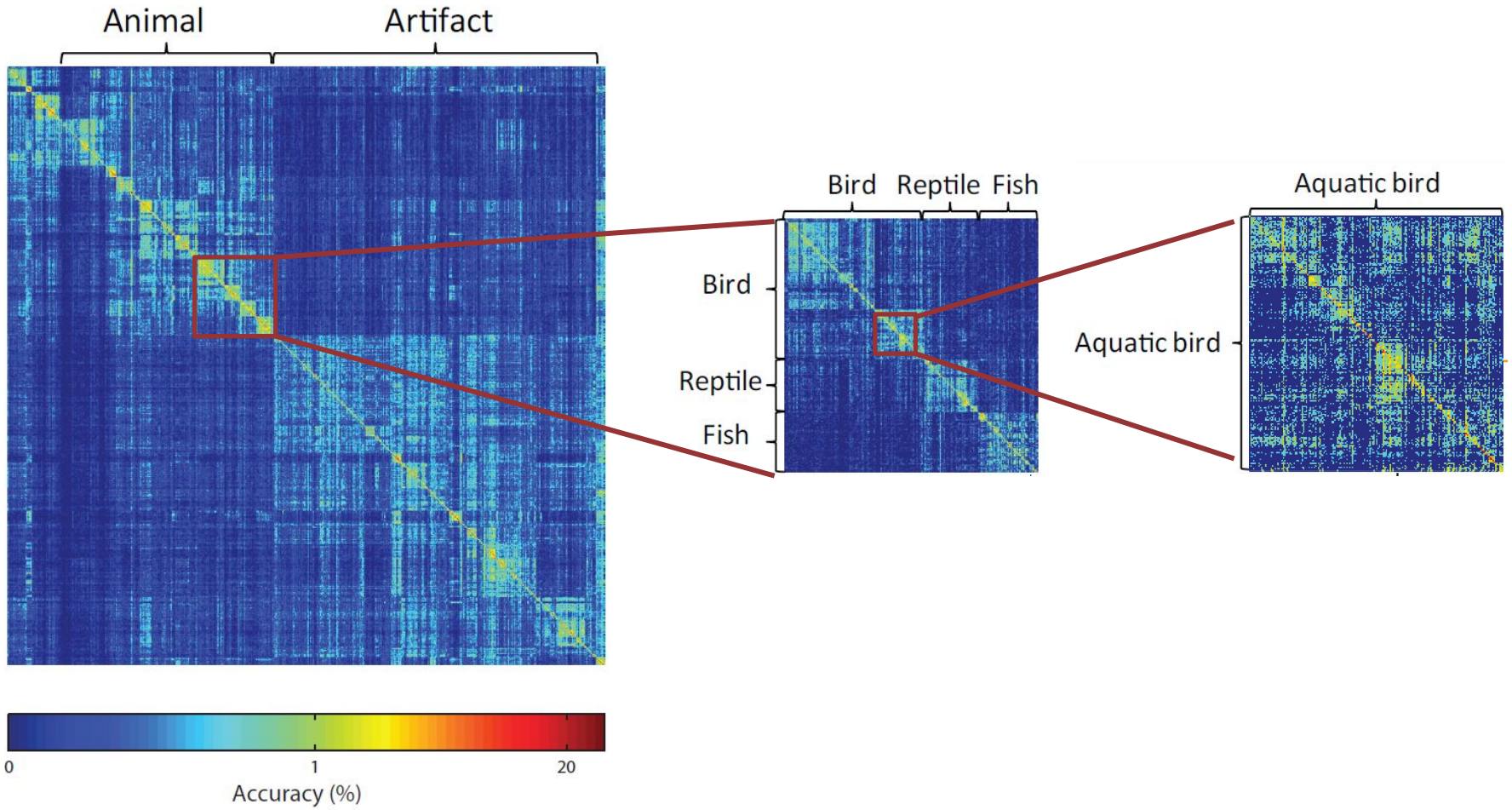
Recitation

Large Scale Recognition & Visual Ontologies

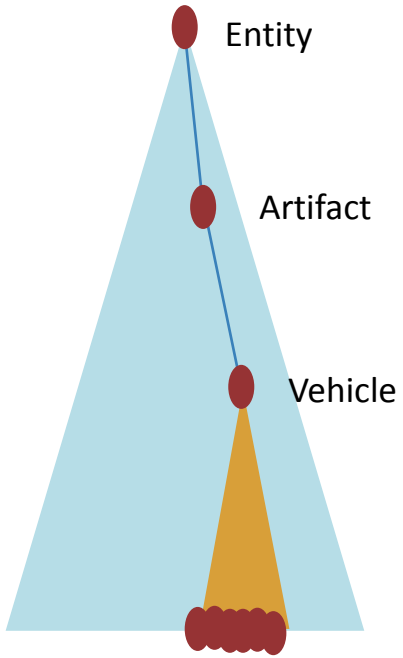
Challenges

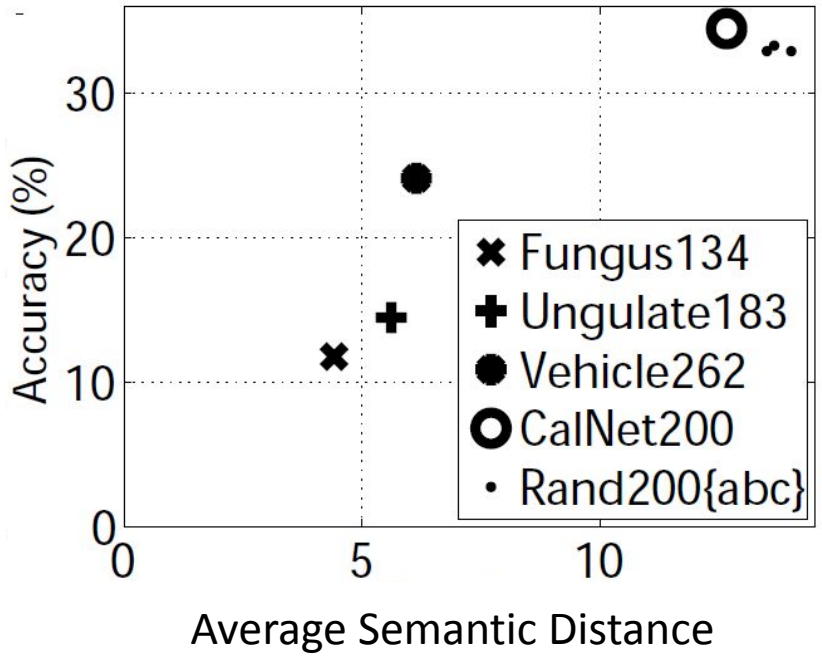
- Semantic hierarchy
- Fine-grained classes

