Models from Data and Human Computation

EE382V Activity Sensing and Recognition

UT Austin • Dept. Electrical and Computer Engineering • Fall 2016

Today + Admin

Final Exam: Thursday, December 8, 7:00-10:00 pm

Talk more about the exam on November 17th

Building activity recognition systems leveraging existing data

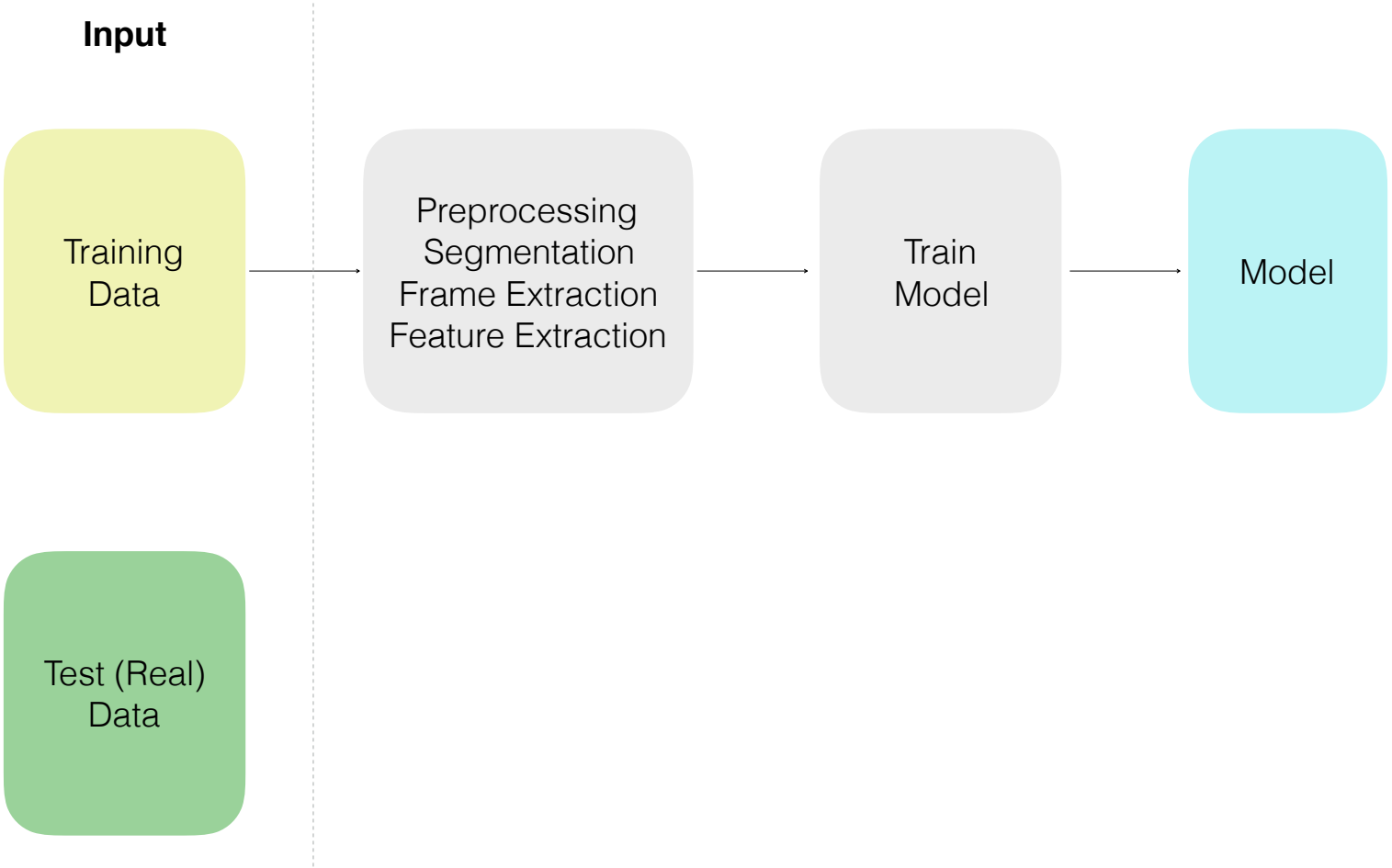
Outsource the ML machinery

Legion:AR

Mining common sense from the web

Recognition of human activities with human computation

Why Explore Other Methods?



Human Computation

“Integrating people into computational processes to solve problems too difficult for computers”

Luis von Ahn
Associate Professor
CMU

Labeling Images with a Computer Game

"If the game is played as much as popular online games, we estimate that most images on the Web can be labeled in a few months."

Player 1 guesses: purse
Player 1 guesses: bag
Player 1 guesses: brown

Success! Agreement on "purse"

Player 2 guesses: handbag

Player 2 guesses: purse
Success! Agreement on "purse"

Labeling Images with a Computer Game

Figure 2. The ESP Game. Players try to "agree" on as many images as they can in 2.5 minutes. The thermometer at the bottom measures how many images partners have agreed on.

"Rather than using computer vision techniques, which don't work well enough, we encourage people to do the work by taking advantage of their desire to be entertained."

Recaptcha

What is happening behind the scenes?

Duolingo

duolingo

Human Computation?

Amazon Mechanical Turk

Make Money
by working on HITs

HITs - *Human Intelligence Tasks* - are individual tasks that you work on. Find HITs now.

As a Mechanical Turk Worker you:

- Can work from home
- Choose your own work hours
- Get paid for doing good work

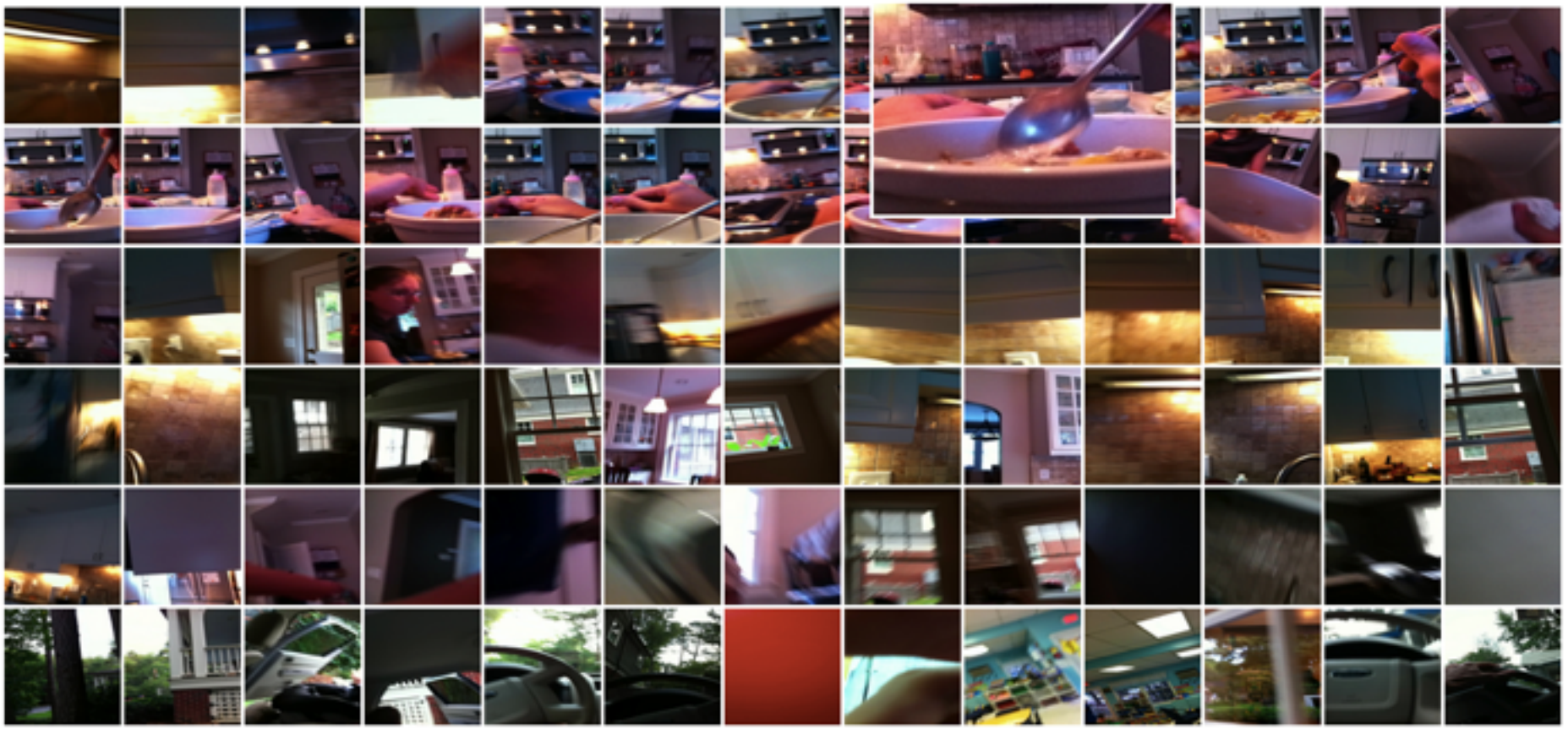
Get Results
from Mechanical Turk Workers

Ask workers to complete HITs - *Human Intelligence Tasks* - and get results using Mechanical Turk. Register Now

As a Mechanical Turk Requester you:

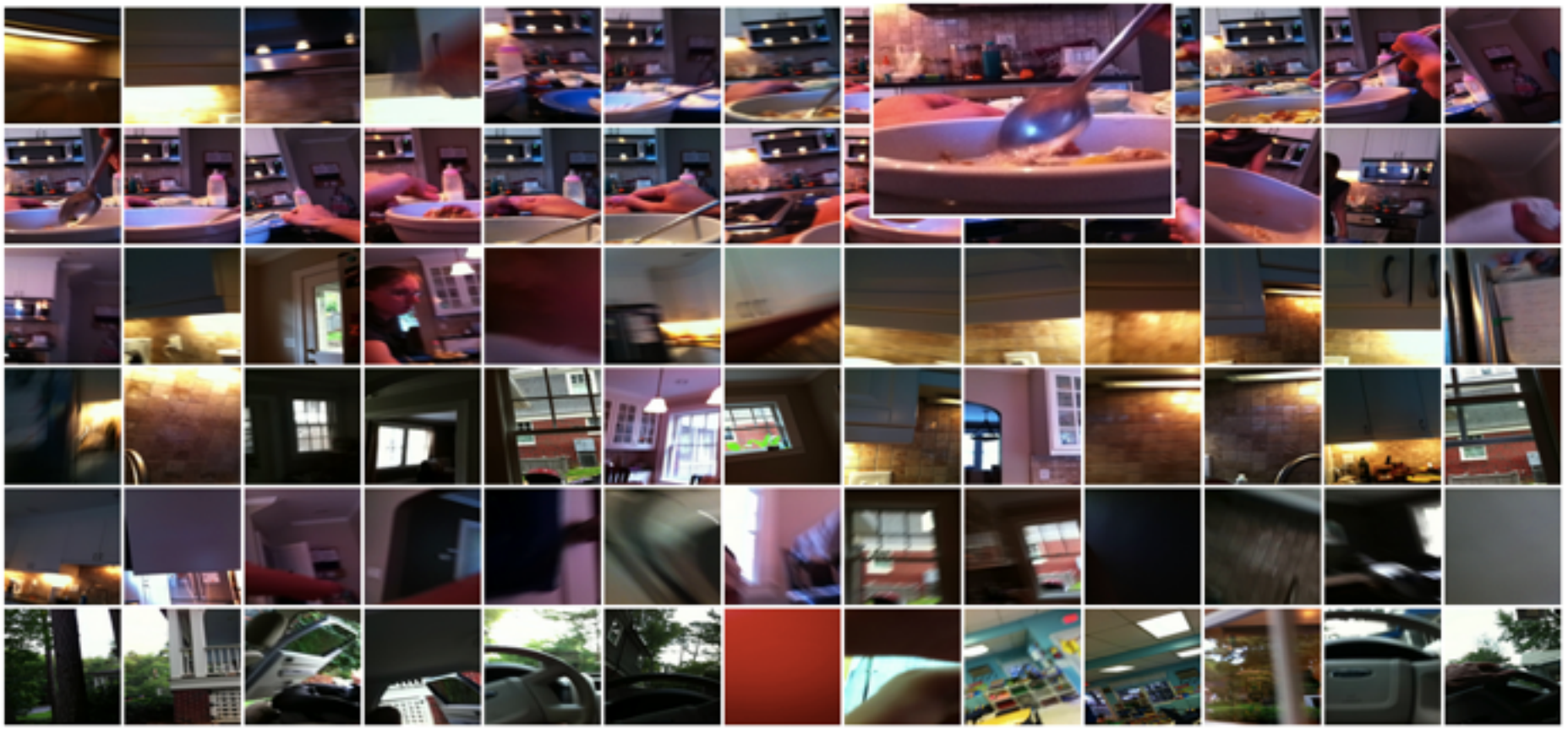
- Have access to a global, on-demand, 24 x 7 workforce
- Get thousands of HITs completed in minutes
- Pay only when you're satisfied with the results

How does it work? Have you tried it?



