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Direct or indirect match? Selecting right concepts for zero-example case

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Direct or Indirect Match?

Selecting Right Concepts for Zero-Example Case

Speaker: Yi-Jie Lu

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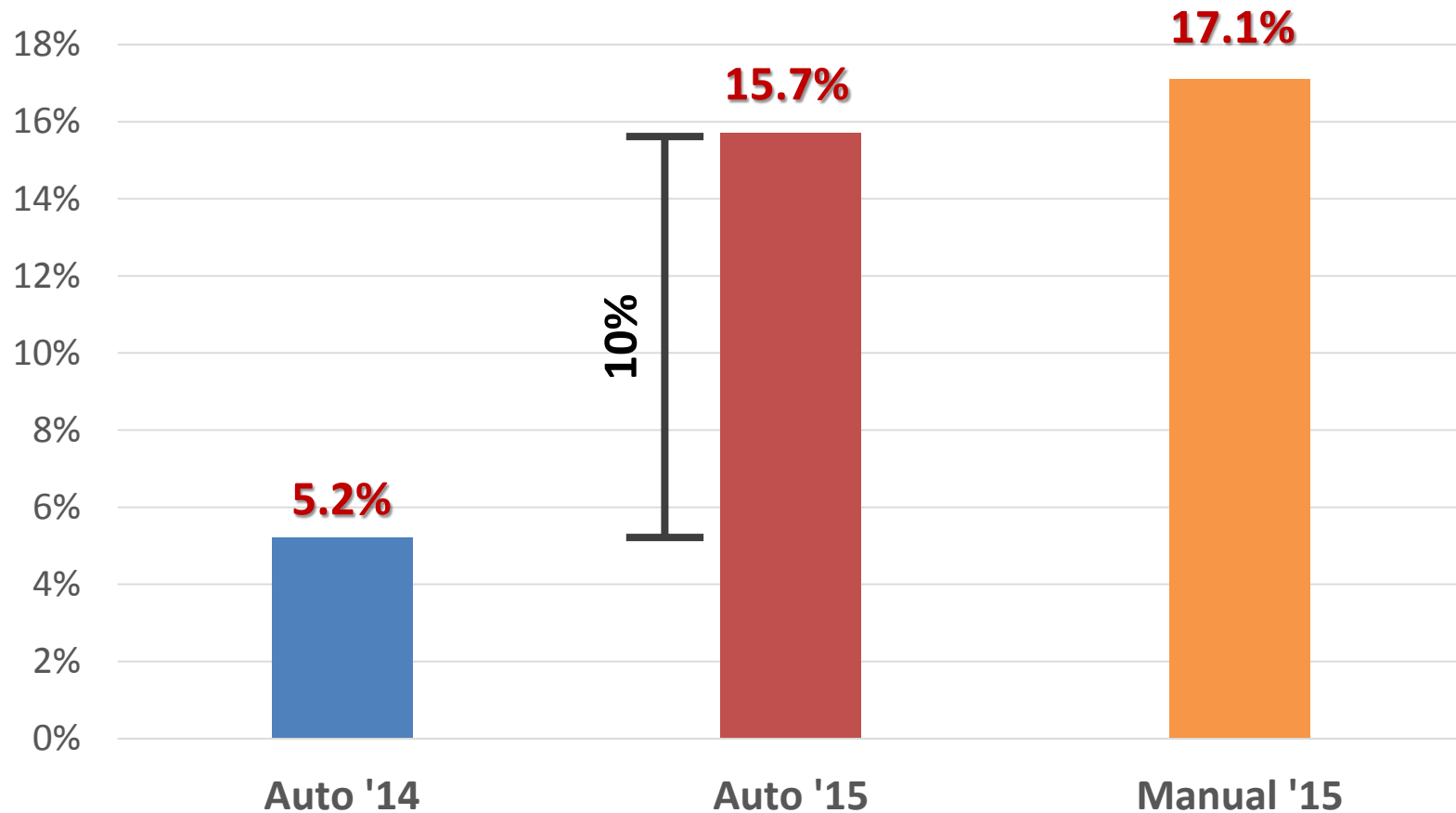
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Outline

- **Introduce overall performance in 2015**
- **Difference with 2014 submission**
 - An enlarged concept bank
 - Strategy to pick up the right concepts from concept bank