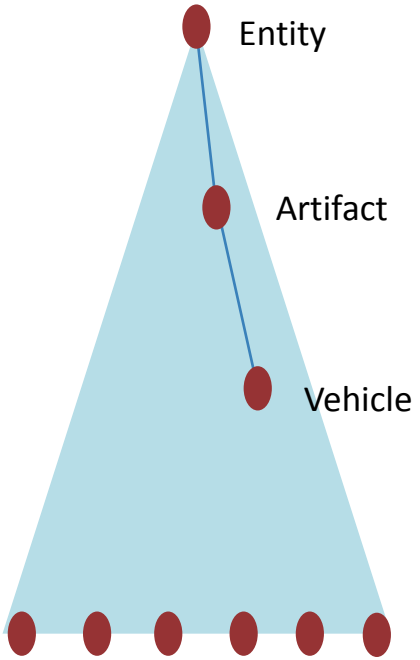
Learn to Classify 10K Classes



Fine-grained categories are a lot harder



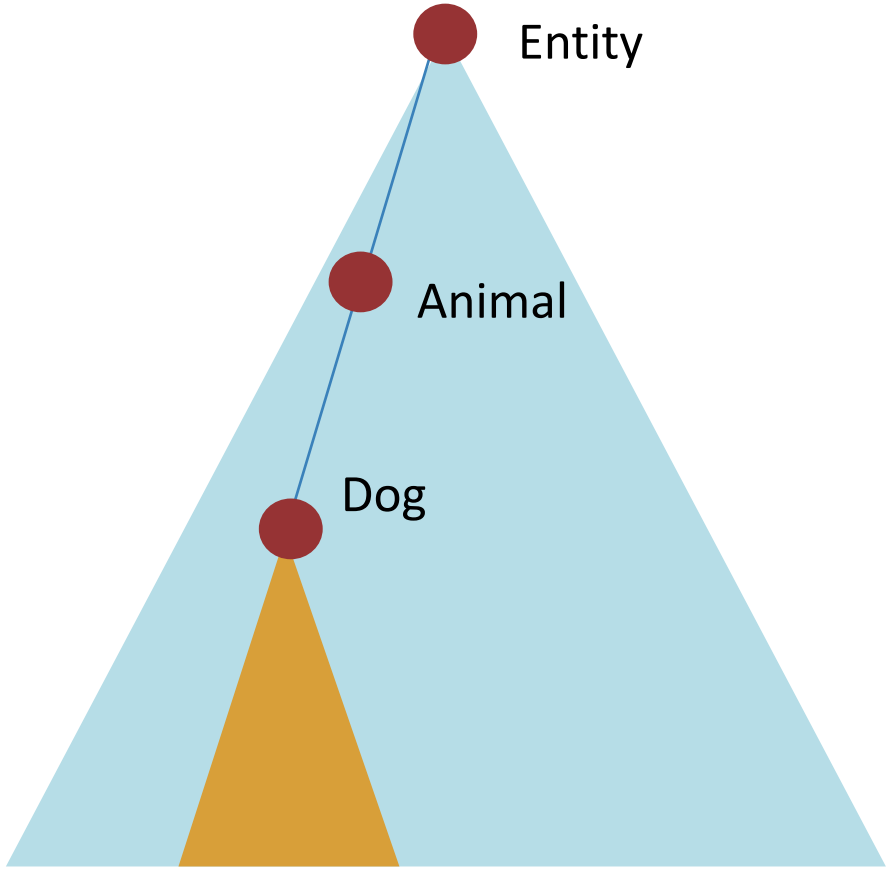




Finer **Coarser**

Deng, Berg, Li, & Fei-Fei, *ECCV2010*

Fine-Grained Recognition



What breed is this dog?

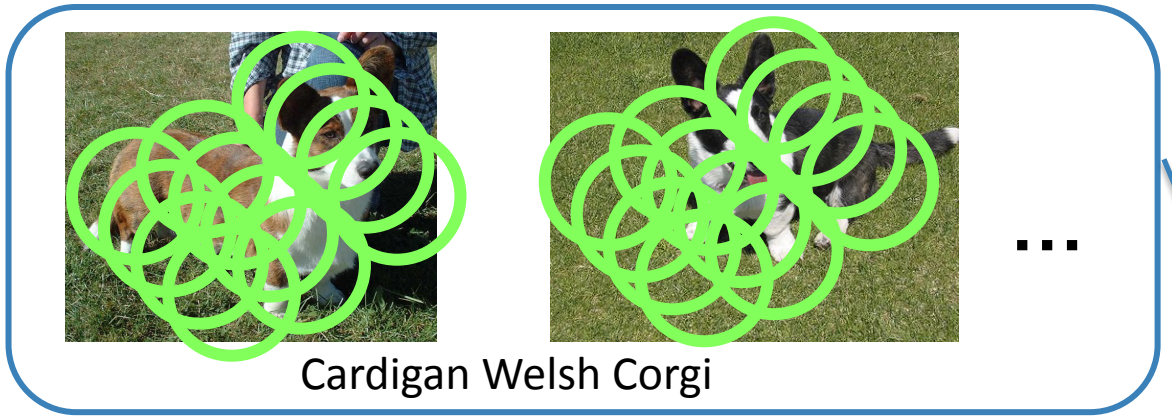
- Basic category known.
- Object already localized.

Fine-Grained Recognition

What breed is this dog?

Key: Find the right features.