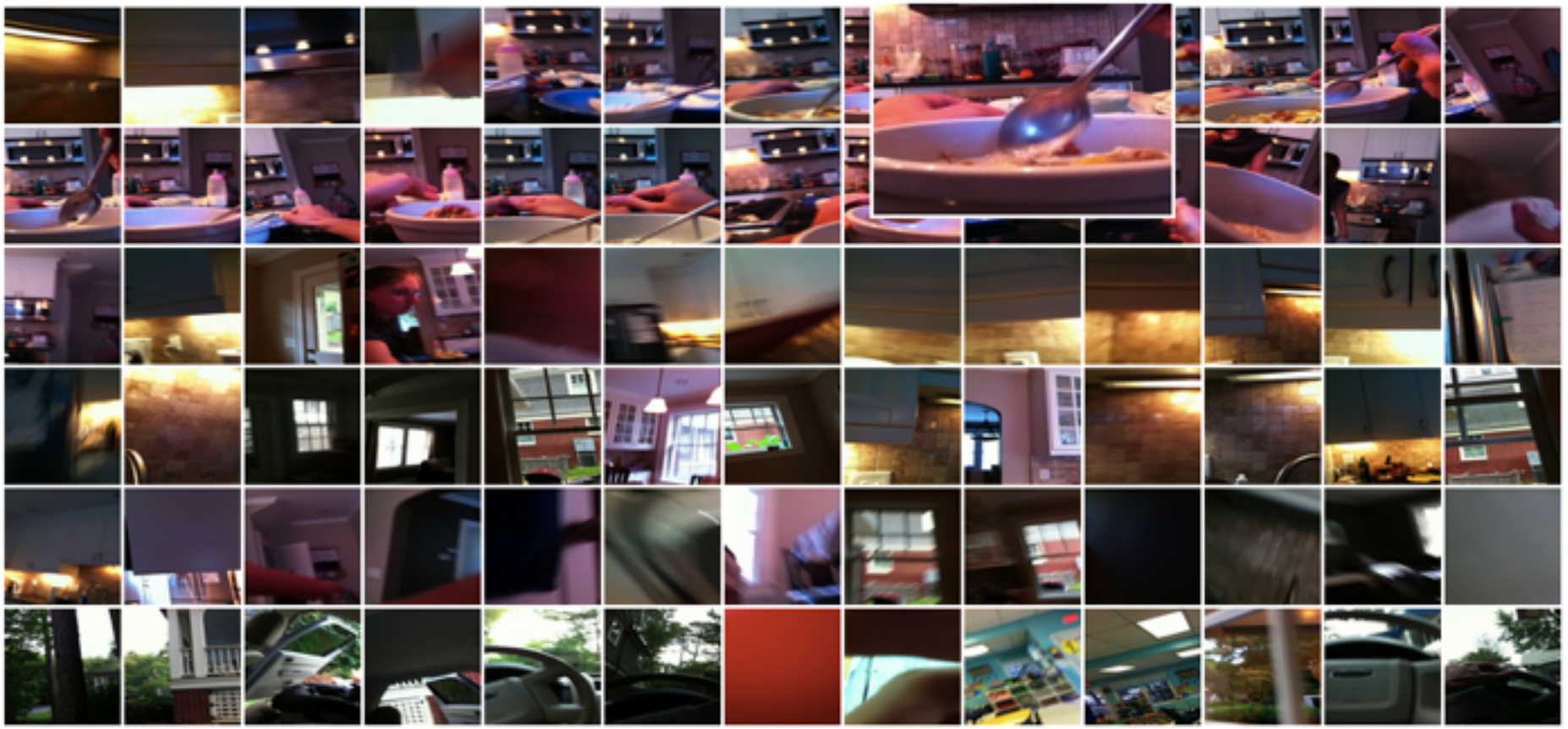
Is it possible to identify eating moments from FPPoV images?

not food recognition!

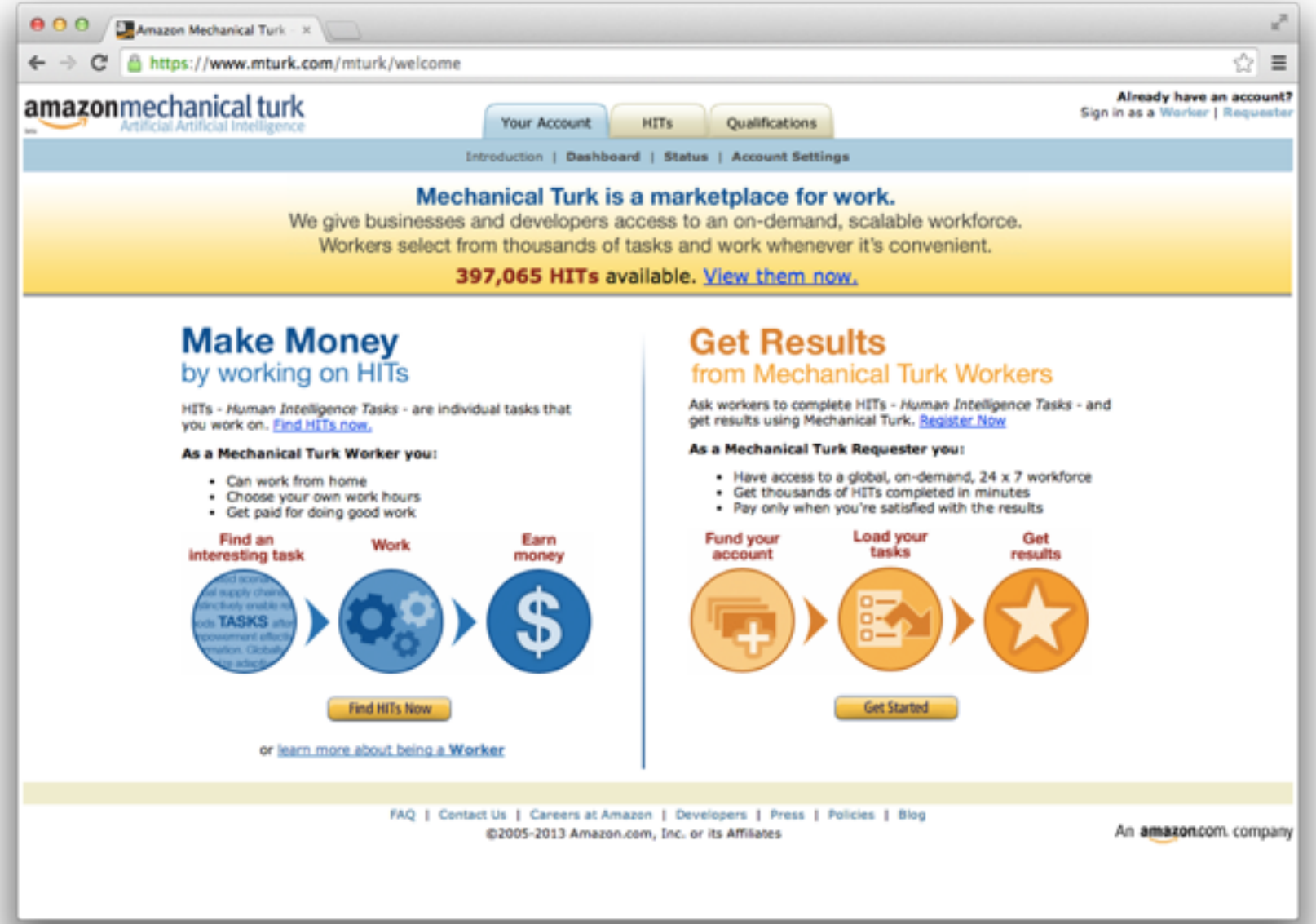


Thousands of images per day (one every 30 seconds)

How to review all the images?