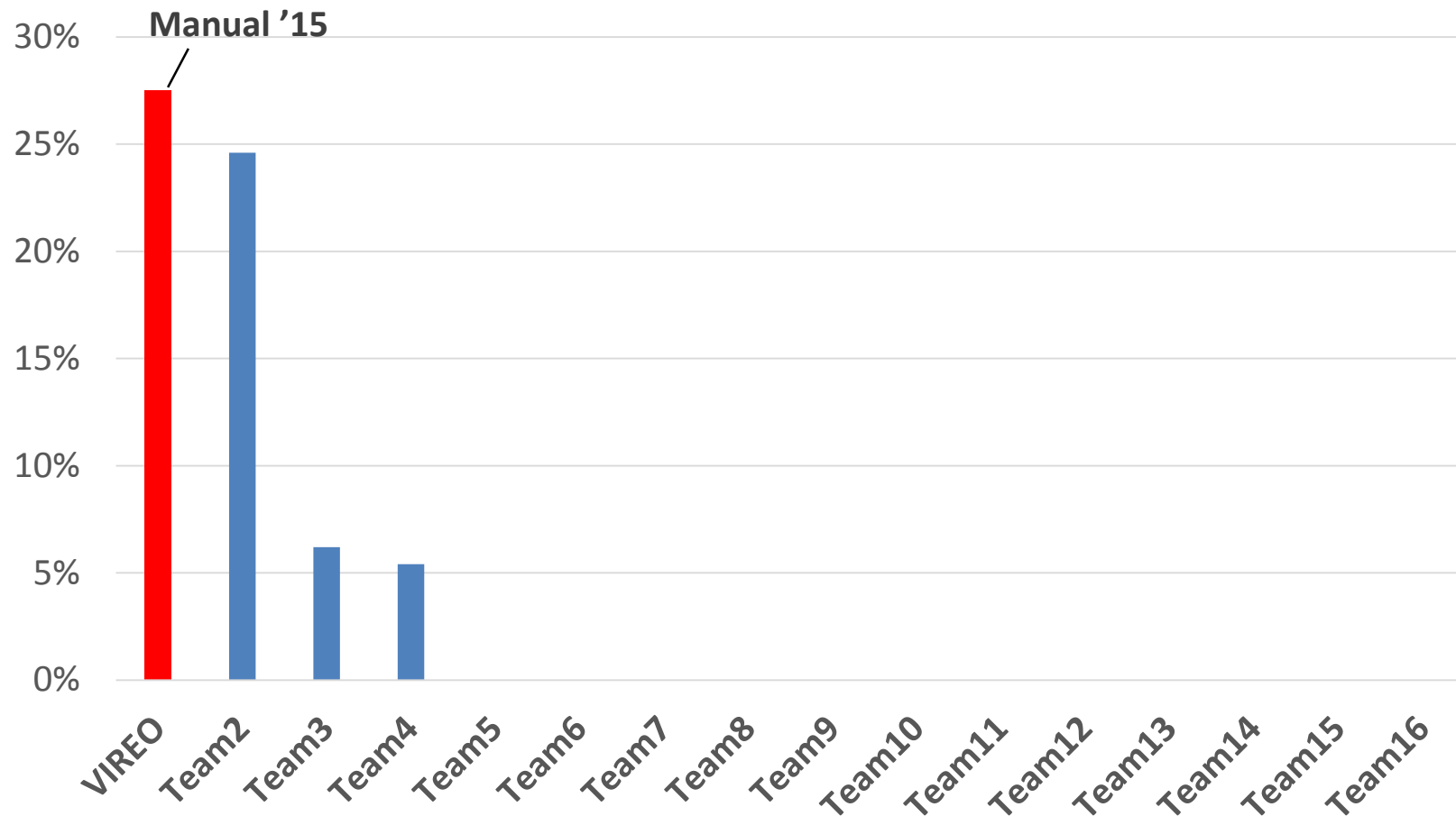
Achievements in 2015

PS_EvalFull_000Ex MAP



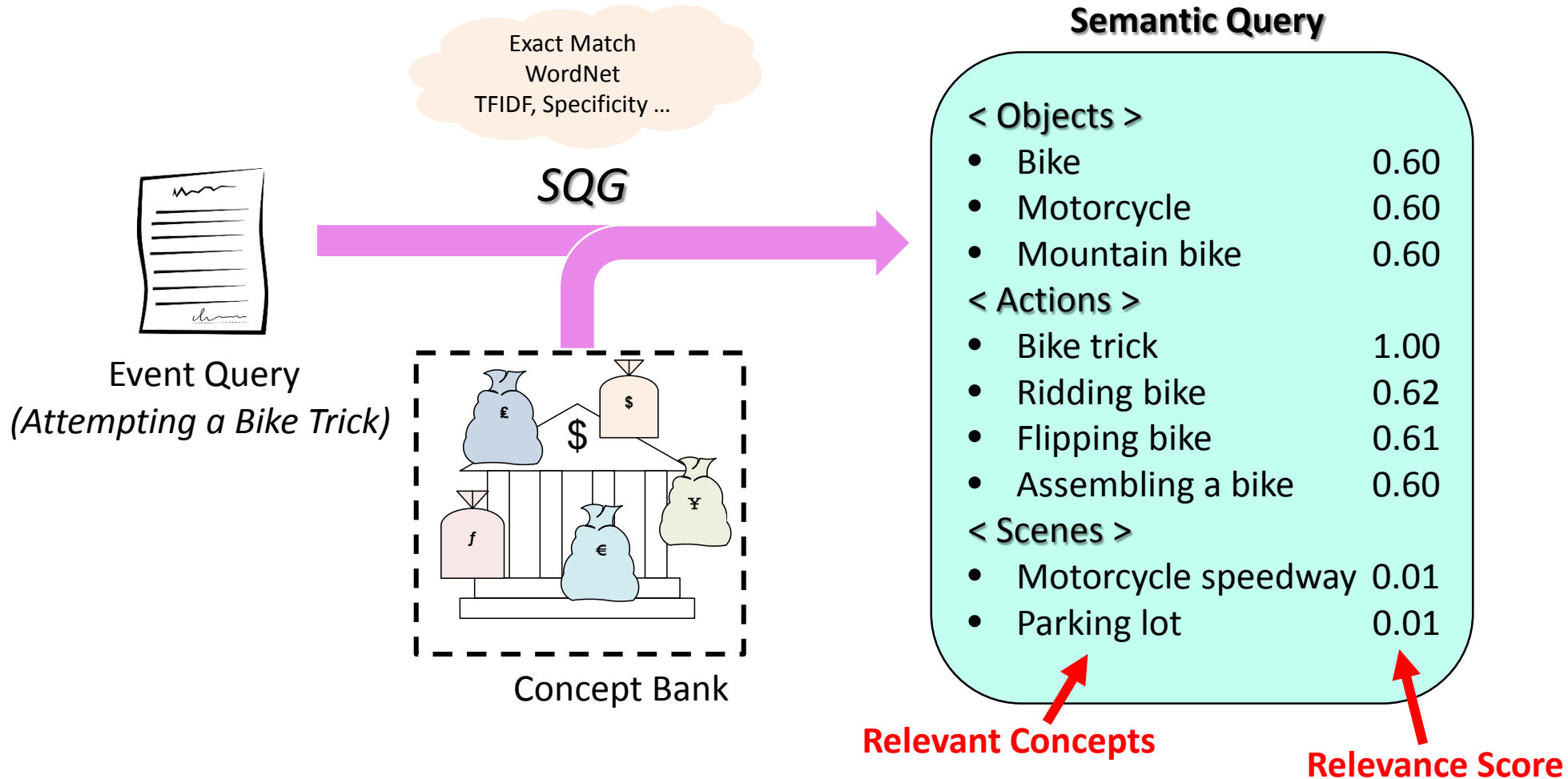
Achievements in 2015

PS_EvalSub_000Ex MAP



Important changes from '14?

