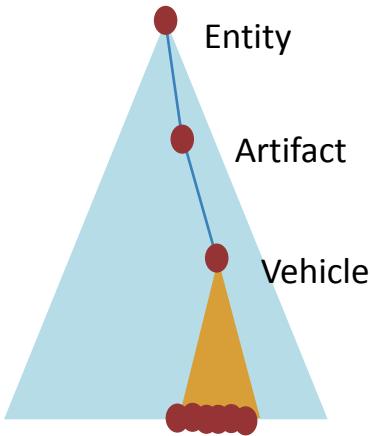


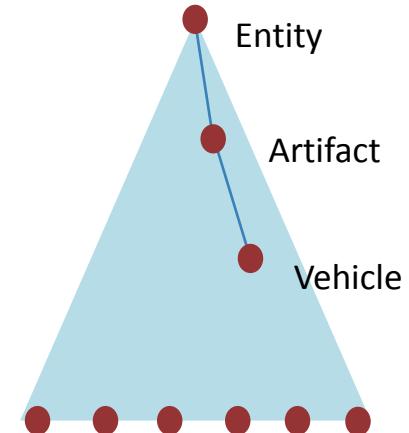
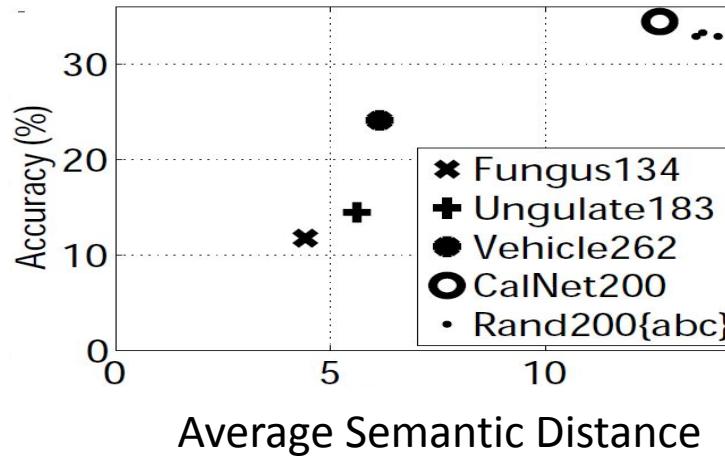
Recitation

Large Scale Recognition & Visual Ontologies

Fine-grained categories are a lot harder

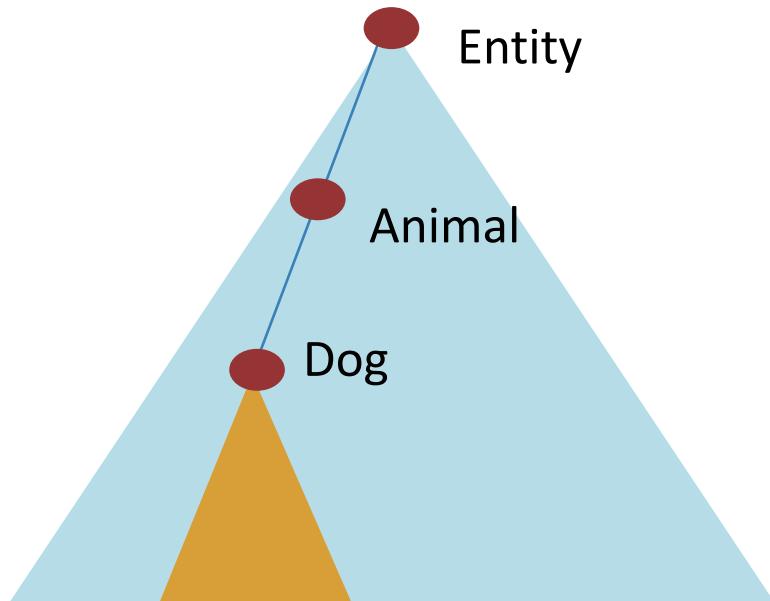


Finer



Coarser

Fine-Grained Recognition



What breed is this dog?

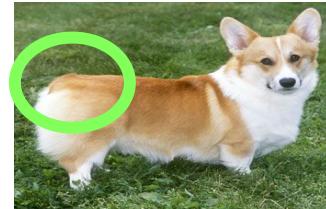
- Basic category known.
- Object already localized.

