing for tag based image search

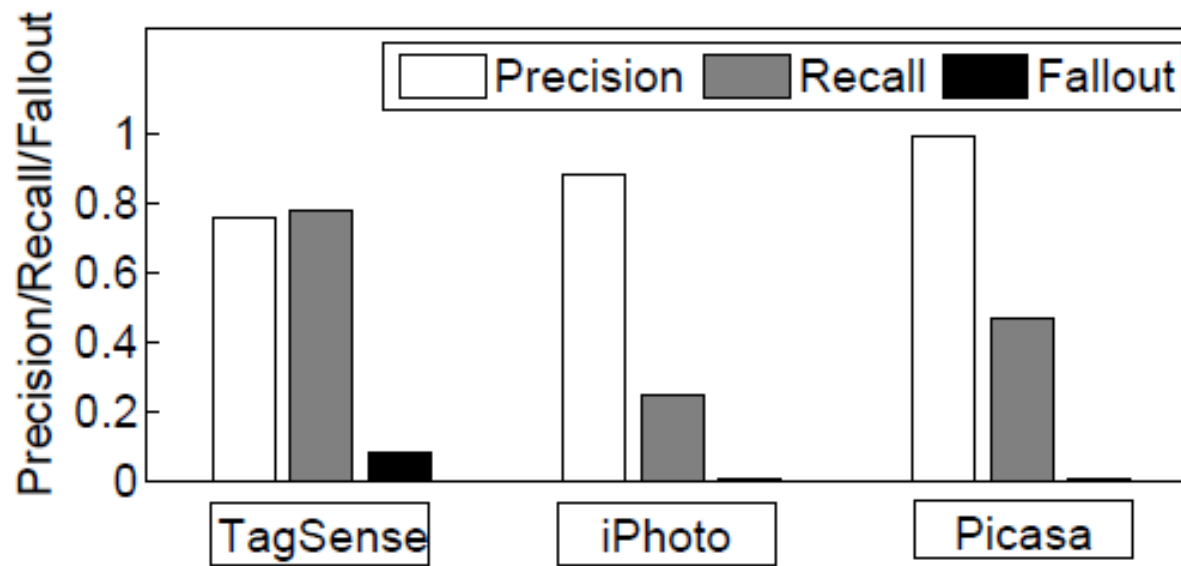


Metrics

$$\text{precision} = \frac{|\text{People Inside} \cap \text{Tagged by TagSense}|}{|\text{Tagged by TagSense}|}$$

$$\text{recall} = \frac{|\text{People Inside} \cap \text{Tagged by TagSense}|}{|\text{People Inside}|}$$

$$\text{fall-out} = \frac{|\text{People Outside} \cap \text{Tagged by TagSense}|}{|\text{People Outside}|}$$



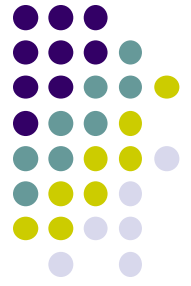


Results:

- Word cloud



Discussions/Conclusions/Future Work



- Multi-phone system to automate picture tagging
- What did you learn from this paper?
- What extensions do the authors plan for future work?
 - Combine with facial recognition, robust system
 - Video-tagging
 - Augmented reality
- Android cameras





References

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