Recall the Semantic Query Generation (SQG):



Recall our 2014 findings

Extinguishing a Fire

Missing key
concepts



[Fire extinguisher]



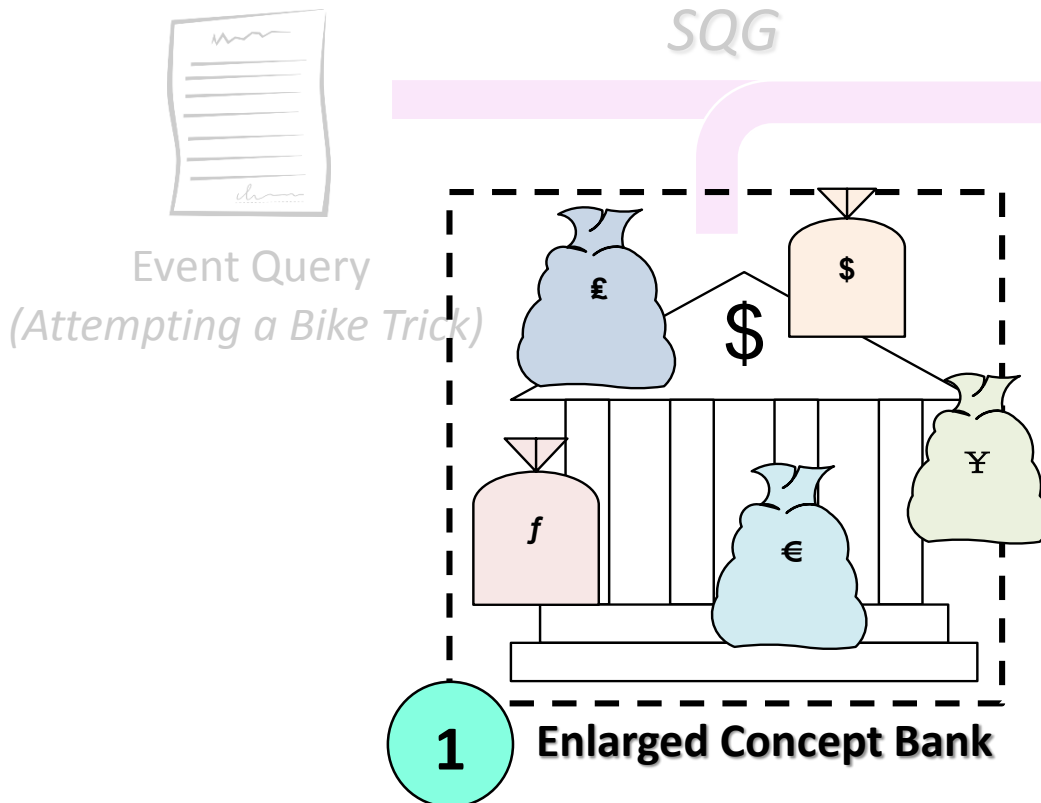
[Firefighter]

Exact match

>>

~~WordNet/ConceptNet~~

● **What we do?**



Semantic Query

< Objects >

- ~~• Bike 0.60~~
- ~~• Motorcycle 0.60~~
- ~~• Mountain bike 0.60~~

< Actions >

- Bike trick 1.00
- ~~• Ridding bike 0.62~~
- Flipping bike 0.61
- ~~• Assembling a bike 0.60~~

< Scenes >

- ~~• Motorcycle speedway 0.01~~
- ~~• Parking lot 0.01~~

2 Manually Refined Query

Enlarge the concept bank

2014

- Research set (497)
- ImageNet ILSVRC (1000)
- SIN (346)

CNN

CNN

CNN

2015

- + Sports (487)
- + FCVID (239)
- + Places (205)

CNN

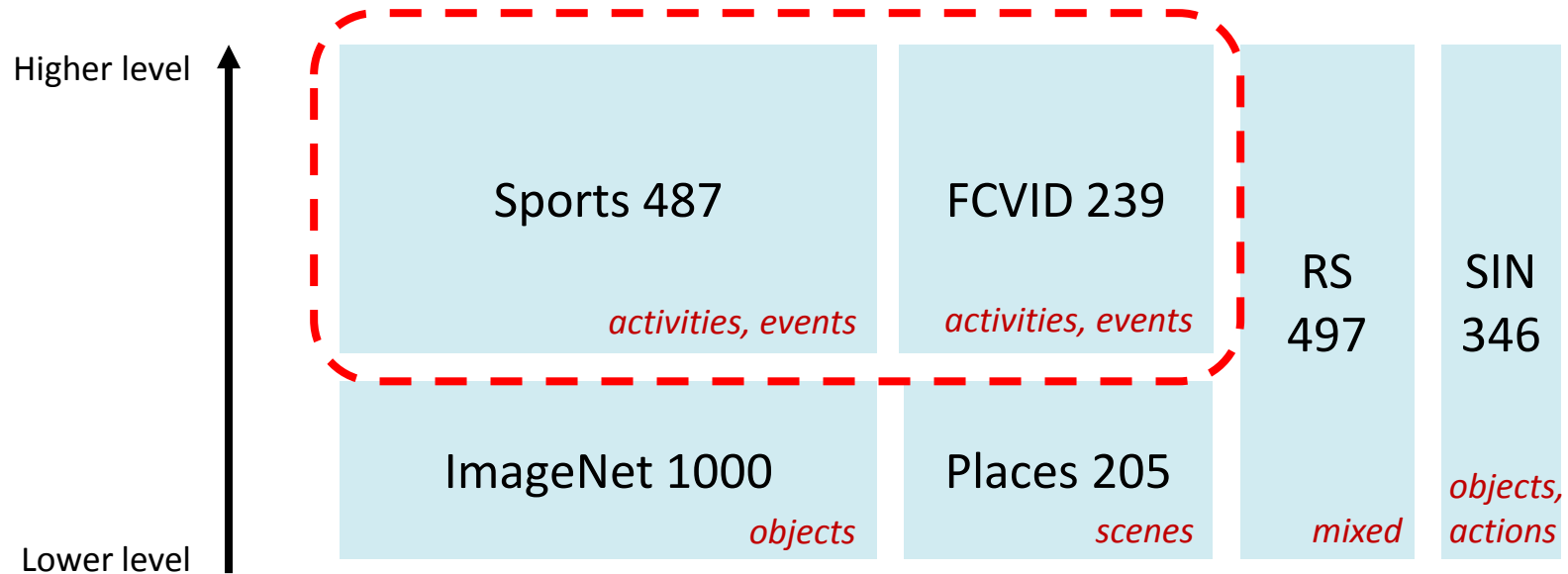
SVM

CNN

SFRISP (2774)