Fine-Grained Recognition



...

Cardigan Welsh Corgi



...

Pembroke Welsh Corgi

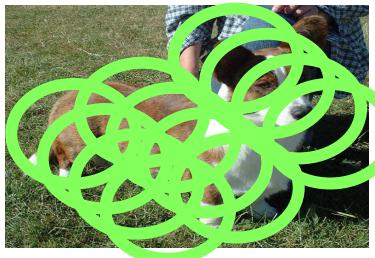


?

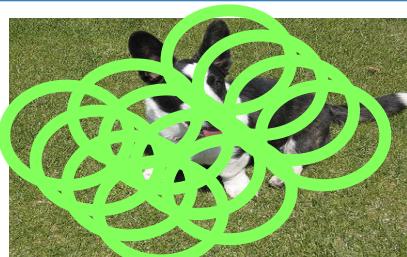
What breed is this
dog?

Key: Find the right features.

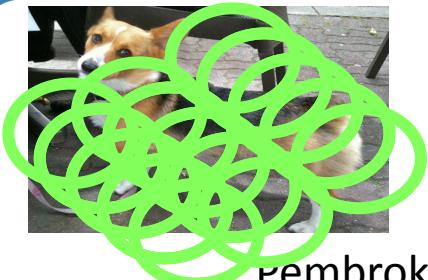
Fine-Grained Recognition



Cardigan Welsh Corgi



...



Pembroke Welsh Corgi



...

Existing Work

Feature Selection
from all possible
locations

[Branson et al. '10]

[Bo et al. '10]

[Farrell et al. '11]

[Yao et al. '11]

[Yao et al. '12]

Fine-Grained Recognition



Cardigan Welsh Corgi



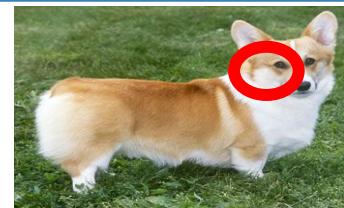
...