Fine-Grained Recognition

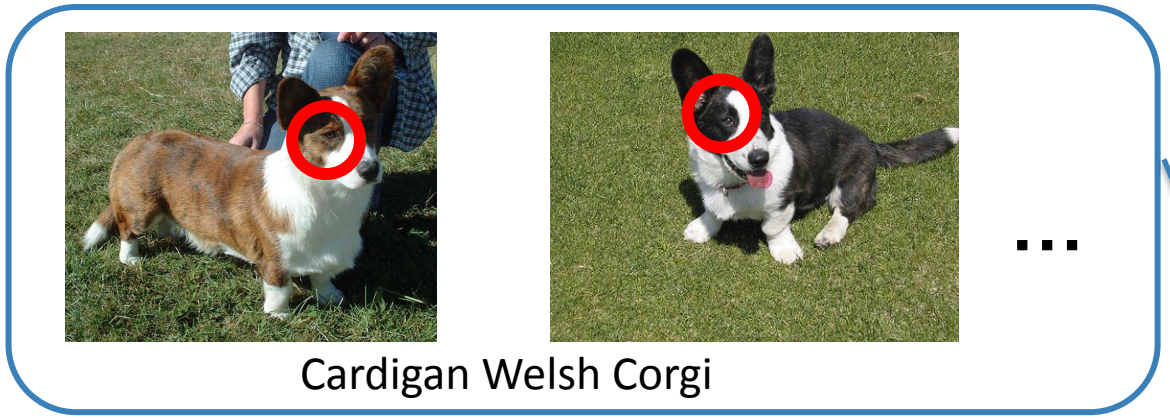


Existing Work

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



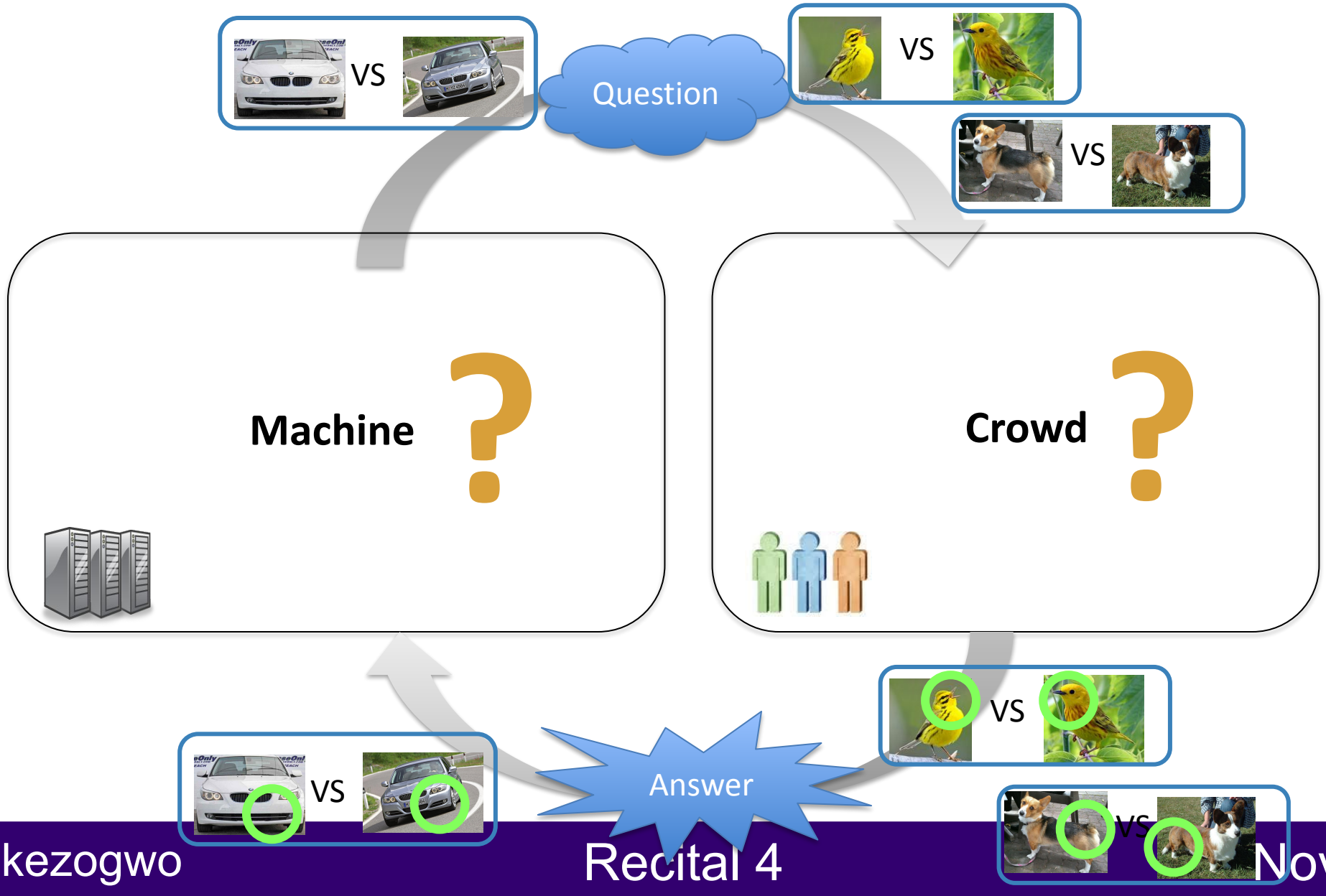
Existing Work

Feature Selection from all possible locations

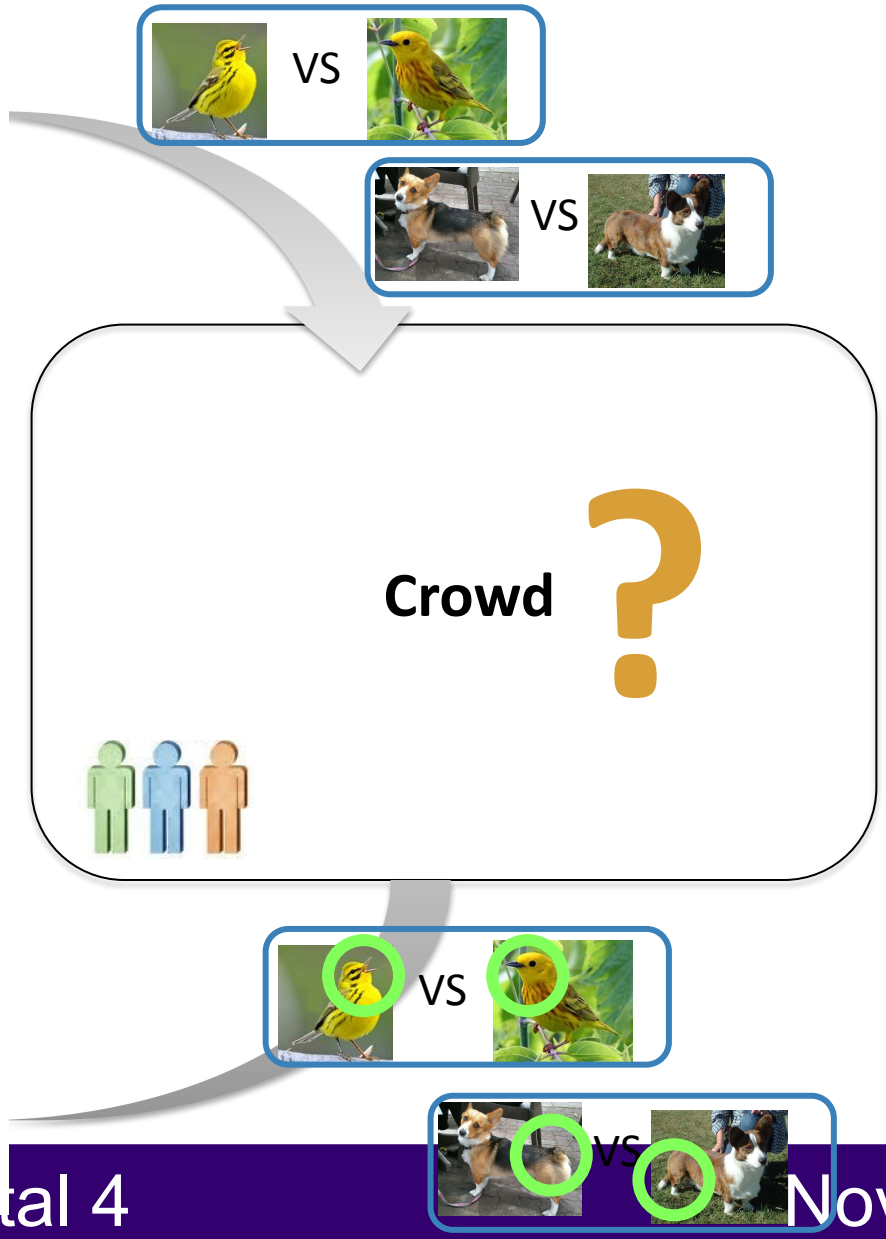
[Branson et al. '10]
[Bo et al. '10]
[Farrell et al. '11]
[Yao et al. ’11]
[Yao et al. ’12]

Can fail to find the right features.

Crowd-Machine Collaboration



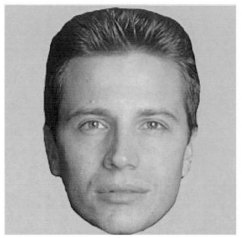
Crowd-Machine Collaboration



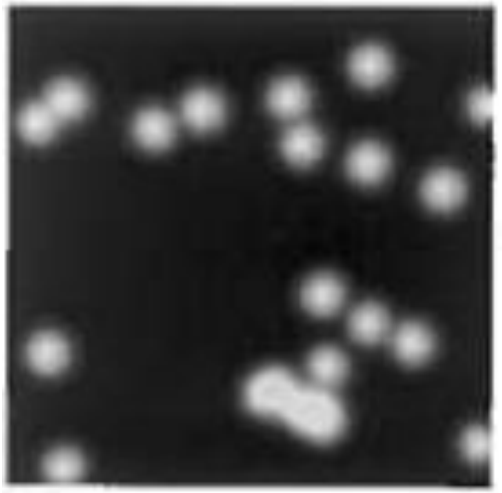
Bubbles [Gosselin & Schyns, ’01]

Smiling

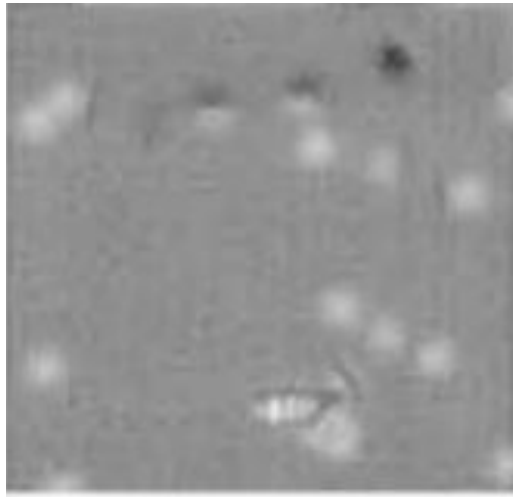
VS



Neutral



Random Bubble Mask

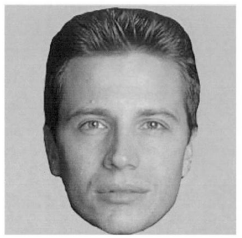


?