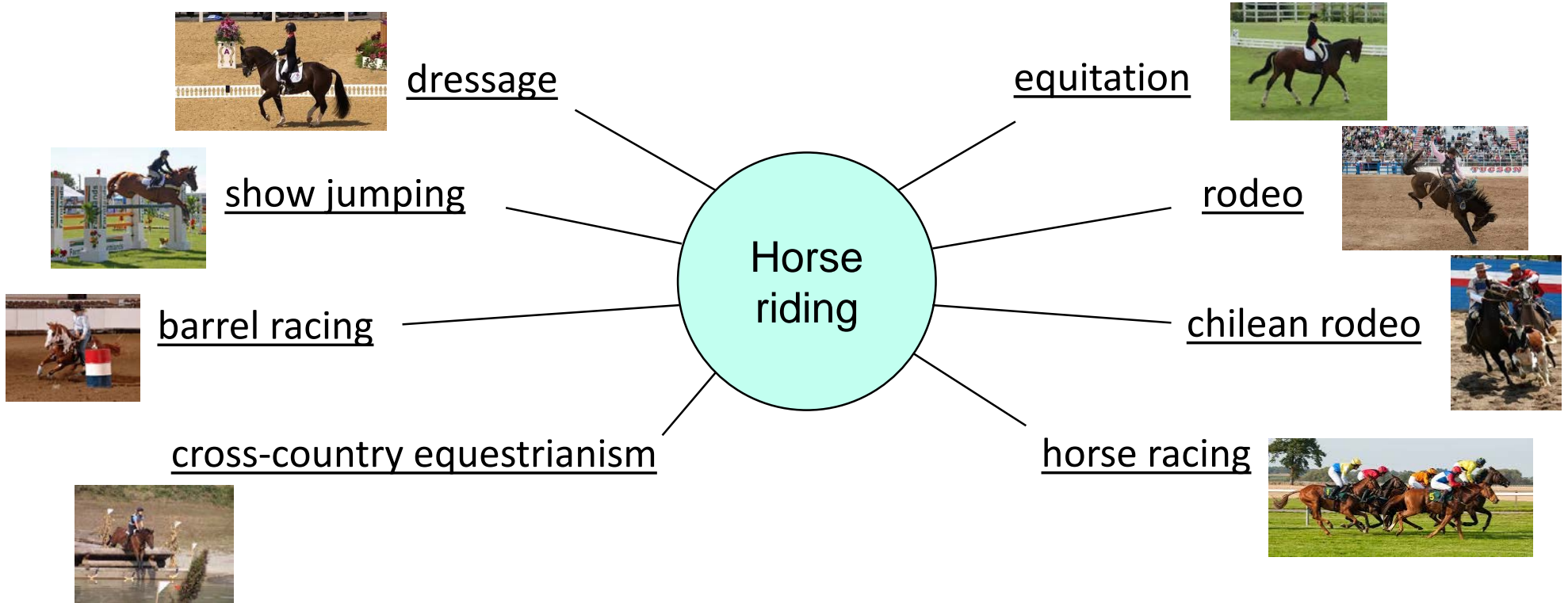


Concept Bank Review



Concept Bank Review

- **Sports (487) [1]**



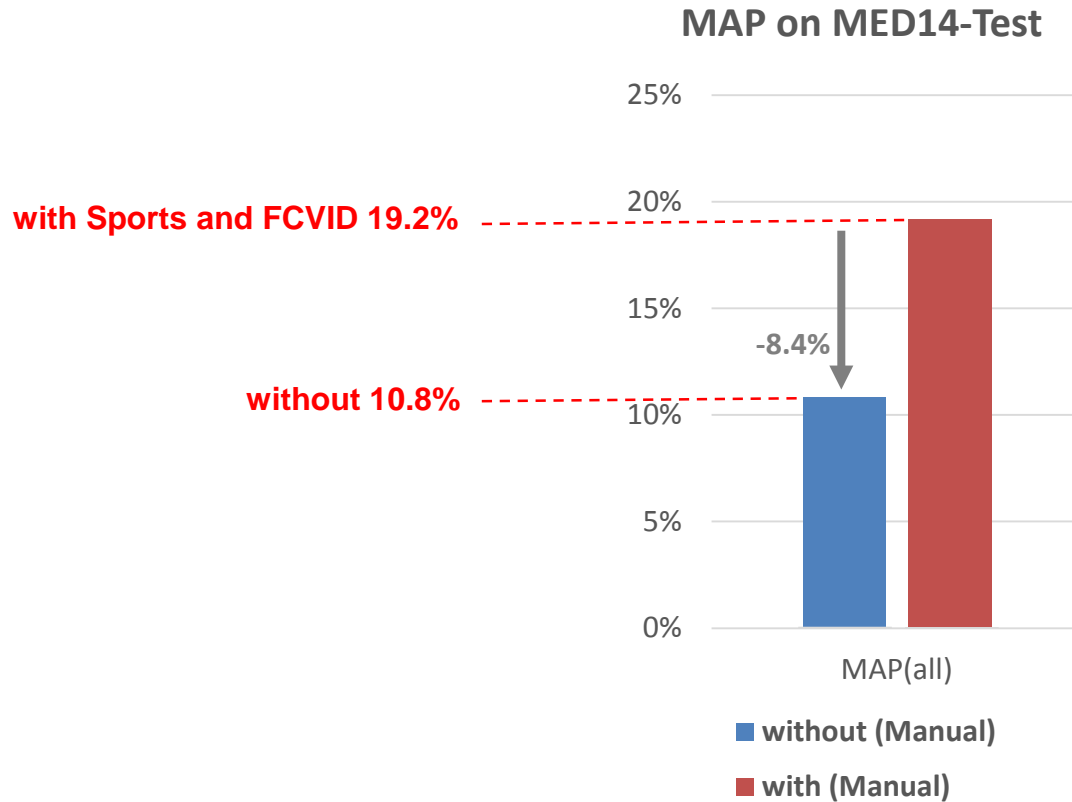
[1] L. Jiang, S.-I. Yu, D. Meng, T. Mitamura, and A. G. Hauptmann, "Bridging the ultimate semantic gap: A semantic search engine for internet videos," in *International Conference on Multimedia Retrieval*, 2015.