Existing Work

Feature Selection
from all possible
locations



Pembroke Welsh Corgi

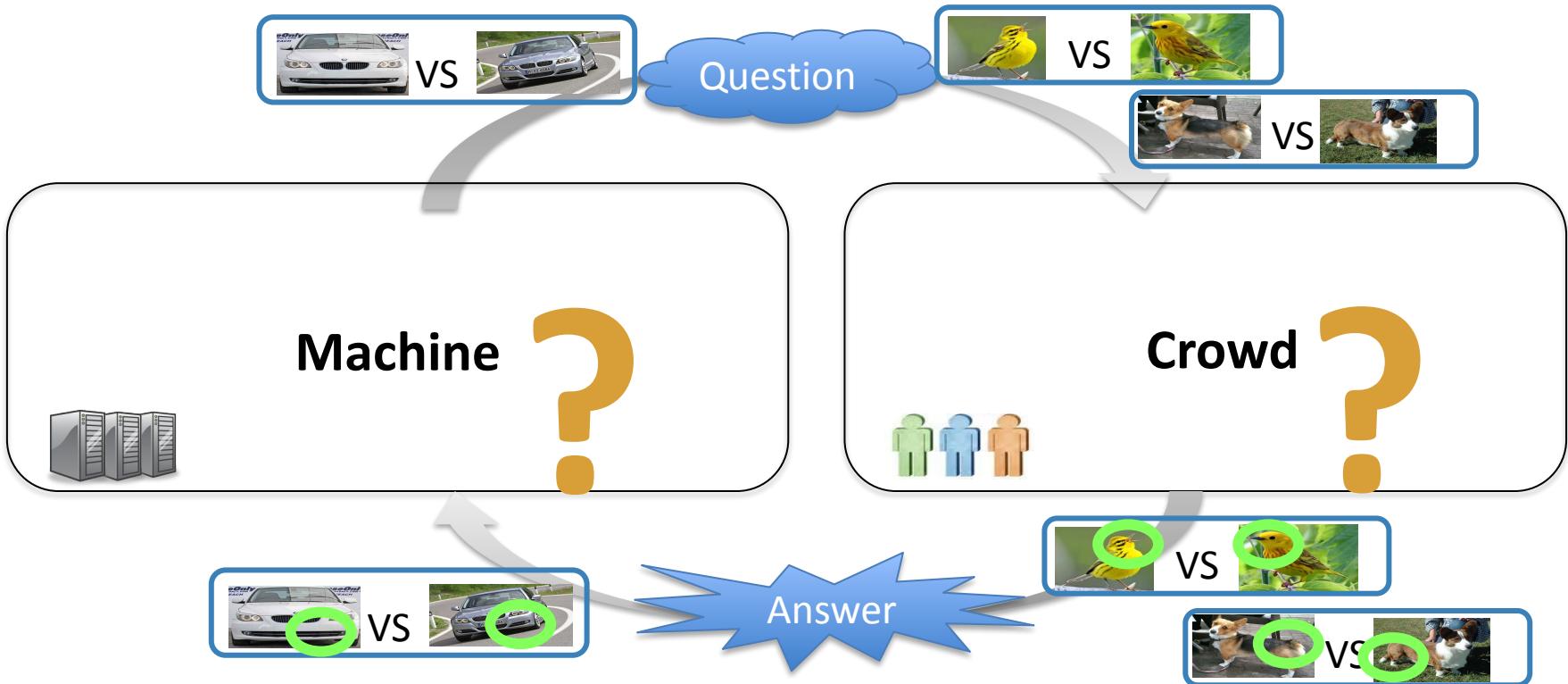


...

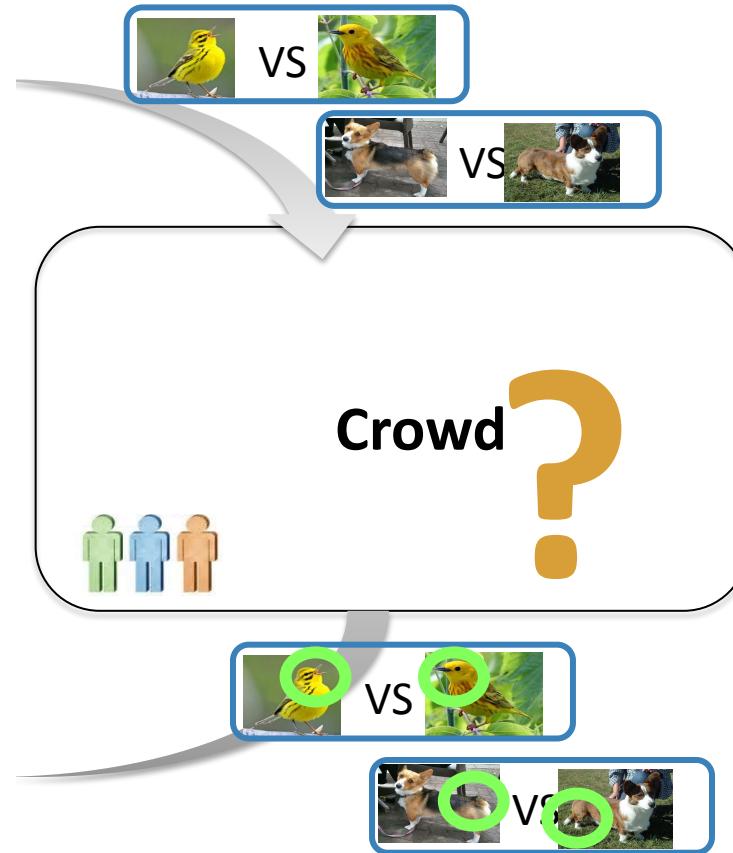
- [Branson et al. '10]
- [Bo et al. '10]
- [Farrell et al. '11]
- [Yao et al. '11]
- [Yao et al. '12]

Can fail to find the right features.

Crowd-Machine Collaboration



Crowd-Machine Collaboration



Bubbles [Gosselin & Schyns, '01]

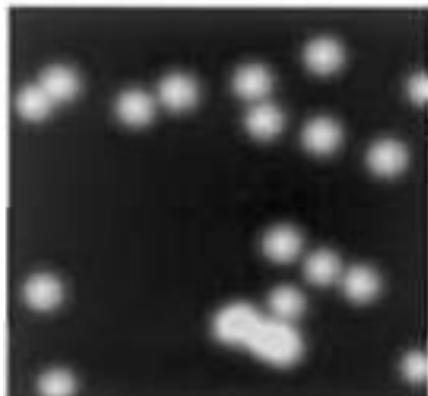


Smiling

VS



Neutr
al



Random Bubble Mask



?