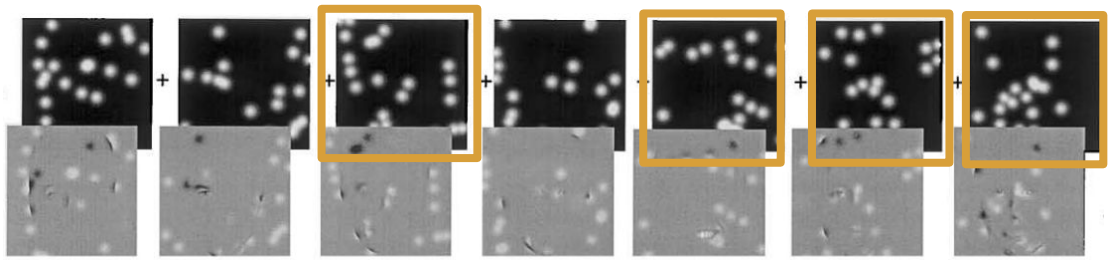
Bubbles [Gosselin & Schyns, ’01]

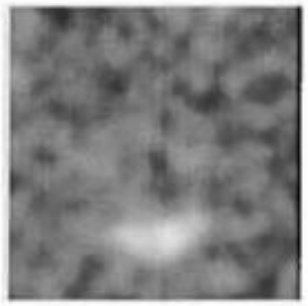
Smiling

VS



Neutral





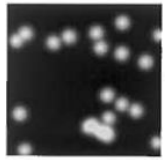
Too costly

Annotation Rationale

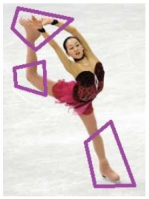
[Donahue & Grauman ’11]

What makes the form of the skater good?

No easy quality assurance

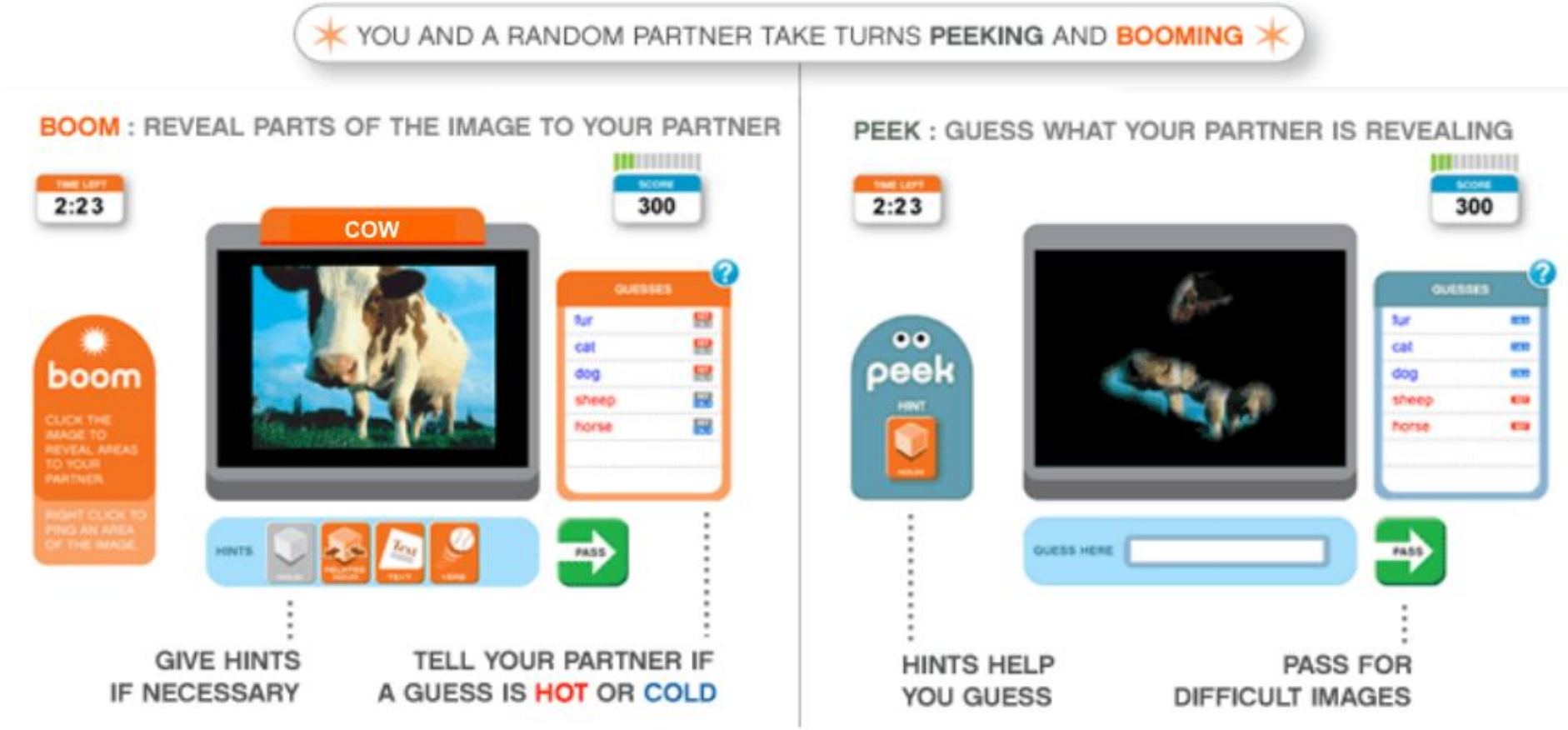


Gosselin & Schyns ’01



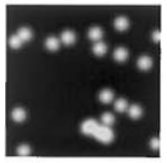
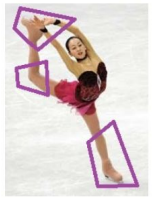
Donahue & Grauman ’11

Cost Effective	✗	✔	GAMES
Quality Assurance	✔	✗	



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**.**

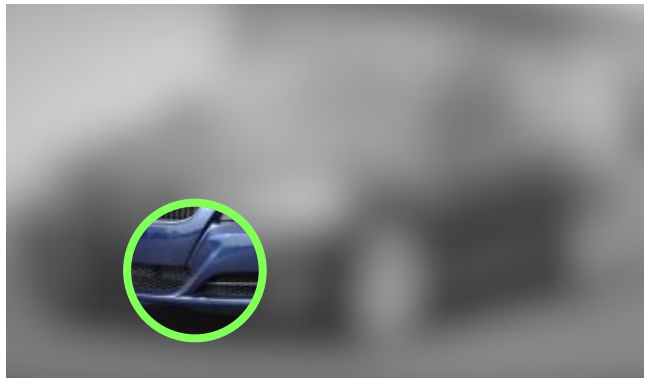
Let’s play

?

Let’s play

?