Concept Bank Review

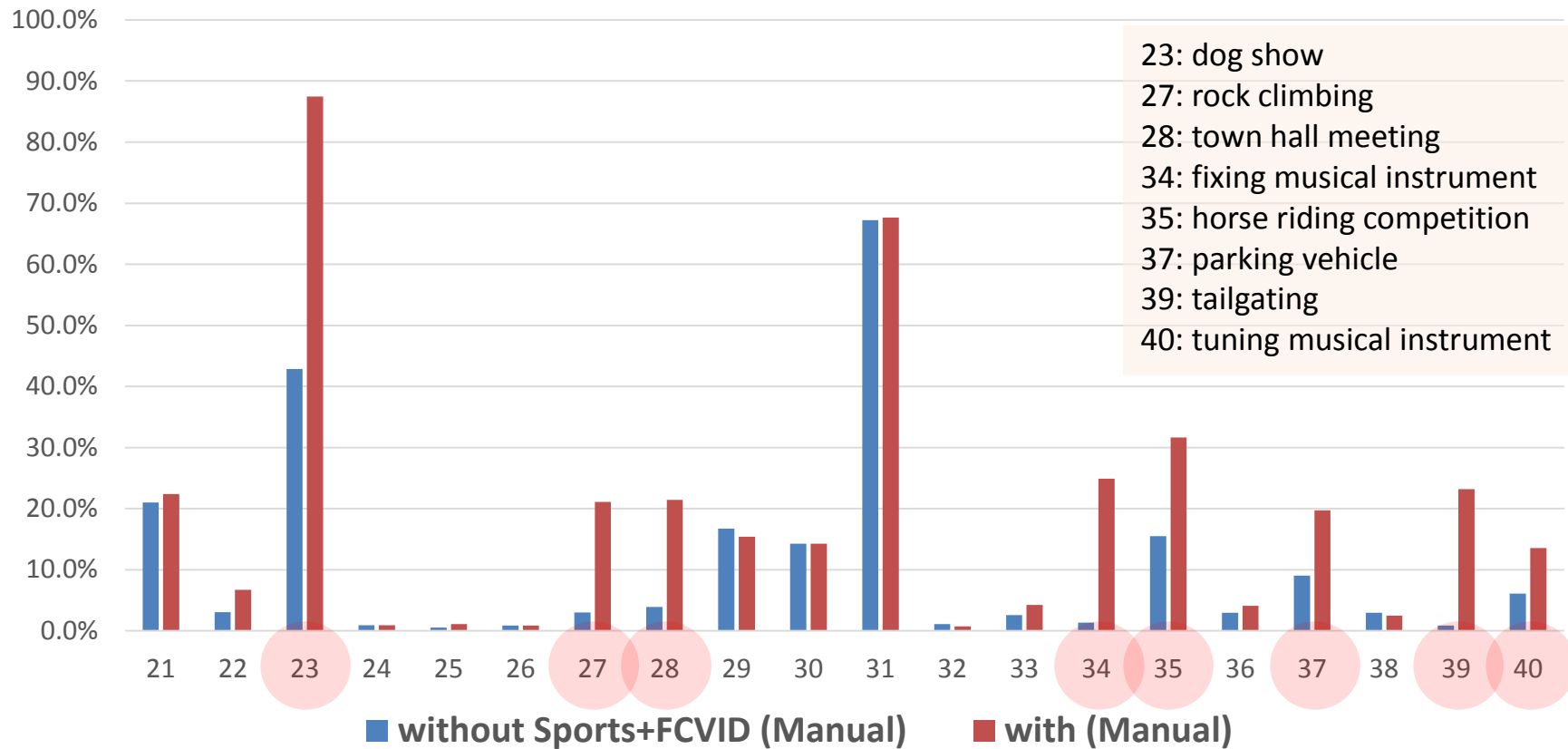
- **FCVID (239)**

- A large dataset contains high-level activities/events
 - *accordion performance*
 - *American football professional*
 - *bungee jumping*
 - *car accidents*
 - *fire fighting*
 - *playing frisbee with dog*
 - *rock climbing*
 - *wedding ceremony*

Contributions of Sports and FCVID



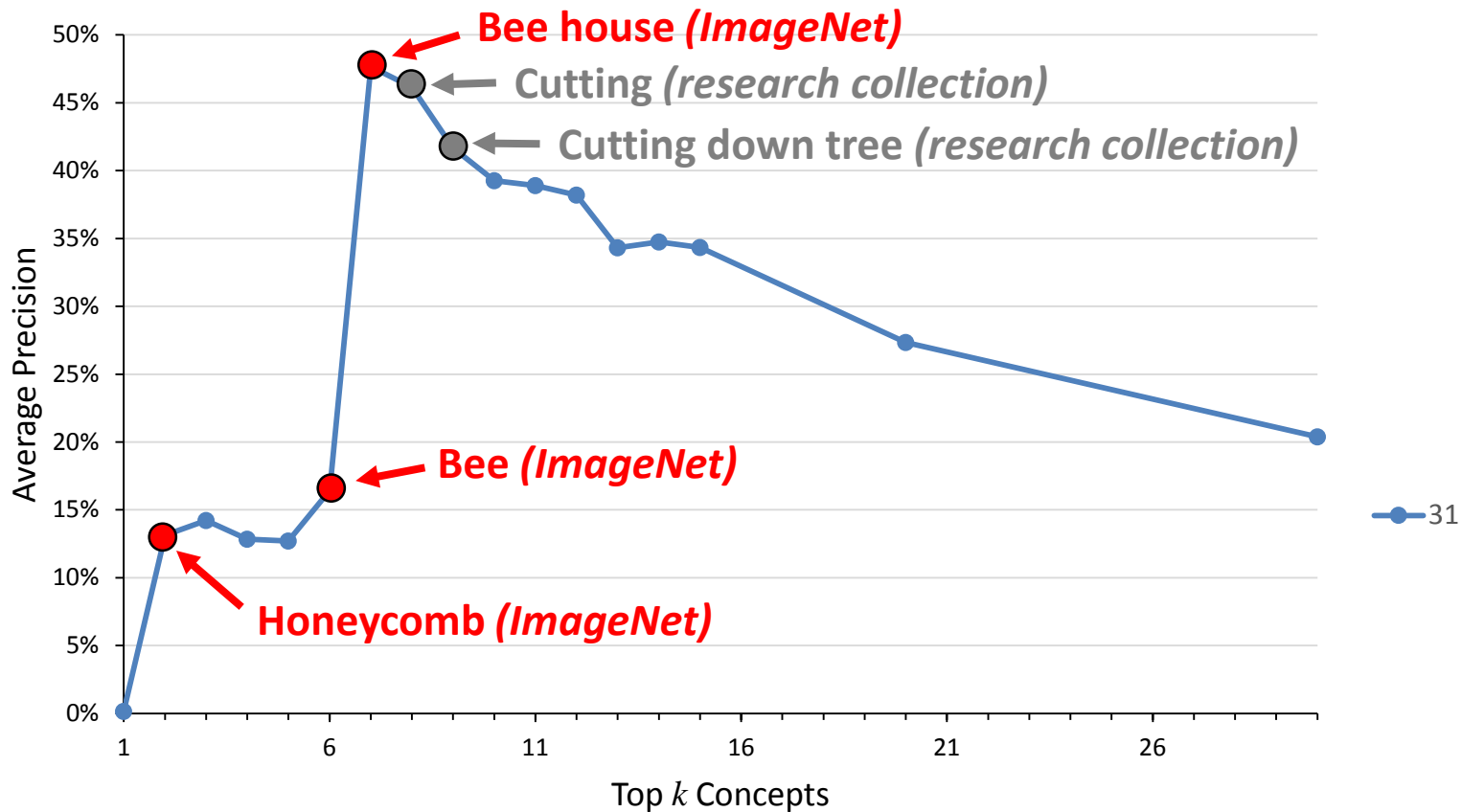
Contribution of Sports+FCVID (726 concepts) on MED14-Test