Bubbles [Gosselin & Schyns, '01]



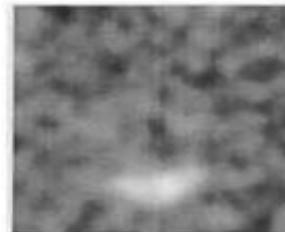
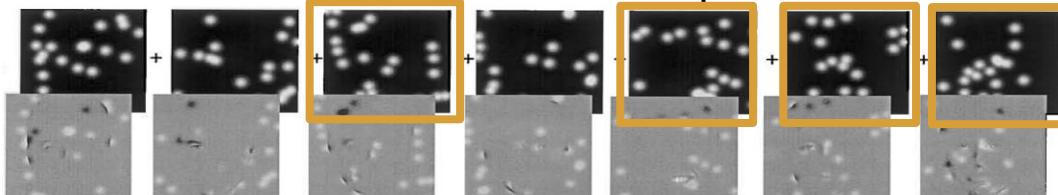
Smiling

VS



Neutra

Too costly



Annotation Rationale

[Donahue & Grauman '11]



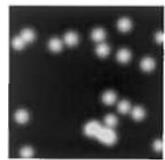
No easy quality assurance

What makes the form of the skater good?

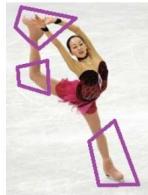
Cost Effective



Quality Assurance



Gosselin &
Schyns '01



Donahue &
Grauman '11



YOU AND A RANDOM PARTNER TAKE TURNS PEEKING AND BOOMING *

BOOM : REVEAL PARTS OF THE IMAGE TO YOUR PARTNER

TIME LEFT
2:23

boom
CLICK THE
IMAGE TO
REVEAL AREAS
TO YOUR
PARTNER
RIGHT CLICK TO
PING AN AREA
OF THE IMAGE



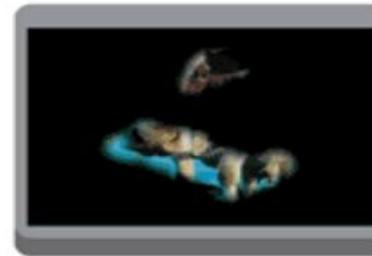
GIVE HINTS
IF NECESSARY

TELL YOUR PARTNER IF
A GUESS IS **HOT** OR **COLD**

PEEK : GUESS WHAT YOUR PARTNER IS REVEALING

TIME LEFT
2:23

peek
HINT
BOOK



HINTS HELP
YOU GUESS

PASS FOR
DIFFICULT IMAGES

Peekaboom [Ahn, Liu, Blum '06]