Human Computation (Amazon Mechanical Turk)


Amazon Mechanical Turk
https://www.mturk.com/mturk/welcome
amazonmechanical turk
Artificial Artificial Intelligence
Your Account
HITs
Qualifications
Already have an account?
Sign in as a Worker | Requester
Introduction | Dashboard | Status | Account Settings
Mechanical Turk is a marketplace for work.
We give businesses and developers access to an on-demand, scalable workforce.
Workers select from thousands of tasks and work whenever it's convenient.
397,065 HITs available. View them now.
Make Money
by working on HITs
HITs - Human Intelligence Tasks - are individual tasks that you work on. Find HITs now.
As a Mechanical Turk Worker you:
Can work from home
Choose your own work hours
Get paid for doing good work
Find an interesting task
Work
Earn money
TASKS
Find HITs Now
or learn more about being a Worker
Get Results
from Mechanical Turk Workers
Ask workers to complete HITs - Human Intelligence Tasks - and get results using Mechanical Turk. Register Now
As a Mechanical Turk Requester you:
Have access to a global, on-demand, 24 x 7 workforce
Get thousands of HITs completed in minutes
Pay only when you're satisfied with the results
Fund your account
Load your tasks
Get results
Get Started
FAQ | Contact Us | Careers at Amazon | Developers | Press | Policies | Blog
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An amazon.com company