Let’s play



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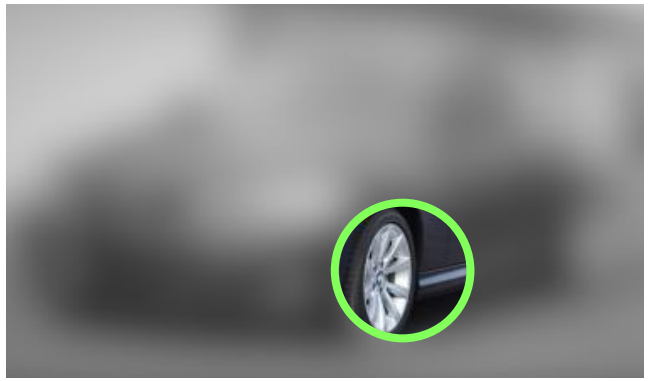
Let’s play



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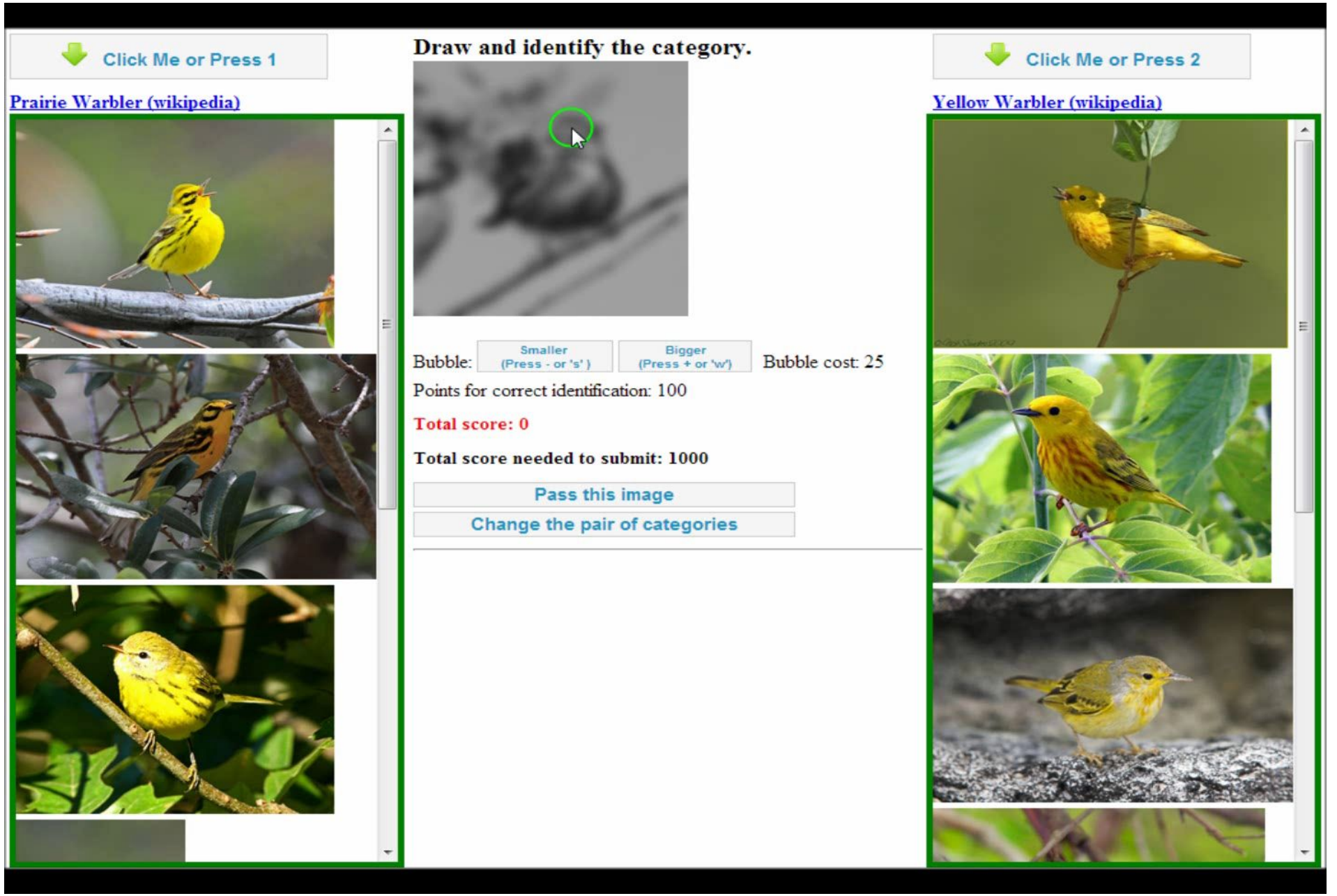
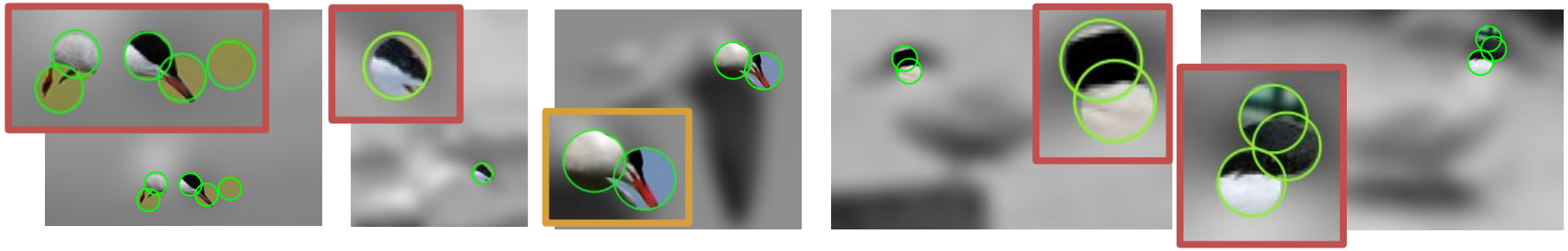
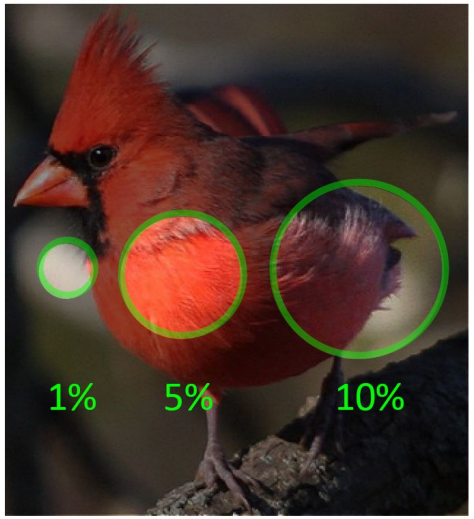

Click Me or Press 1
Prairie Warbler (wikipedia)
Draw and identify the category.
Bubble:
Smaller (Press - or 's')
Bigger (Press + or 'w')
Bubble cost: 25
Points for correct identification: 100
Total score: 0
Total score needed to submit: 1000
Pass this image
Change the pair of categories
Click Me or Press 2
Yellow Warbler (wikipedia)

Crowd Picked Bubbles (AMT for now)