Does not work for fine-grained classes



Gosselin &
Schyns '01



Donahue &
Grauman '11



Ahn, Liu,
Blum '06



Cost Effective

✗

✓

✓

✓

Quality Assurance

✓

✗

✓

✓

Fine Grained

✓

✓

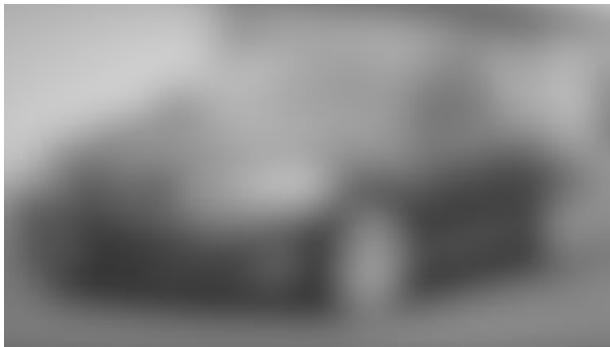
✗

✓

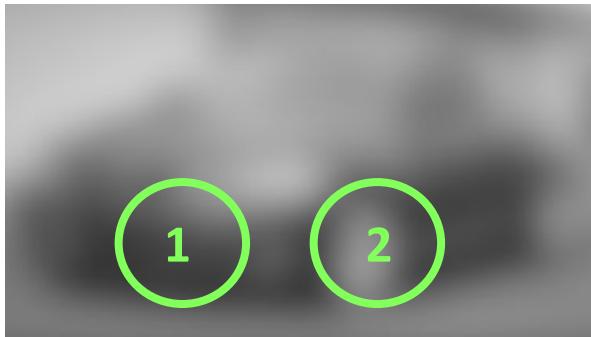
The Bubbles Game

J. Deng, J. Krause, L. Fei-Fei. **Fine-Grained Crowdsourcing for Fine-Grained Recognition.** CVPR 2013.

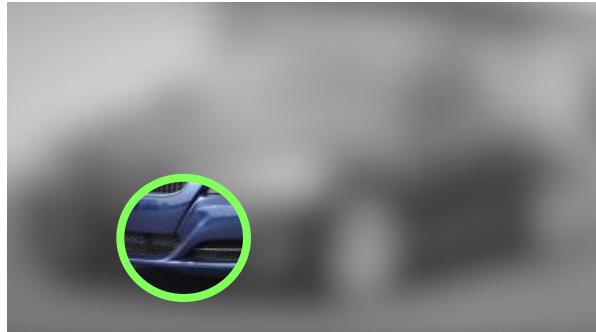
Let's play



Let's play



Let's play



?



Let's play





Click Me or Press 1

Prairie Warbler (wikipedia)



Draw and identify the category.



Bubble:

Smaller
(Press - or 's')

Bigger
(Press + or 'w')

Bubble cost: 25

Points for correct identification: 100

Total score: 0

Total score needed to submit: 1000

Pass this image

Change the pair of categories

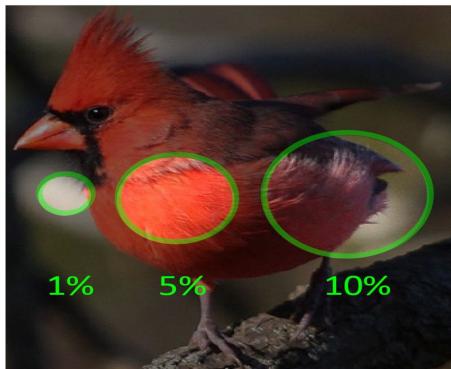
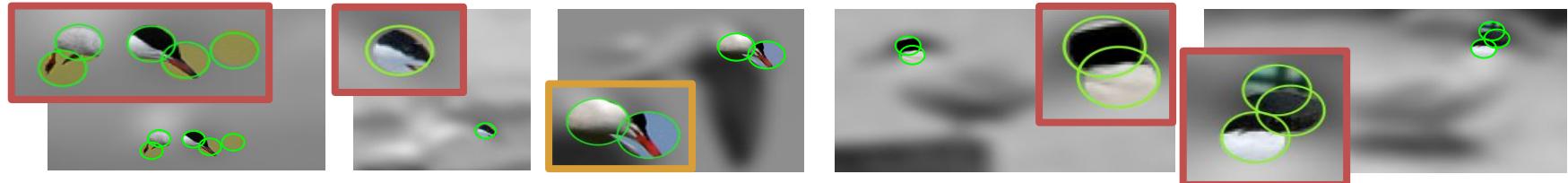


Click Me or Press 2

Yellow Warbler (wikipedia)



Crowd Picked Bubbles (AMT for now)



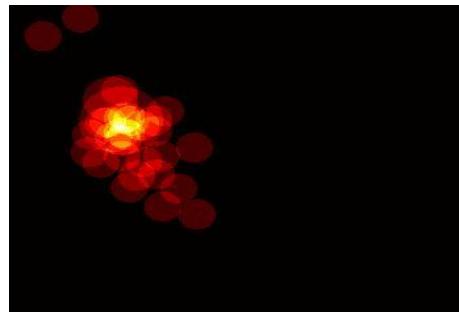
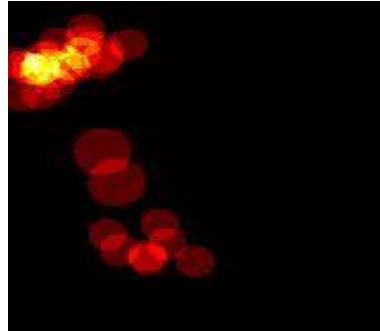
Bubble sizes as proportions of image