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User Study

Participants

5 participants, 3 days

iPhone 3GS as camera held with lanyard

Custom application

Photo every 30s

17,575 images total

IRB & Privacy Concerns

1

Concerns regarding participants & secondary participants

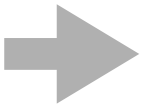
Images released to AMT workers

2

Image removed if any recognizable body part

Two phase review process

- Participant review
- Researchers review



Step 1

Participants review (and delete) images

Step 2

Researchers review (and delete) images

3

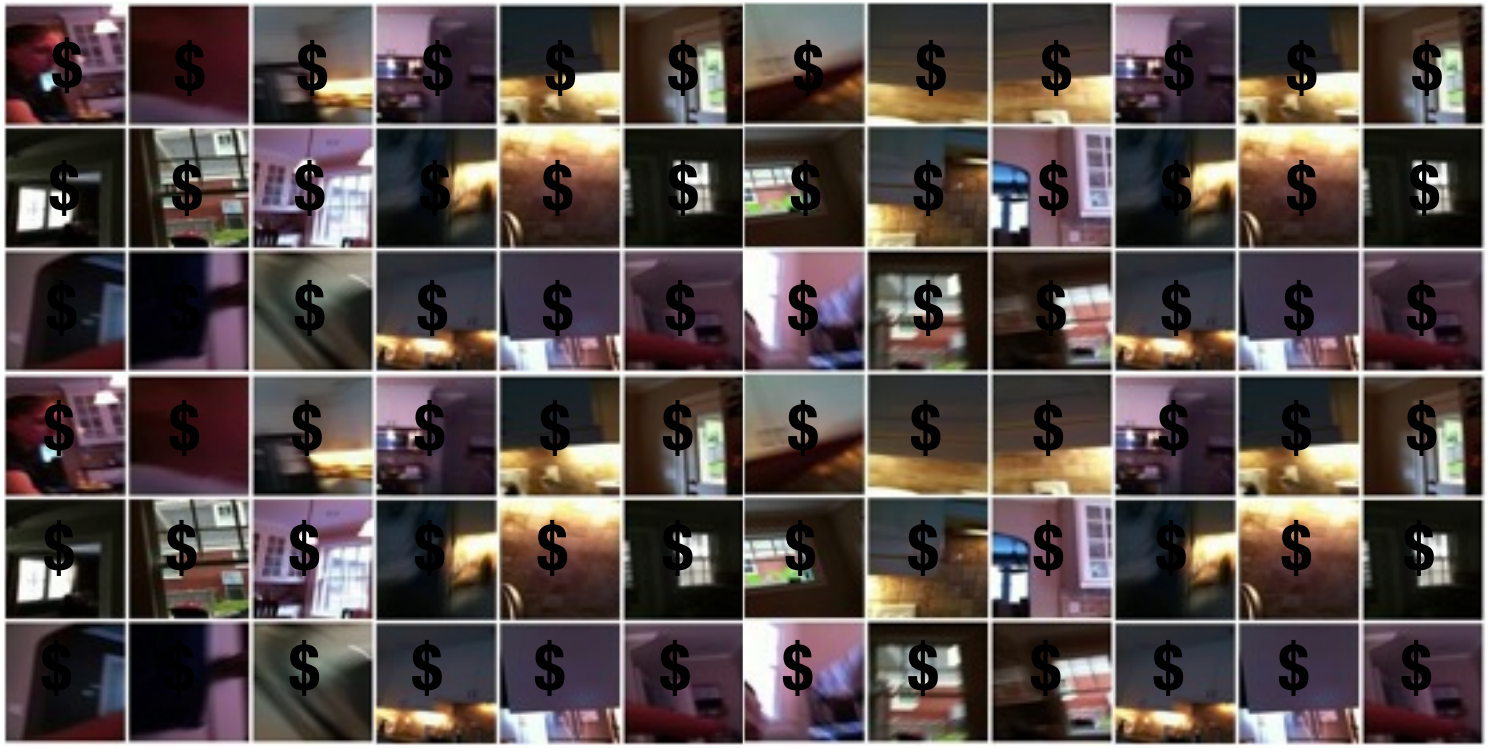
Methodology

Generating AMT HITs

One image per HIT

Good recognition

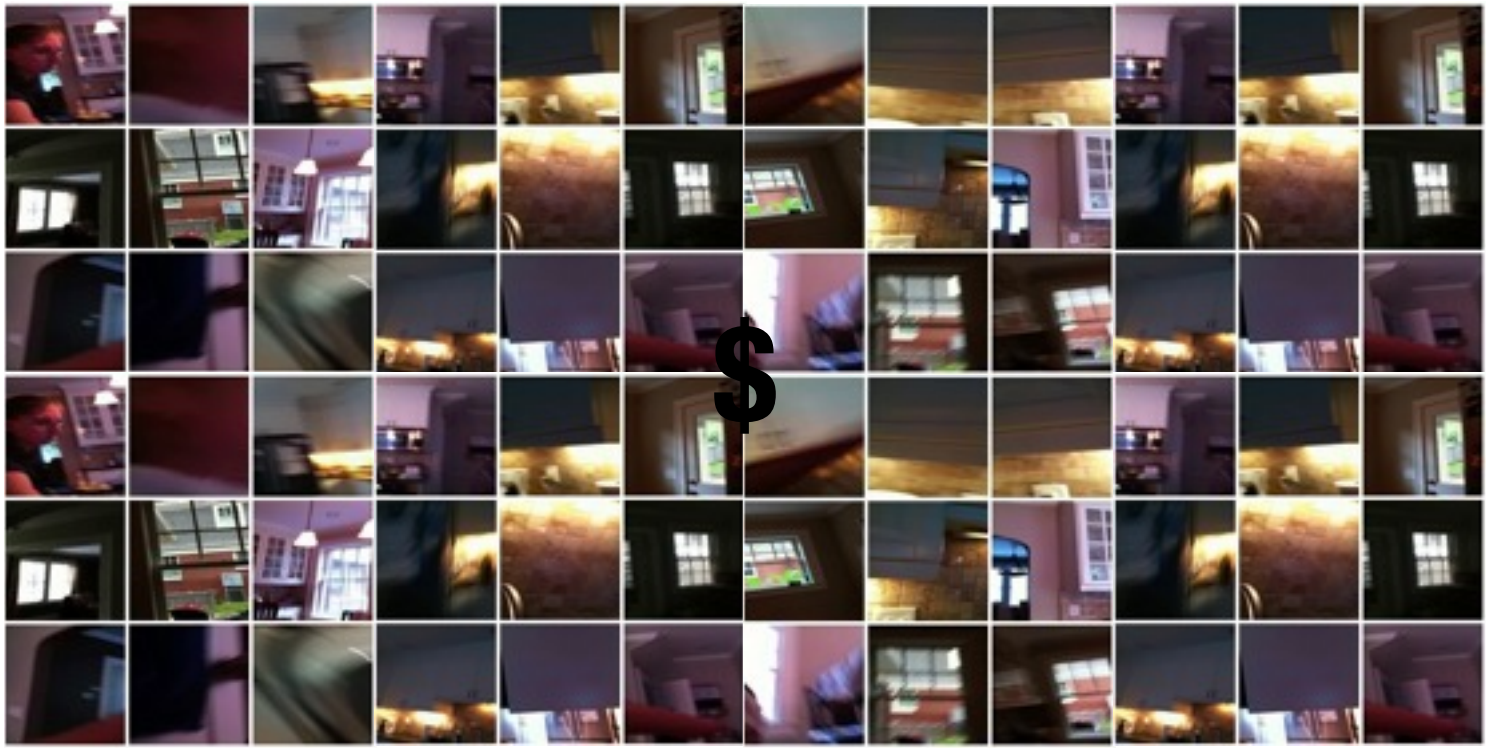
Expensive



All images in one HIT

Subpar recognition

$0.1 or Cheaper



Group of Images

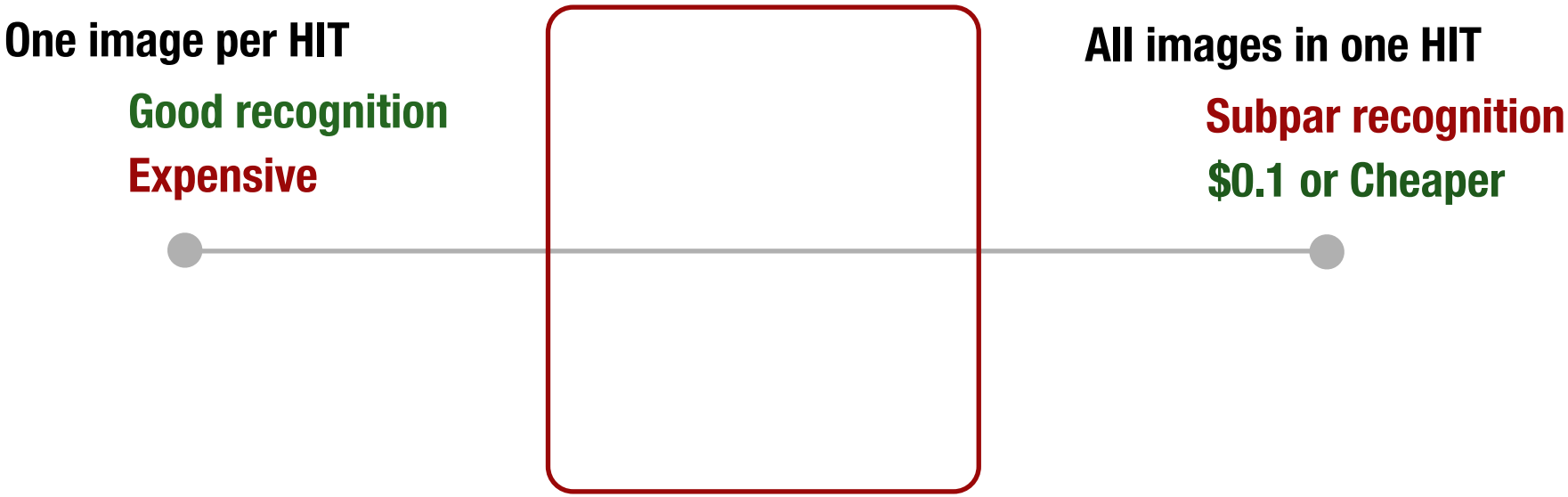
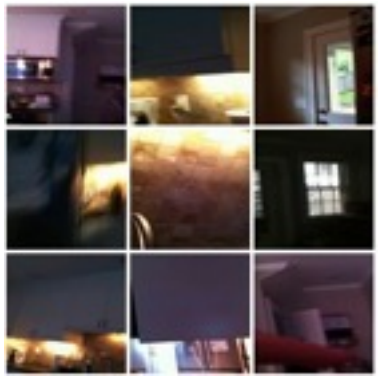