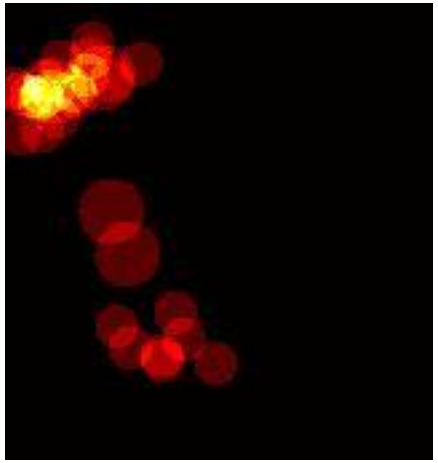
Bubble sizes as proportions of image

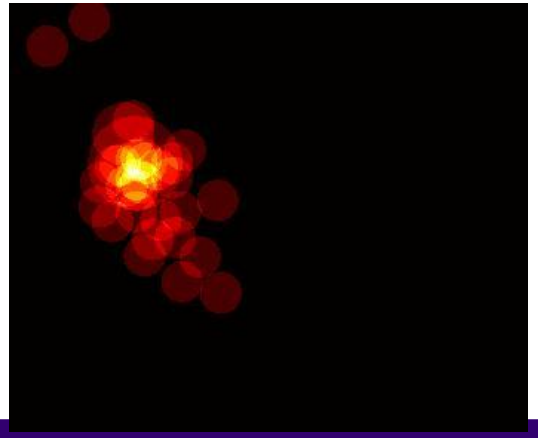
70% of games are successful

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

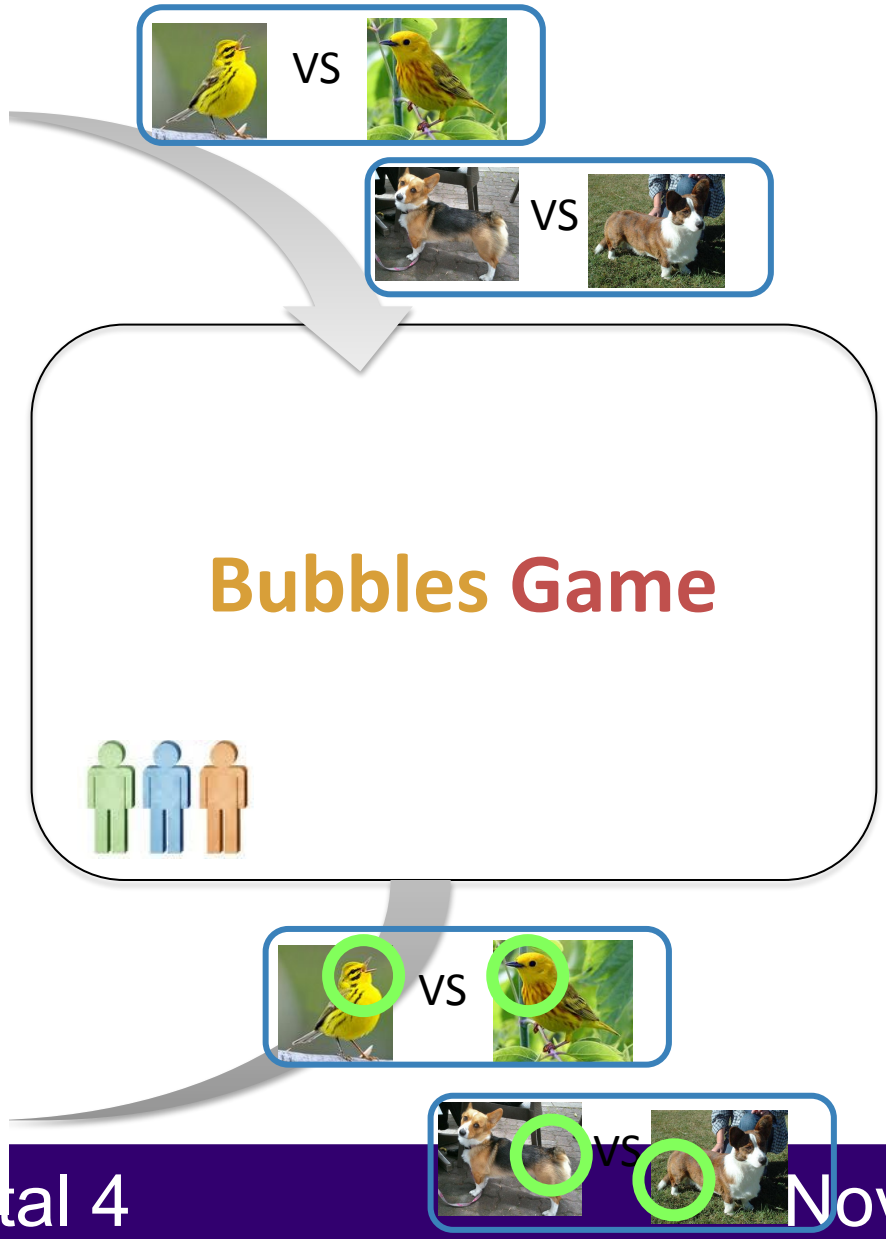
Deng, Krause, & Fei-Fei, *CVPR2013*

Bubble Heatmaps





Crowd-Machine Collaboration



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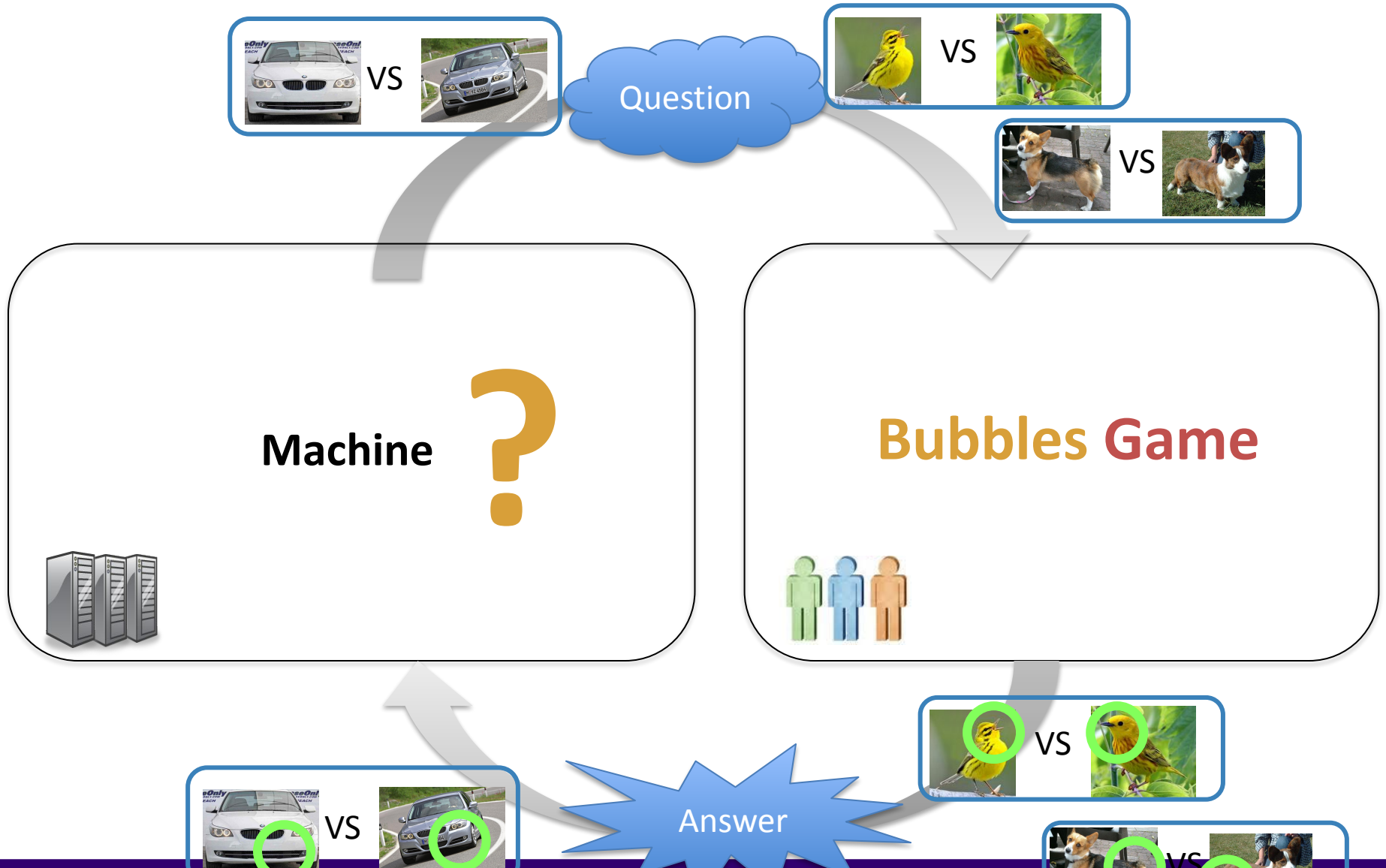
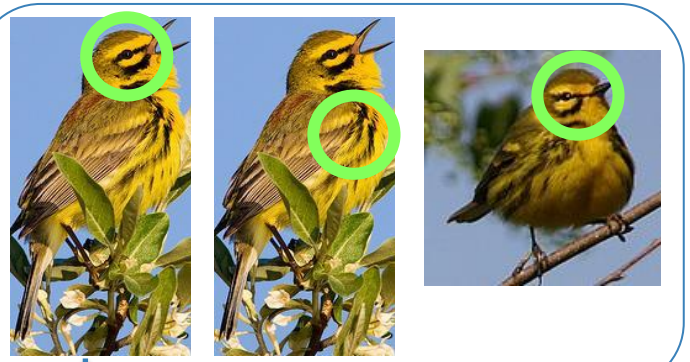