70% of games are successful

>90% of successful games use <10% of area

Deng, Krause, & Fei-Fei,
CVPR2013

Bubble Heatmaps



Crowd-Machine Collaboration



VS



VS



VS



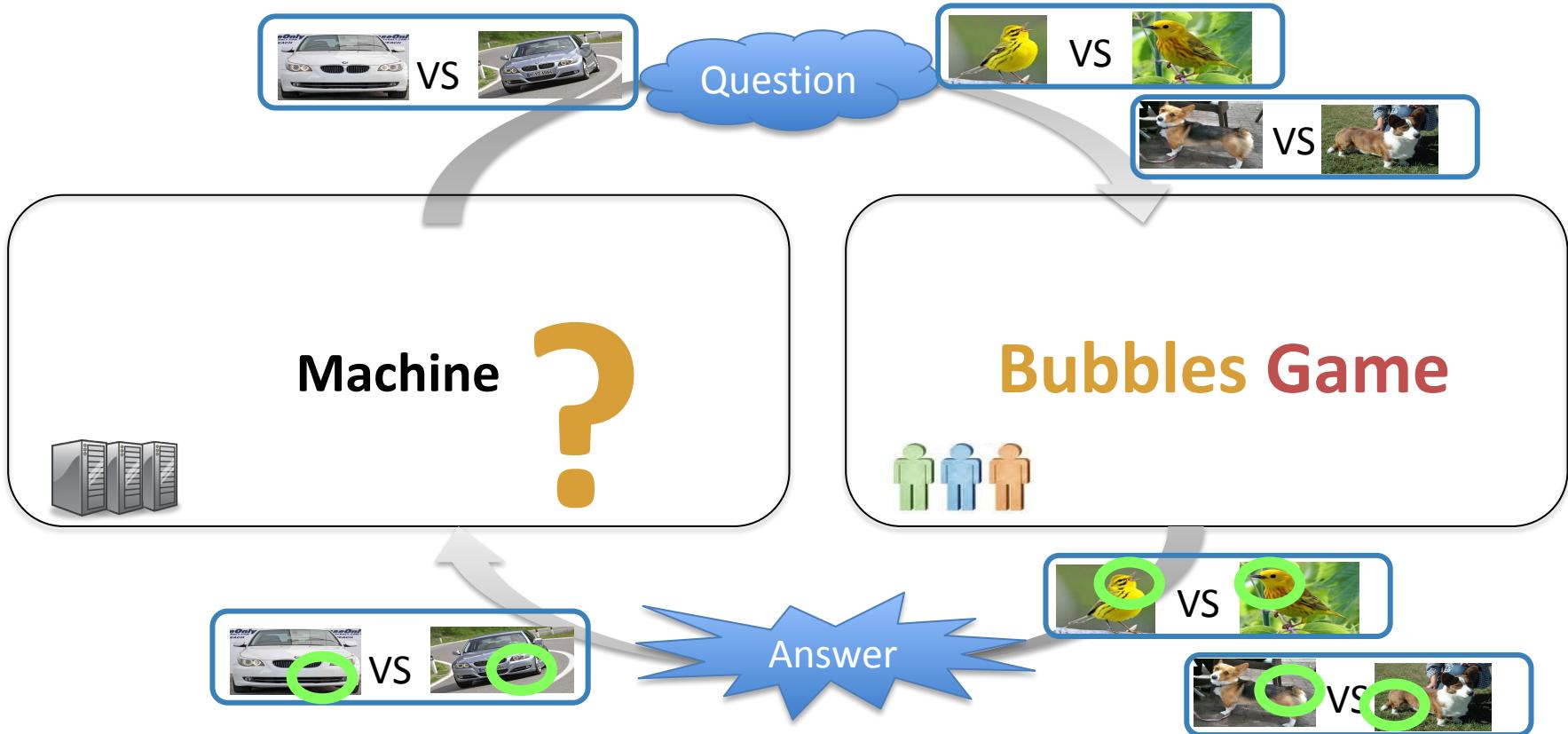
VS



VS



Crowd-Machine Collaboration

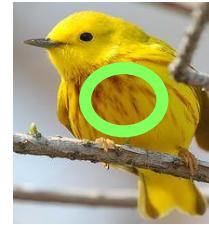
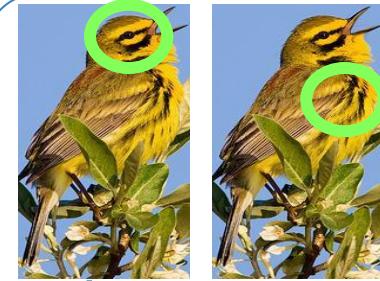