Image Groups

~120 Images per Group

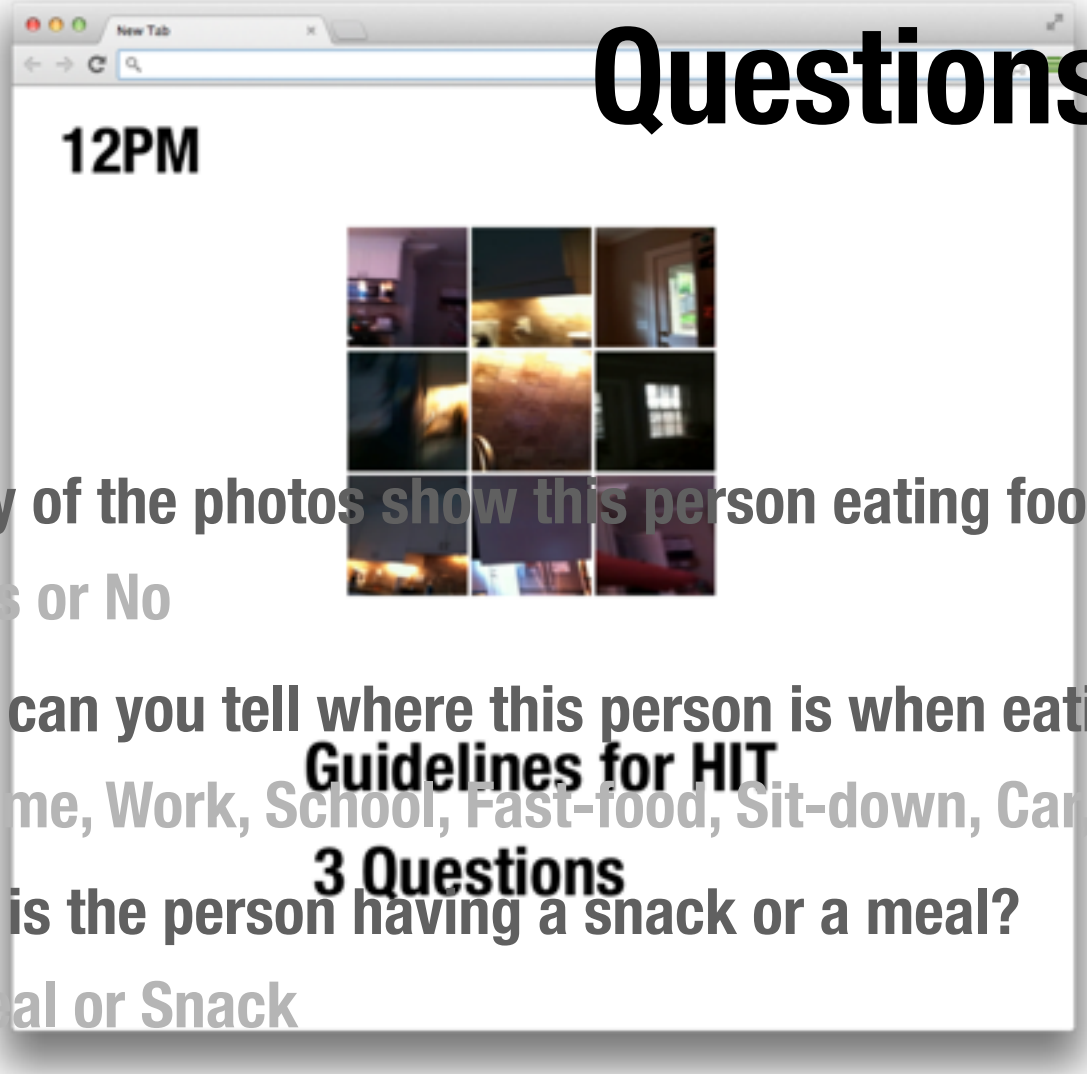
12PM



Guidelines for HIT

3 Questions

Questions



1. Do any of the photos show this person eating food?

   Yes or No

2. If yes, can you tell where this person is when eating?

   Home, Work, School, Fast-food, Sit-down, Car, Other

3. If yes, is the person having a snack or a meal?

   Meal or Snack

Guidelines for HIT

3 Questions

Guess eating behavior based on photos

Please visit this page (opens in new window), review the photos and answer the questions below.

The photos were taken by one person throughout the day. You can move the mouse over the images to see them in more detail.

Please note:

- A snack tends to be a small, quick meal such as a chocolate bar, a yogurt, a piece of fruit or a cookie.
- A meal is typically a longer eating event (eg. breakfast, lunch and dinner), involving the consumption of more food than a snack.
- If you see the person cooking food, it doesn't necessarily mean that the person is eating food.
- If you see the person shopping for food, it doesn't necessarily mean that the person is eating food.
- Drinking does not count as an eating activity.
- Out of many images, only one or two might suggest an eating behavior. So please, pay attention!
- Do your best, use your judgement. We realize this is not an easy task.

1. Do any of the photos show this person eating food?

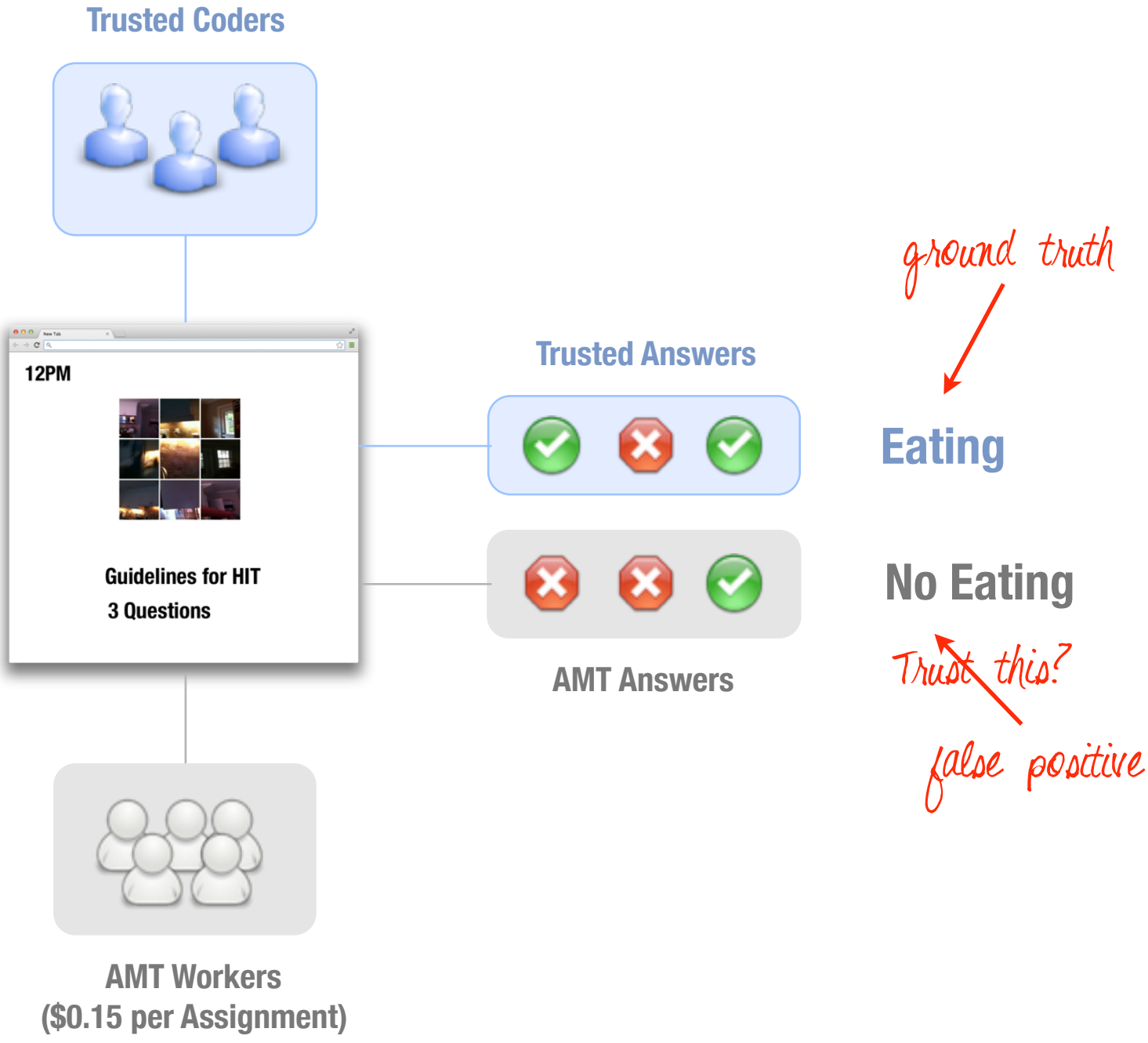
◯ Yes ◯ No

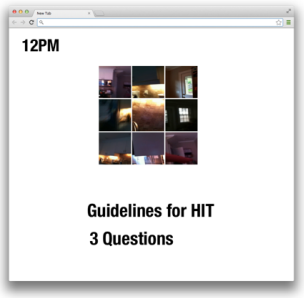
2. If yes, can you tell where this person is when eating?

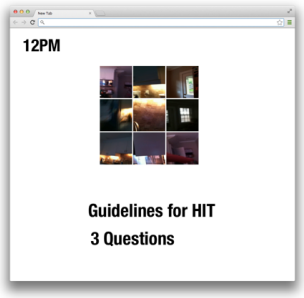
Pick location

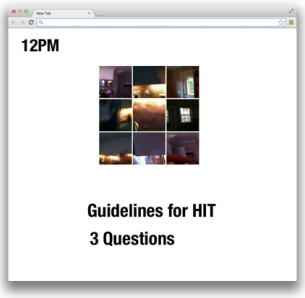
3. If yes, is this person having a snack or a meal?