In combination of 6 different resources:

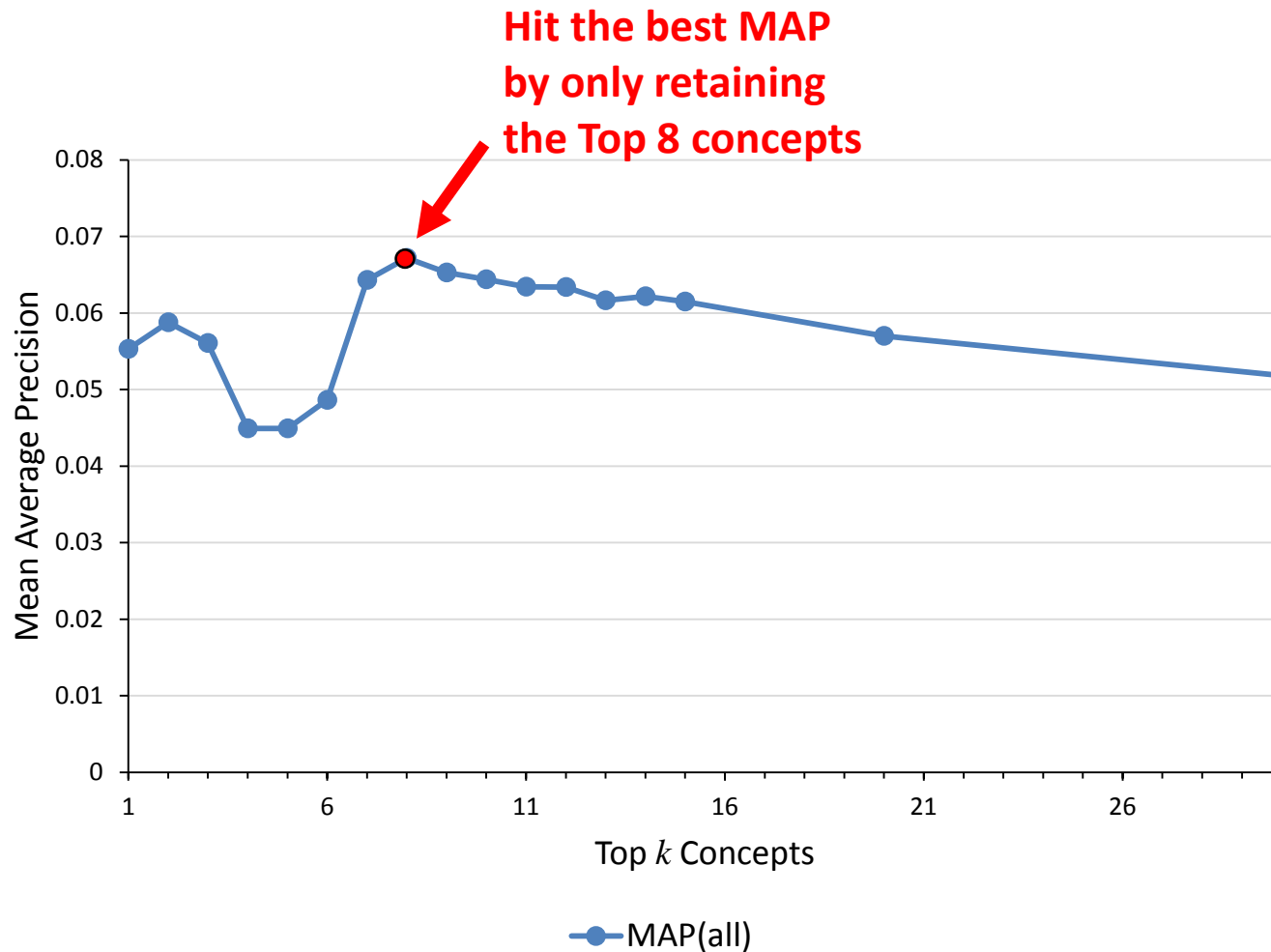
**How to wisely choose the
right concepts?**

Recall an important finding in the last year



Event 31: Beekeeping

Strategies for automatic SQG last year



What we got?

- The top few concepts might have already achieved a good performance
- Adding concepts that are *less relevant* tends to decrease the performance

Per-dataset performance by using *best-k* concepts (MED14-Test)

EventID EventName	Research497 (Top 2)	ILSVRC1000 (Top 3)	SIN346 (Top 5)	Places205 (Top 2)	FCVID239 (Top 1)	Sports487 (Manual)
21 attempting_bike_trick	0.132	0.109	0.059	0.007	0.065	0.196
22 cleaning_appliance	0.012	0.019	0.005	0.009	0.062	0.002
23 dog_show	0.430	0.011	0.012	0.004	0.004	0.777
24 giving_direction_location	0.006	0.003	0.003	0.007	0.001	0.003
25 marriage_proposal	0.005	0.002	0.006	0.002	0.010	0.006
26 renovating_home	0.007	0.003	0.003	0.003	0.001	0.006
27 rock_climbing	0.022	0.004	0.001	0.004	0.065	0.288
28 town_hall_meeting	0.024	0.001	0.016	0.008	0.148	0.001
29 winning_race_vehicle	0.147	0.005	0.001	0.006	0.011	0.016
30 working_metal_craft_project	0.144	0.009	0.002	0.001	0.005	0.001
31 beekeeping	0.003	0.648	0.002	0.002	0.262	0.001
32 wedding_shower	0.009	0.003	0.022	0.002	0.005	0.003
33 non-motorized_vehicle_repair	0.026	0.002	0.005	0.002	0.008	0.450
34 fixing_musical_instrument	0.016	0.002	0.011	0.004	0.146	0.001
35 horse_riding_competition	0.013	0.022	0.071	0.234	0.115	0.278
36 felling_tree	0.022	0.004	0.018	0.051	0.018	0.001
37 parking_vehicle	0.026	0.057	0.037	0.022	0.215	0.002
38 playing_fetch	0.002	0.032	0.010	0.017	0.008	0.020
39 tailgating	0.002	0.001	0.001	0.007	0.232	0.001
40 tuning_musical_instrument	0.008	0.048	0.001	0.002	0.050	0.001
MAP(all)	0.053	0.049	0.014	0.020	0.071	0.103
MAP(21-30)	0.093	0.017	0.011	0.005	0.037	0.130
MAP(31-40)	0.013	0.082	0.018	0.034	0.106	0.076

Finding

If a good match can be found, high-level concepts far overwhelm componential concepts such as objects and scenes.