BubbleBank Representation



A test image

Crowd-picked
Bubbles
(on training)



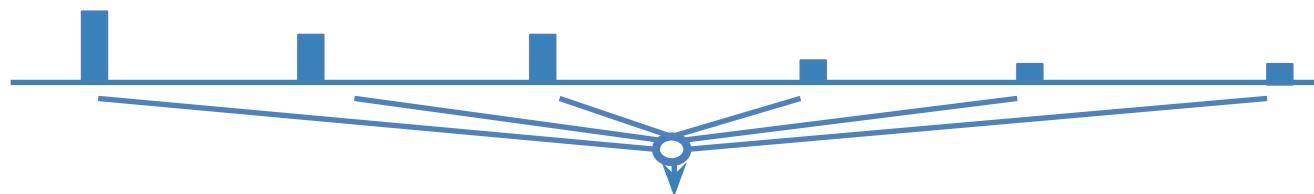
Bubble
Matching



Max-pooling

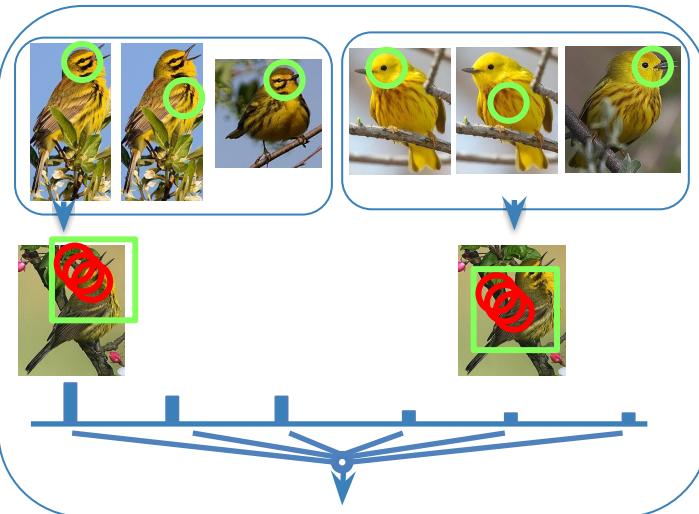


Linear SVM



V1-like models

Templates



Pooling

BubbleBa
nk

Crowd picked

Pool over a single
region (spatial
prior)

[Deng et al. '13]

Prior
Work

Clustering
random patches

Pool over multiple
uniformly sampled
regions (e.g. SPM)

[Lecun et al. '98]

[Csurka et al. '04]

[Lazebnik et al. '06]

[Wang et al. '09]

[Lee et al. '09]