Choose...


Trusted Coders
12PM
Guidelines for HIT
3 Questions
AMT Workers
($0.15 per Assignment)
Trusted Answers
AMT Answers
ground truth
Eating
No Eating
Trust this?
false positive







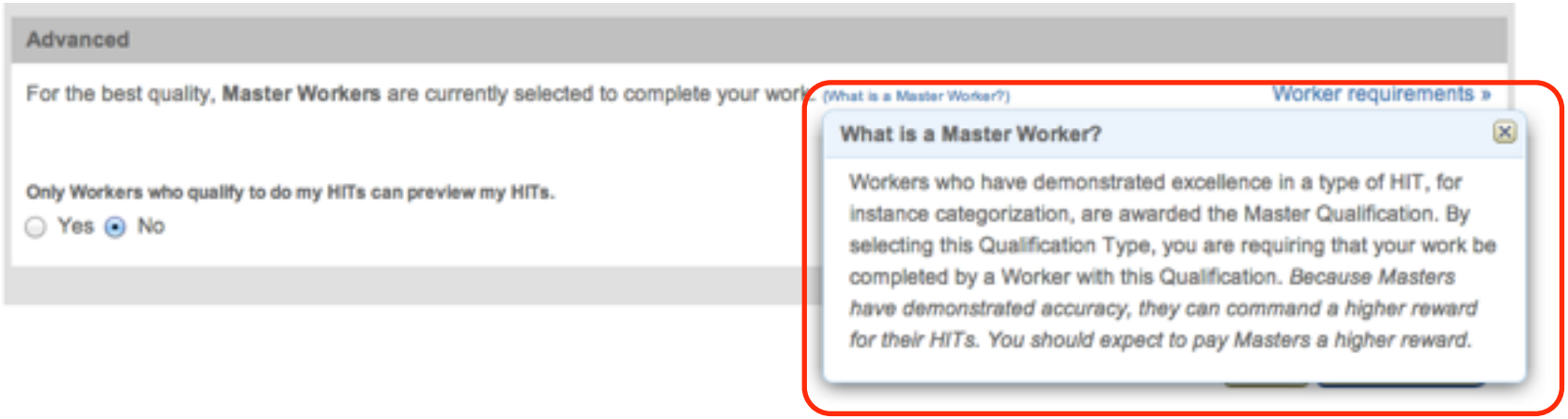
TP	23	43	23	26
FP	10	20	12	9
TN	4	29	7	45
FN	5	6	4	2

4

Results

Participant	Worker Type	TP	FP	TN	FN	Precision	Recall	Accuracy
P1	regular	5	0	33	9	100%	35.71%	80.85%
	master	10	0	33	4	100%	71.42%	91.48%
P2	regular	1	2	59	10	33.34%	9.09%	83.34%
	master	6	1	60	5	85.71%	54.54%	91.67%
P3	regular	1	1	24	7	50%	12.5%	75.75%
	master	5	0	25	3	100%	62.5%	90.90%
P4	regular	2	2	25	8	50%	20%	72.97%
	master	7	3	24	3	70%	70%	83.78%
P5	regular	1	0	28	5	100%	16.67%	85.29%
	master	3	1	27	3	75%	50%	88.23%
All	**regular**	**10**	**5**	**169**	**39**	**66.67%**	**20.4%**	**80.26%**
	master	**31**	**5**	**169**	**18**	**86.11%**	**63.26%**	**89.68%**

Master Workers



Participant	Worker Type	TP	FP	TN	FN	Precision	Recall	Accuracy
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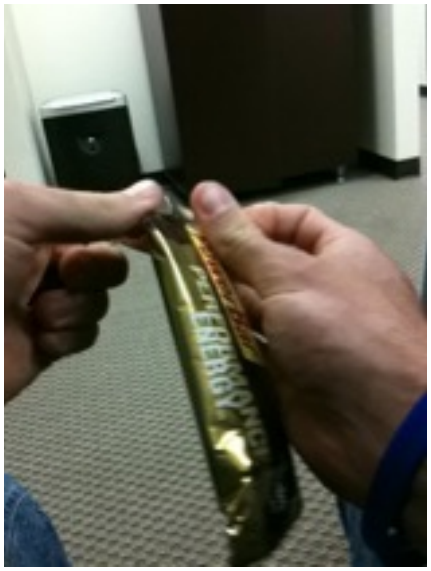
P3	regular	1	1	24	7	50%	12.5%	75.75%
	master	5	0	25	3	100%	62.5%	90.90%
P4	regular	2	2	25	8	50%	20%	72.97%
	master	7	3	24	3	70%	70%	83.78%
P5	regular	1	0	28	5	100%	16.67%	85.29%
	master	3	1	27	3	75%	50%	88.23%
All	**regular**	**10**	**5**	**169**	**39**	**66.67%**	**20.4%**	**80.26%**
	master	**31**	**5**	**169**	**18**	**86.11%**	**63.26%**	**89.68%**

Eating Moments

Low recall (66.67%) on detecting eating moments

50+ images for group
Difficult even for human coder

Meal Type



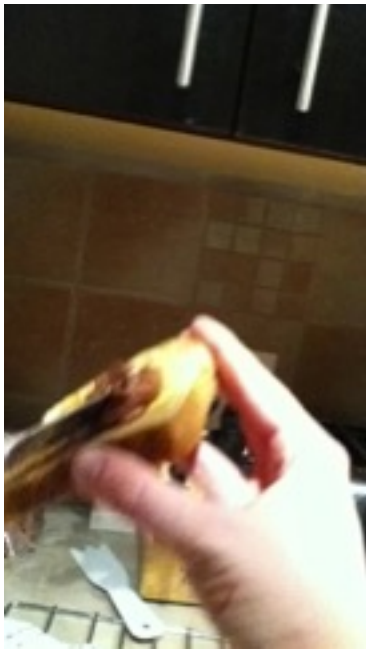
Meal or Snack?

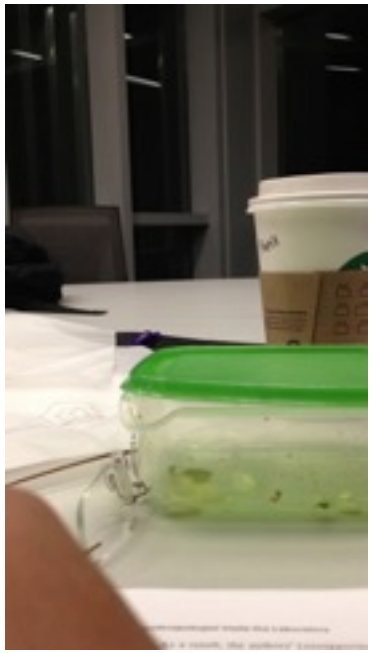
Interpretation

24% recognition

“A meal is typically a longer eating event (e.g., breakfast, lunch, dinner), involving the consumption of more food than a snack.”