BubbleBank Representation

A test image

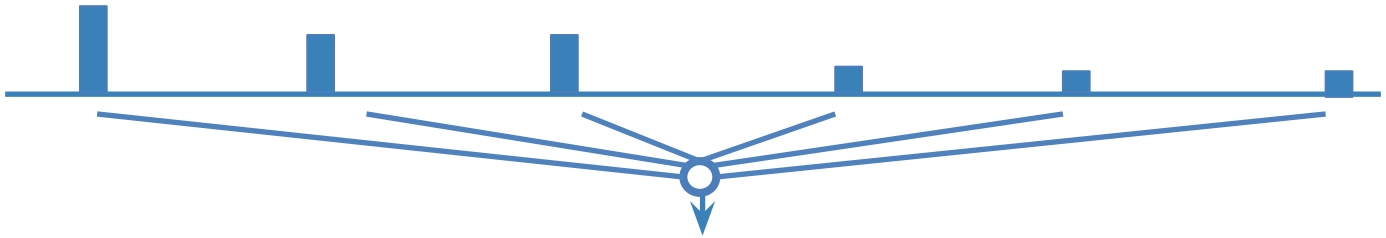
Crowd-picked Bubbles (on training)

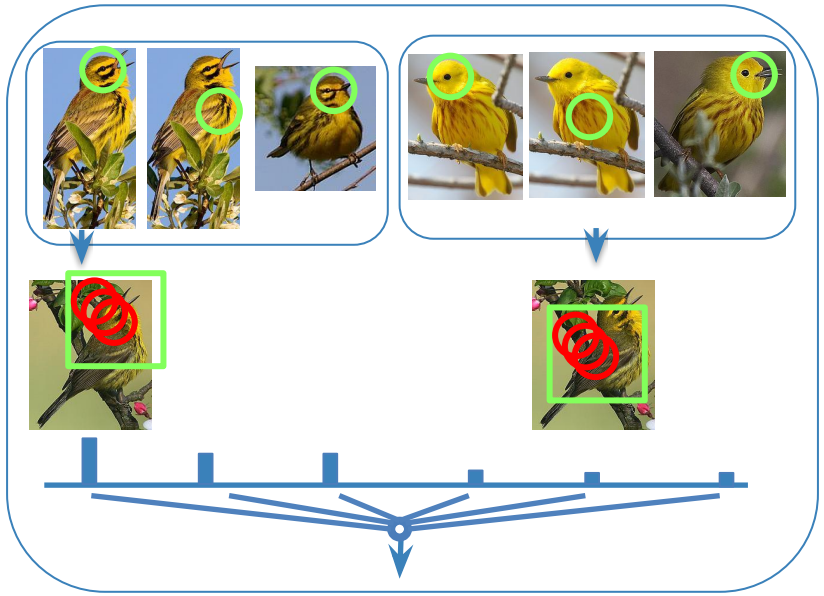


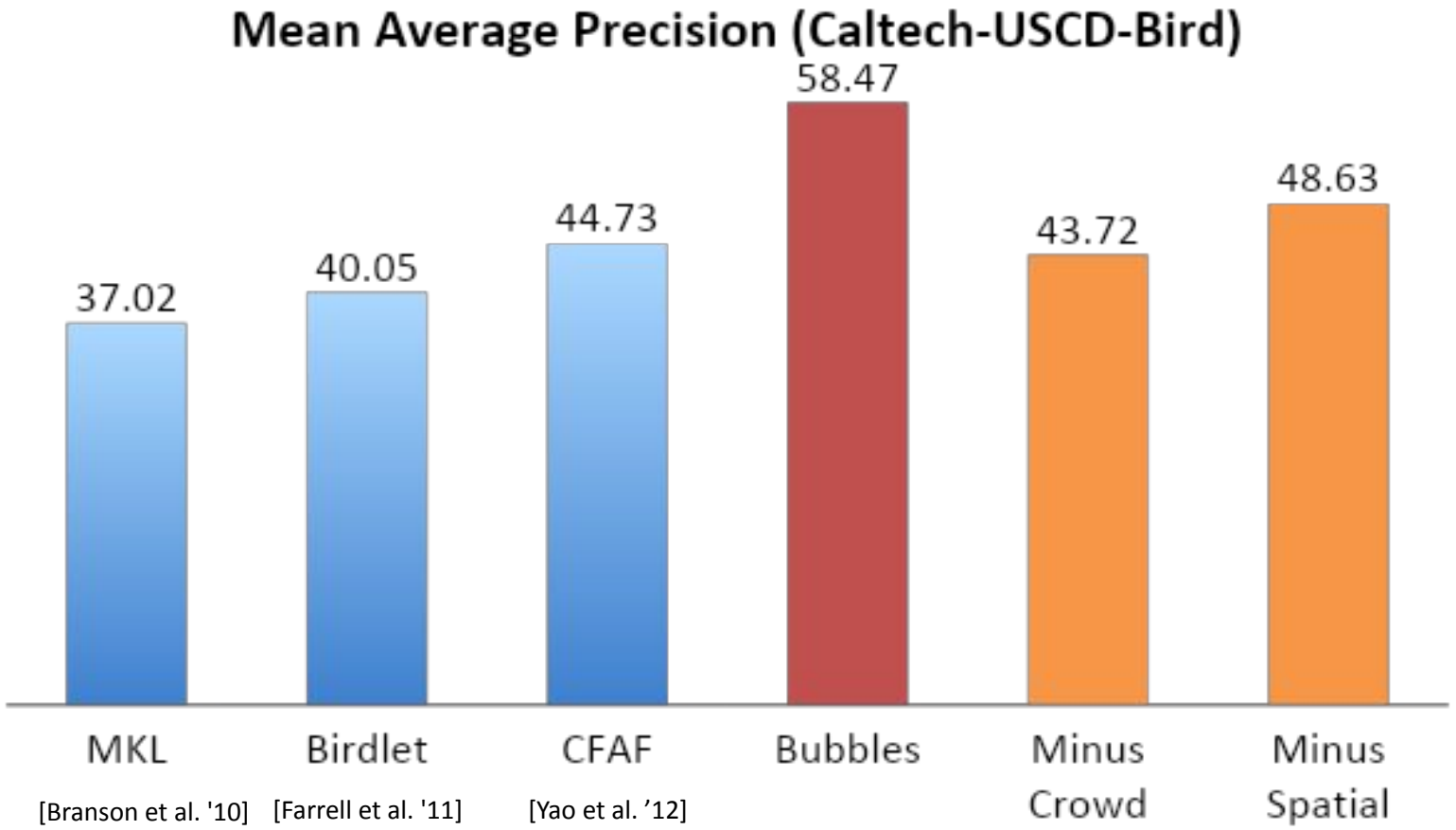
Bubble Matching

Max-pooling

Linear SVM

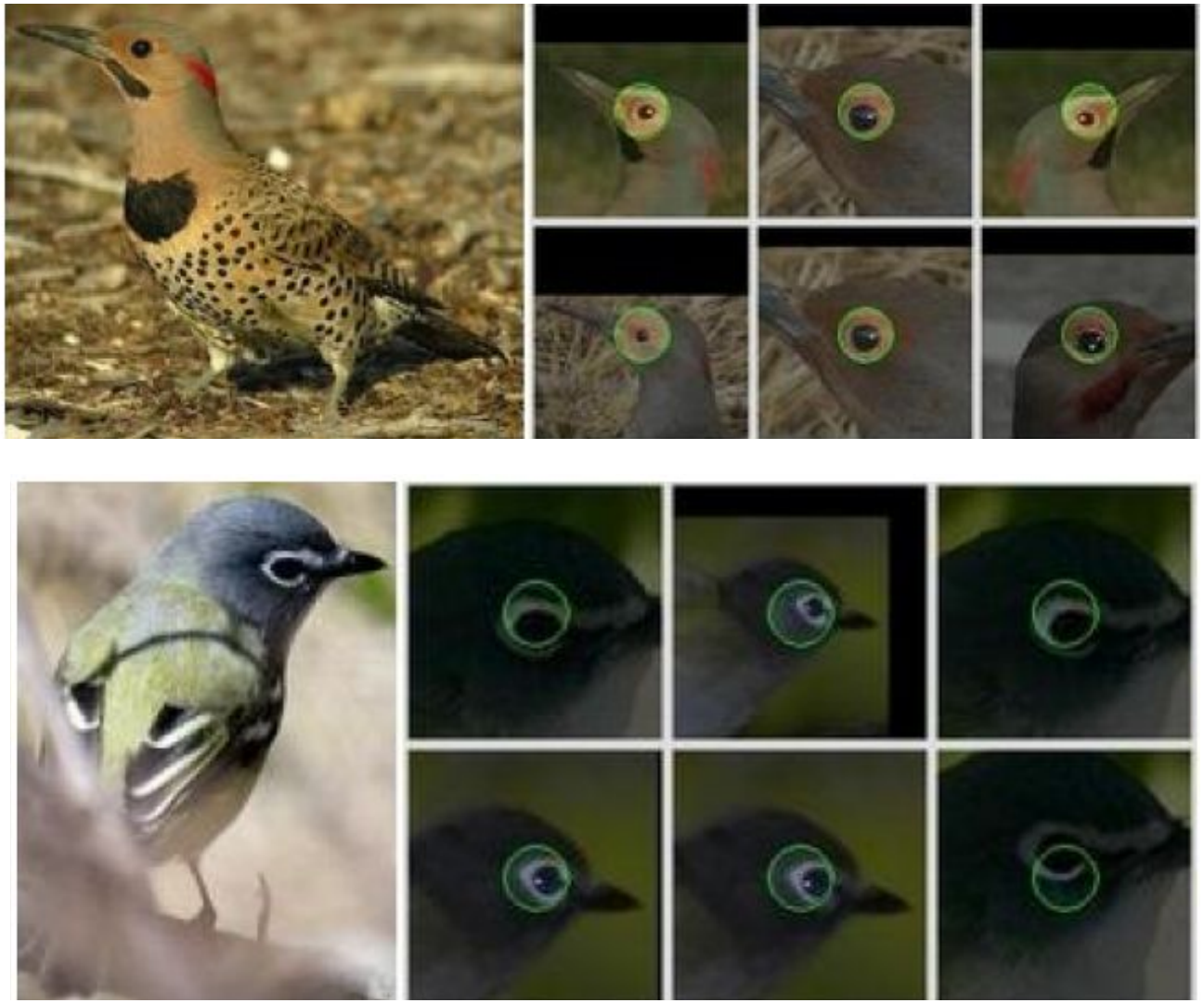


	V1-like models	BubbleBank	Prior Work
Templates		**Crowd picked**	Clustering random patches
Pooling		**Pool over a single region (spatial prior)**	Pool over multiple uniformly sampled regions (e.g. SPM)