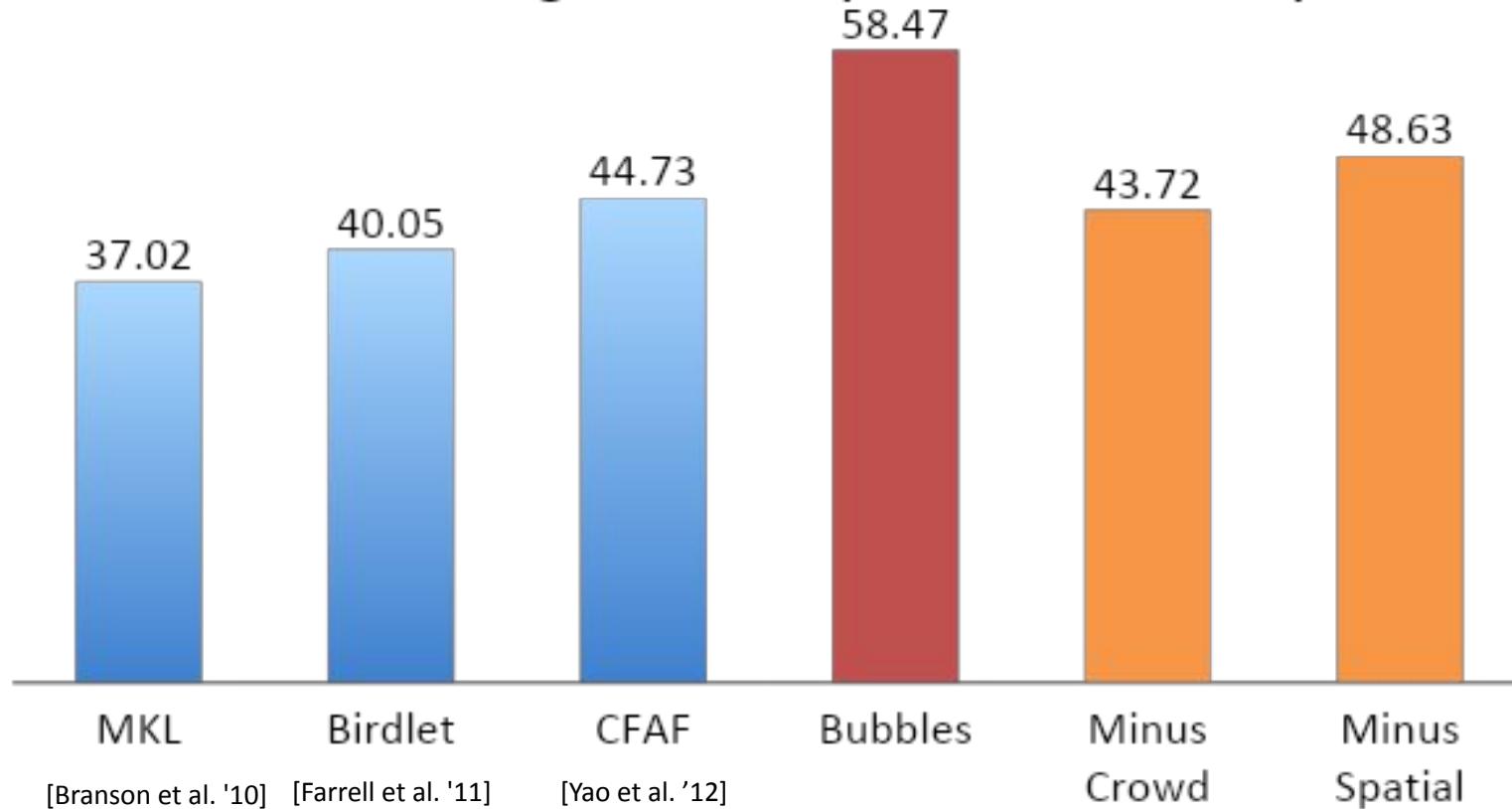
[Pinto et al. '09]

[Perronnin et al. '10]

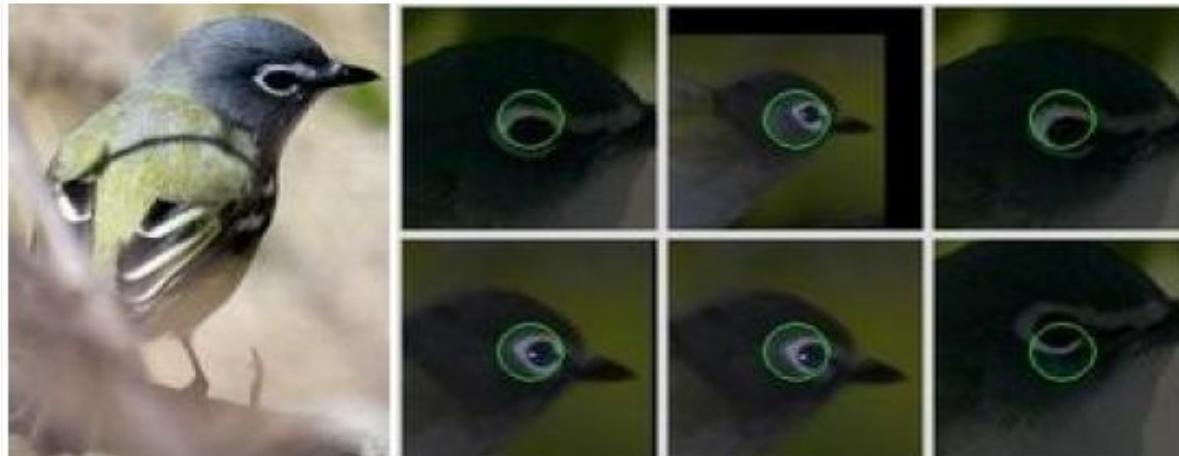
[Li et al. '10]

[Coates & Ng '11].

Mean Average Precision (Caltech-USCD-Bird)



Top Activated Bubbles



Crowd-Machine Collaboration



BubbleBank



Bubbles Game



Answer