Meal Location



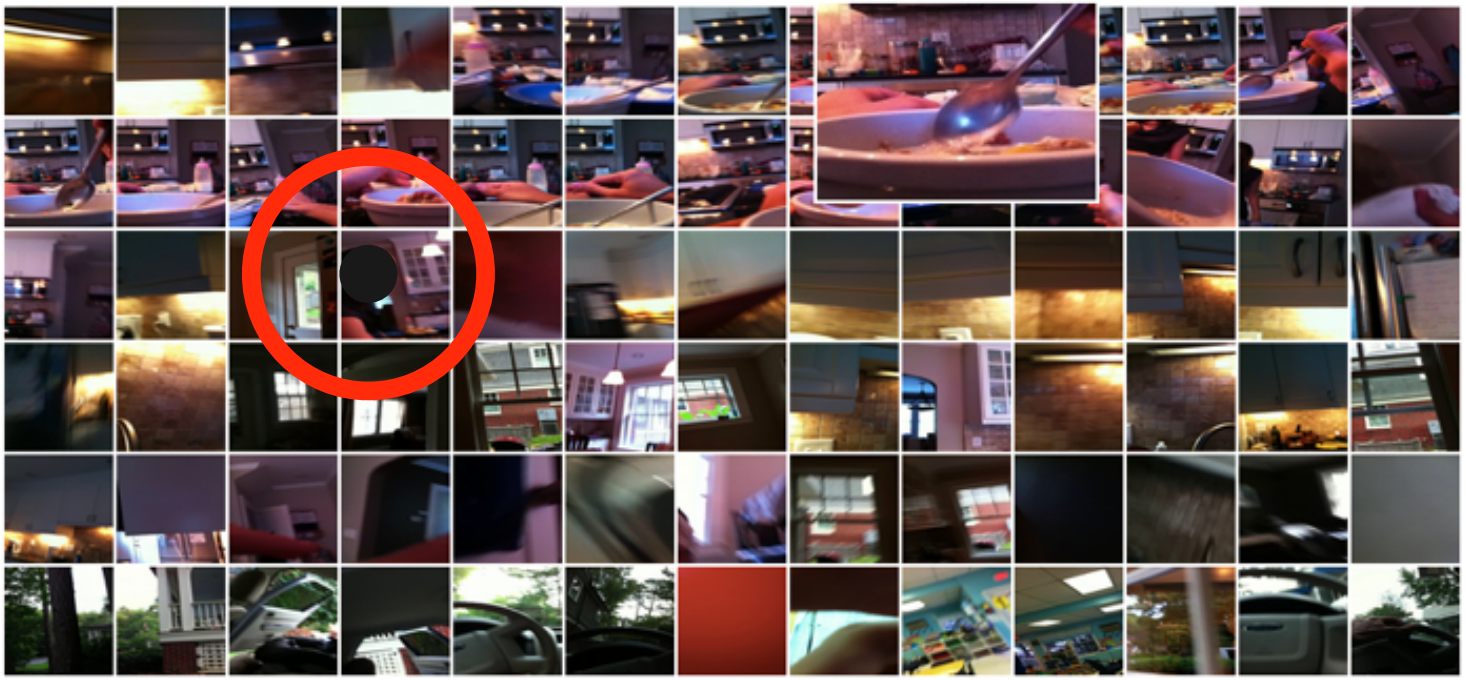


School, Home, Work?

Not enough visual information

19% recognition

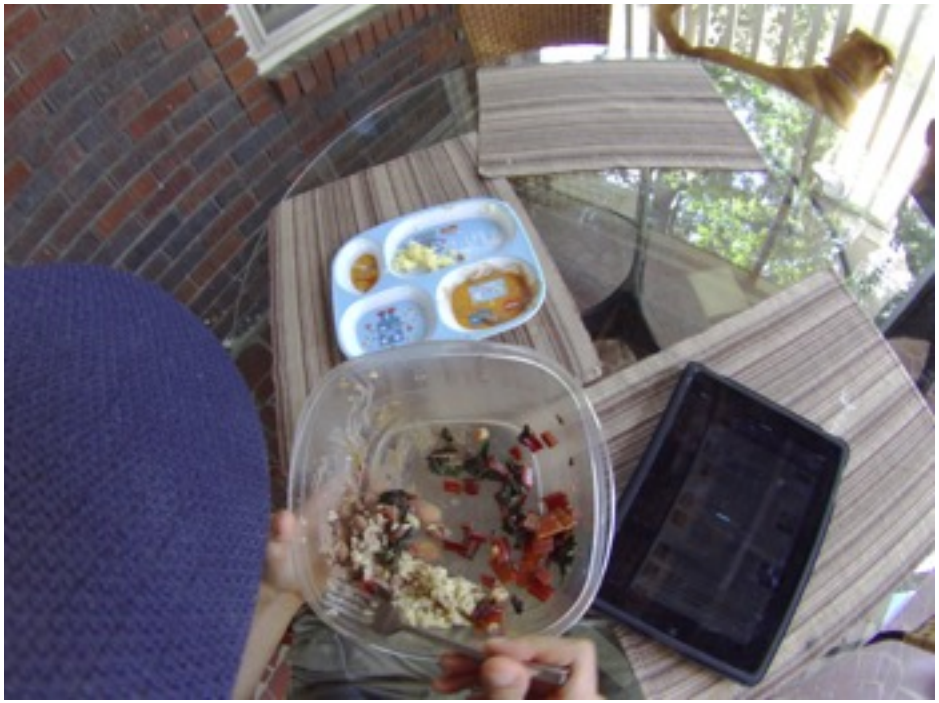
Meal Location

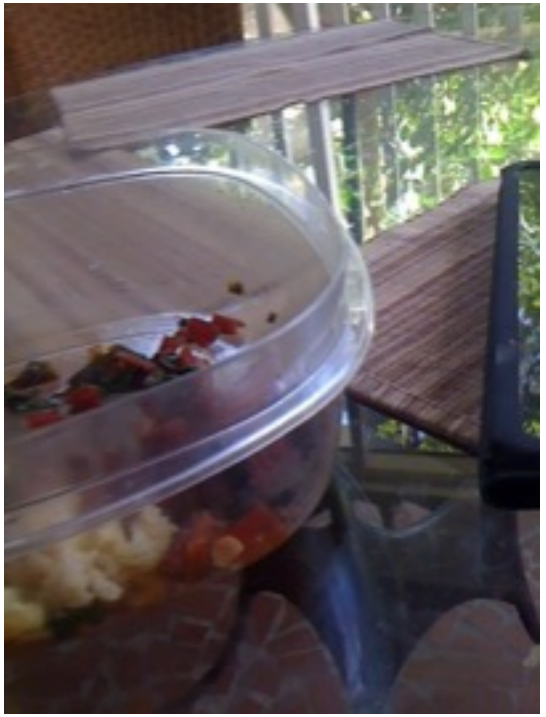


Many “useful” images removed due to privacy protocol

20% of all images. 90% of eating evidence in some cases

Meal Location





Camera placement, lens type

5

Contribution

{ FPPoV images
Human Computation } = **Identification of Eating Moments**

Your Thoughts

Papers + Panel of Experts