Strategies for manual concept screening

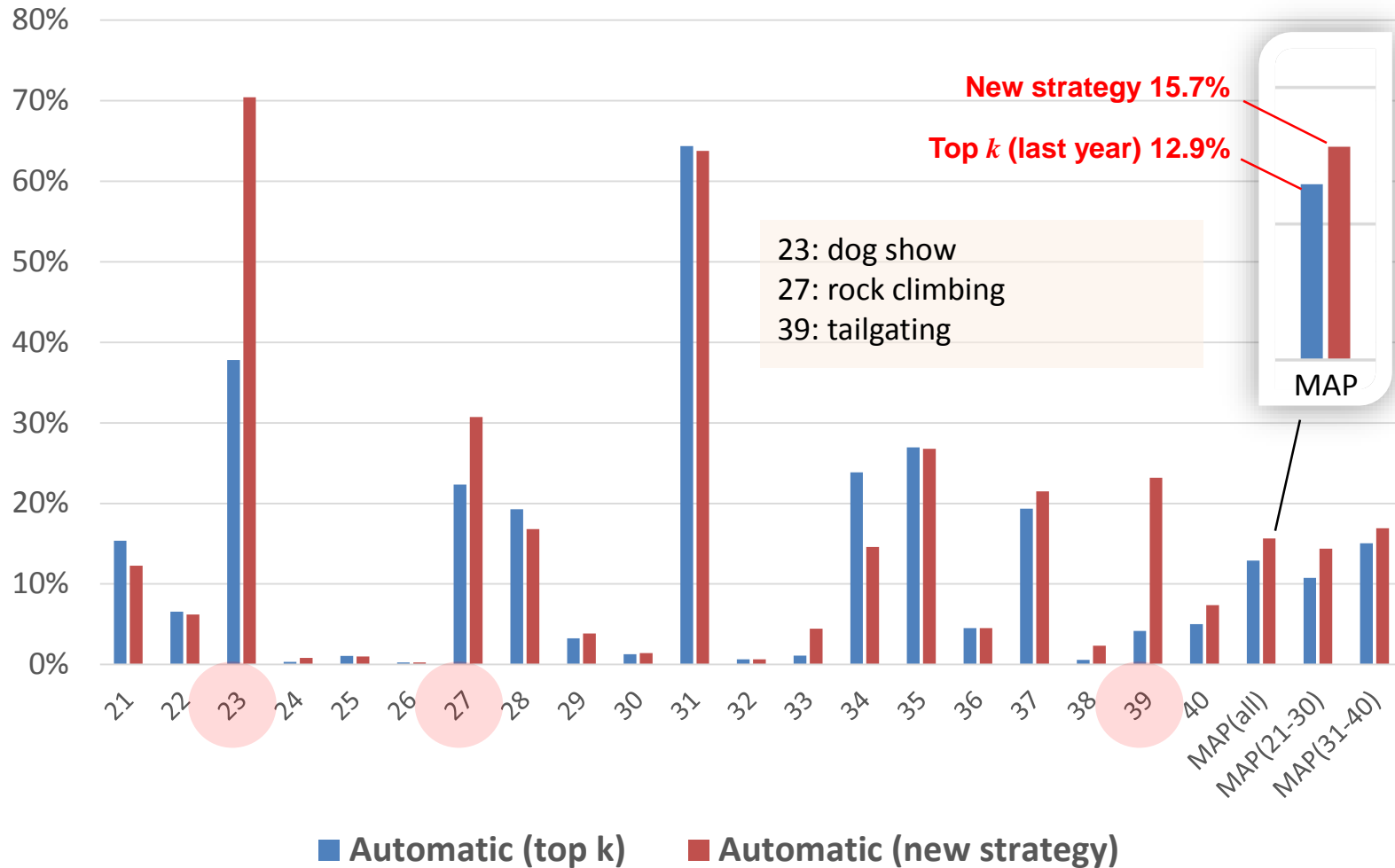
- Only carefully include concepts that are *distinctive* to an event if we find a concept detector *semantically same* as the event
- Remove *false positives* by screening the names of concepts
- Remove concepts for which training videos appear in *very different context* based on human's common sense

- | | |
|--------------------------------------------------------------------------|--------------------------|
| - <i>Rock climbing, bouldering, sport climbing, artificial rock wall</i> | Relevant |
| - <i>Rope climbing, climbing, rock</i> | Not distinctive |
| - <i>Rock fishing, rock band performance</i> | False positive |
| - <i>Stone wall, grabbing rock</i> | Different context |