		[Deng et al. '13]	[Lecun et al. '98] [Csurka et al. '04] [Lazebnik et al. '06] [Wang et al. '09] [Lee et al. '09] [Pinto et al. '09] [Perronnin et al. '10] [Li et al. '10] [Coates & Ng '11]. [Yao et al. '12]



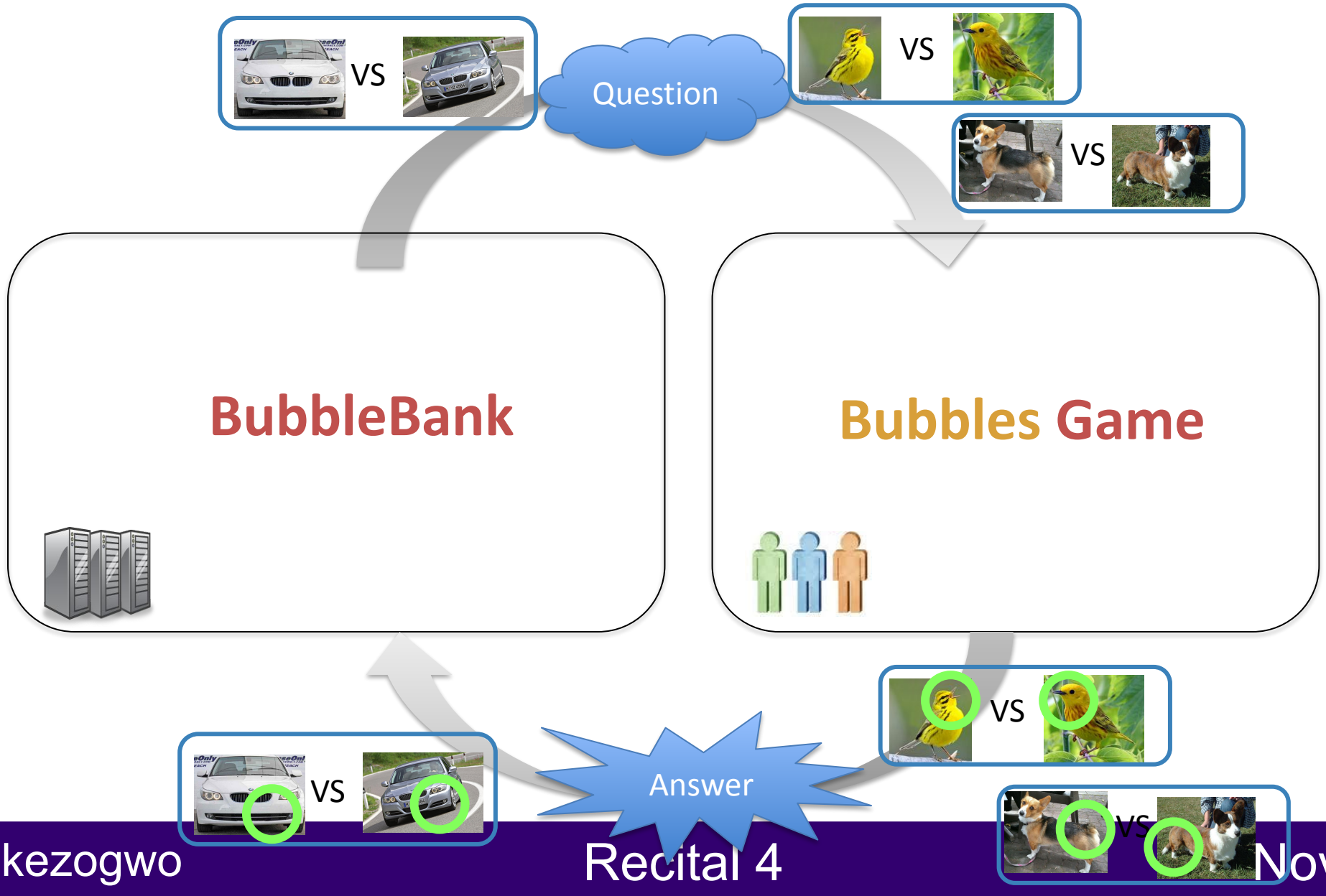
Deng, Krause, & Fei-Fei, *CVPR2013*

Top Activated Bubbles



Deng, Krause, & Fei-Fei, *CVPR2013*

Crowd-Machine Collaboration



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- Semantic hierarchy
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