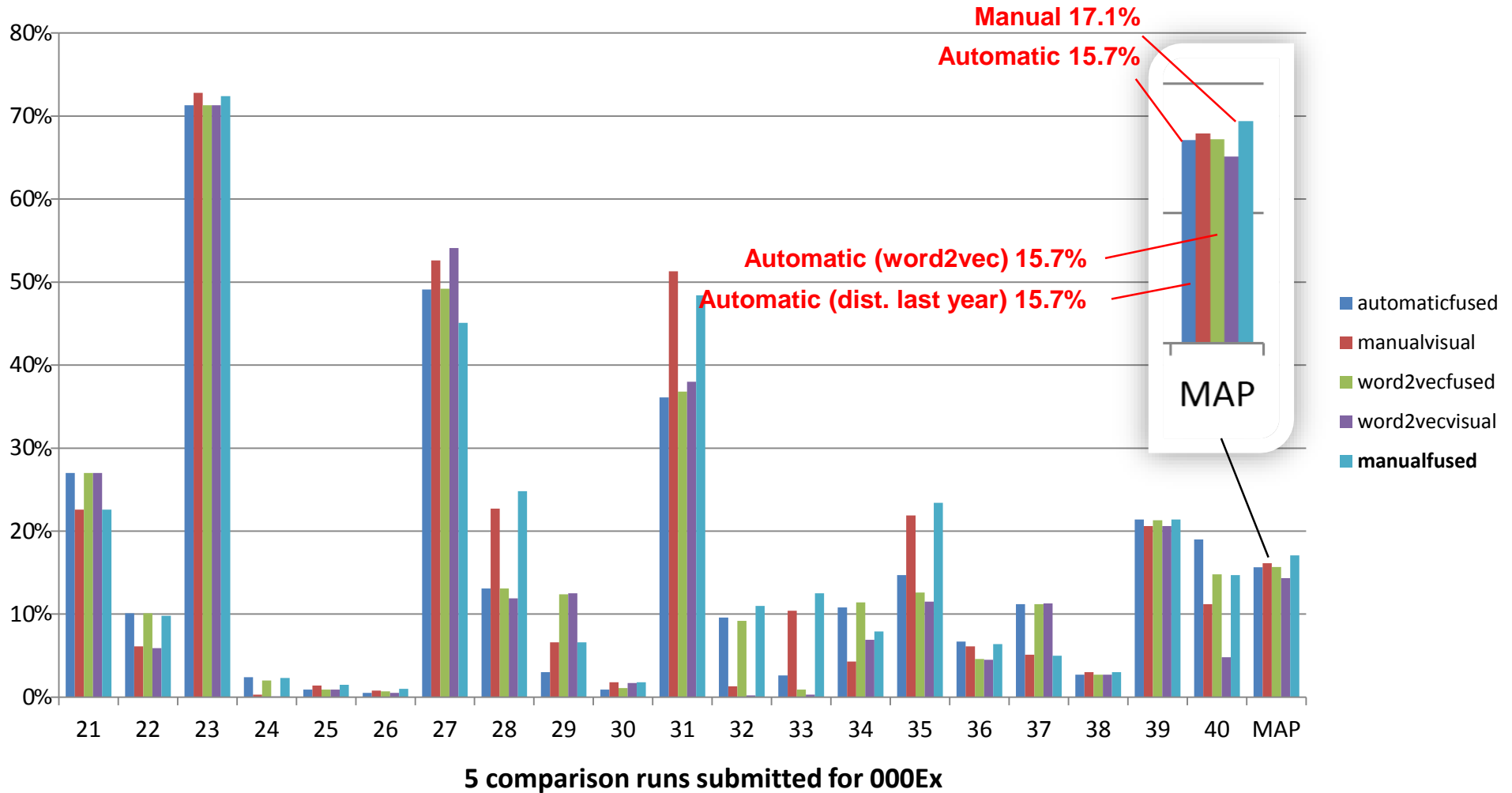
Strategies for automatic SQG

- If a concept detector with the *same name* of the event can be found, simply choose that detector and discard anything else
- Otherwise, choose the **top k** concepts according to the relevance score
- k is found to be optimized at around **10**, and kept the same for all events

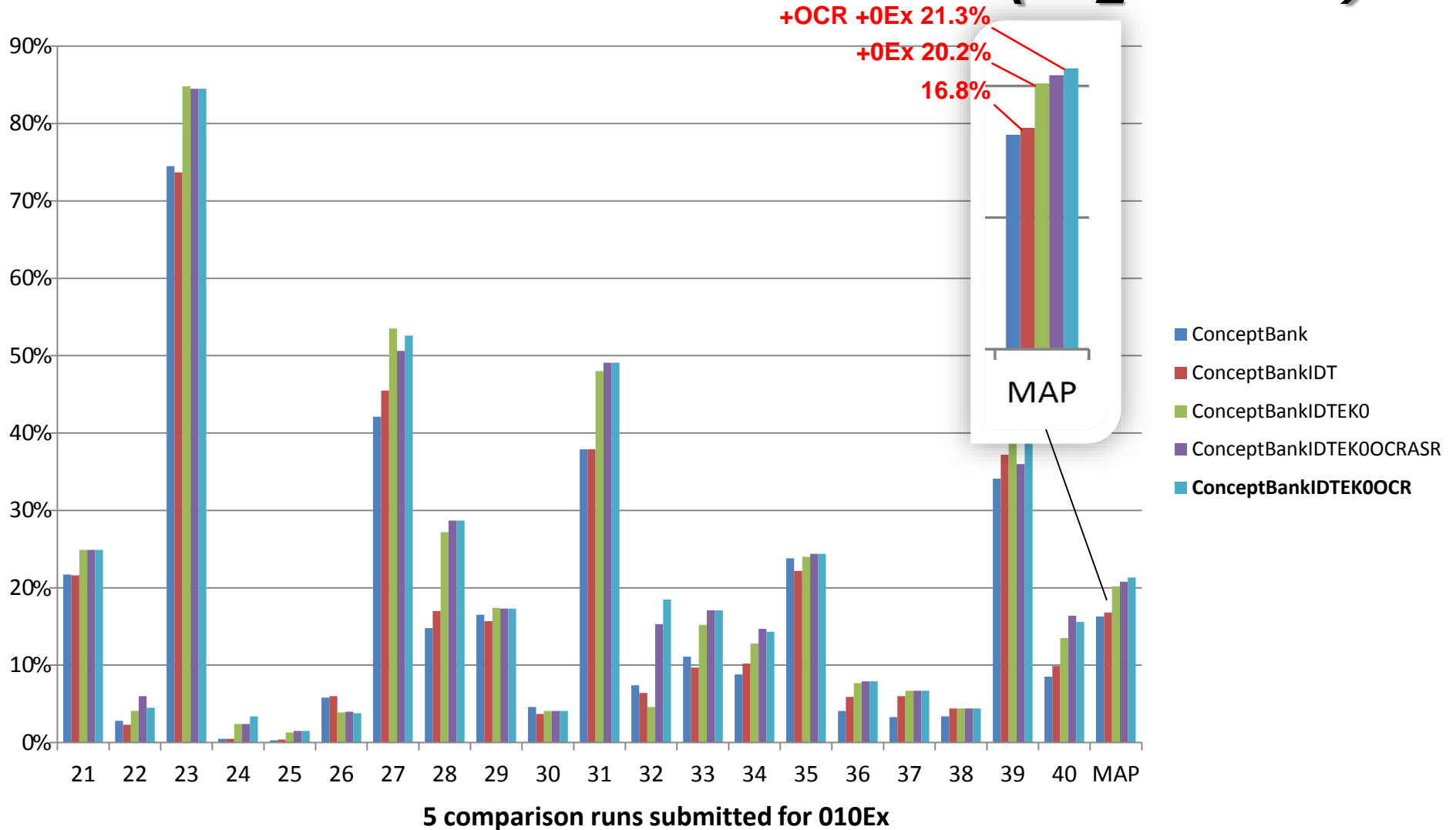
Automatic SQG top k vs. new strategy (MED14-Test)



Manual vs. Automatic (*PS_EvalFull*)



Contribution of 0Ex in 10Ex task (*PS_EvalFull*)



Summary

- An enlarged concept bank involving *high-level concepts* such as activities and events does great help for event detection
- A wise strategy for picking up the right concepts given a large concept bank is key to the detection performance

Thank you!