



Collecting a Dataset for Computer Vision in 2025...

an Egocentric Perspective

Machine Learning in Practice

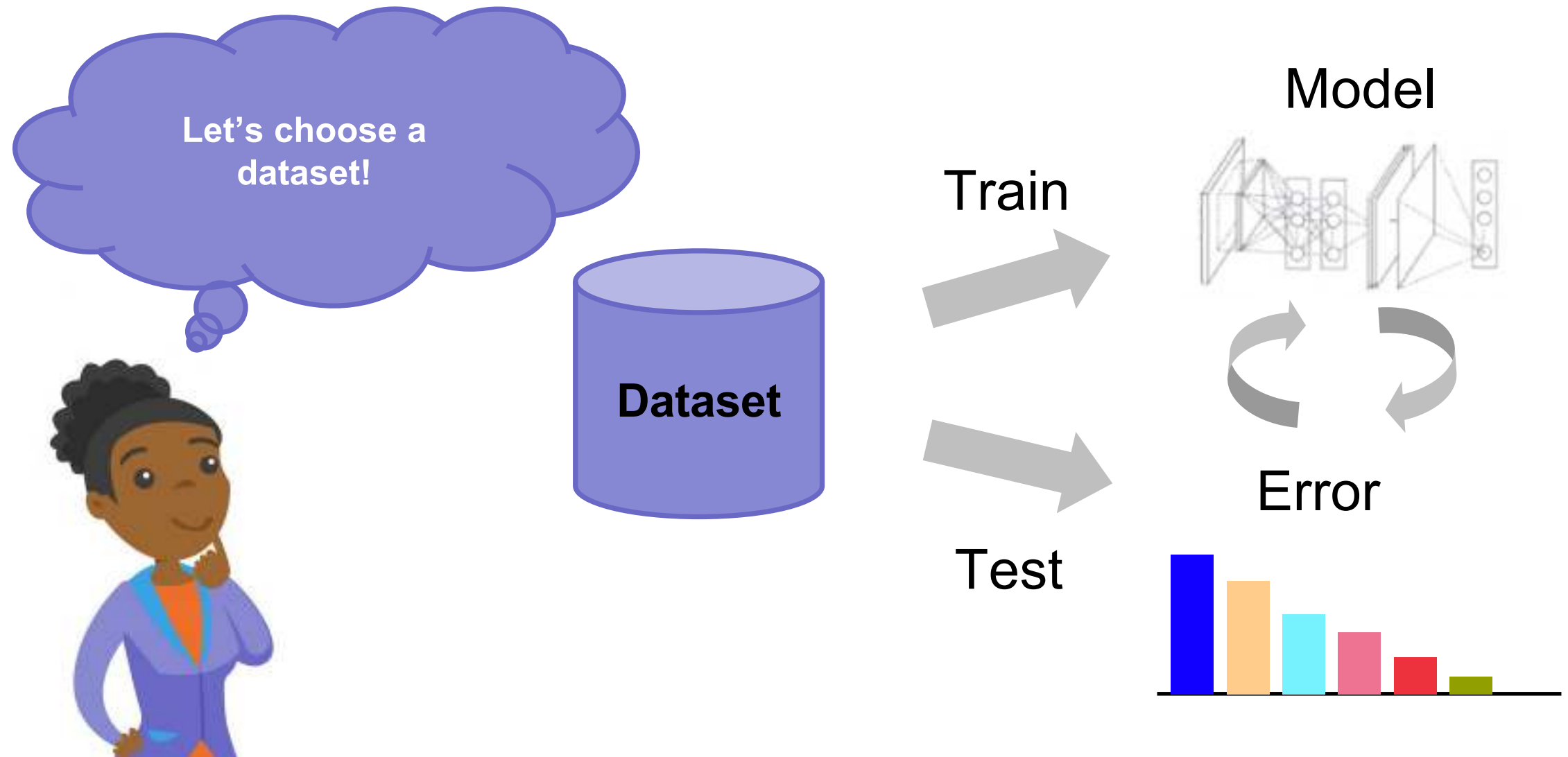
**no data
no machine
learning research**



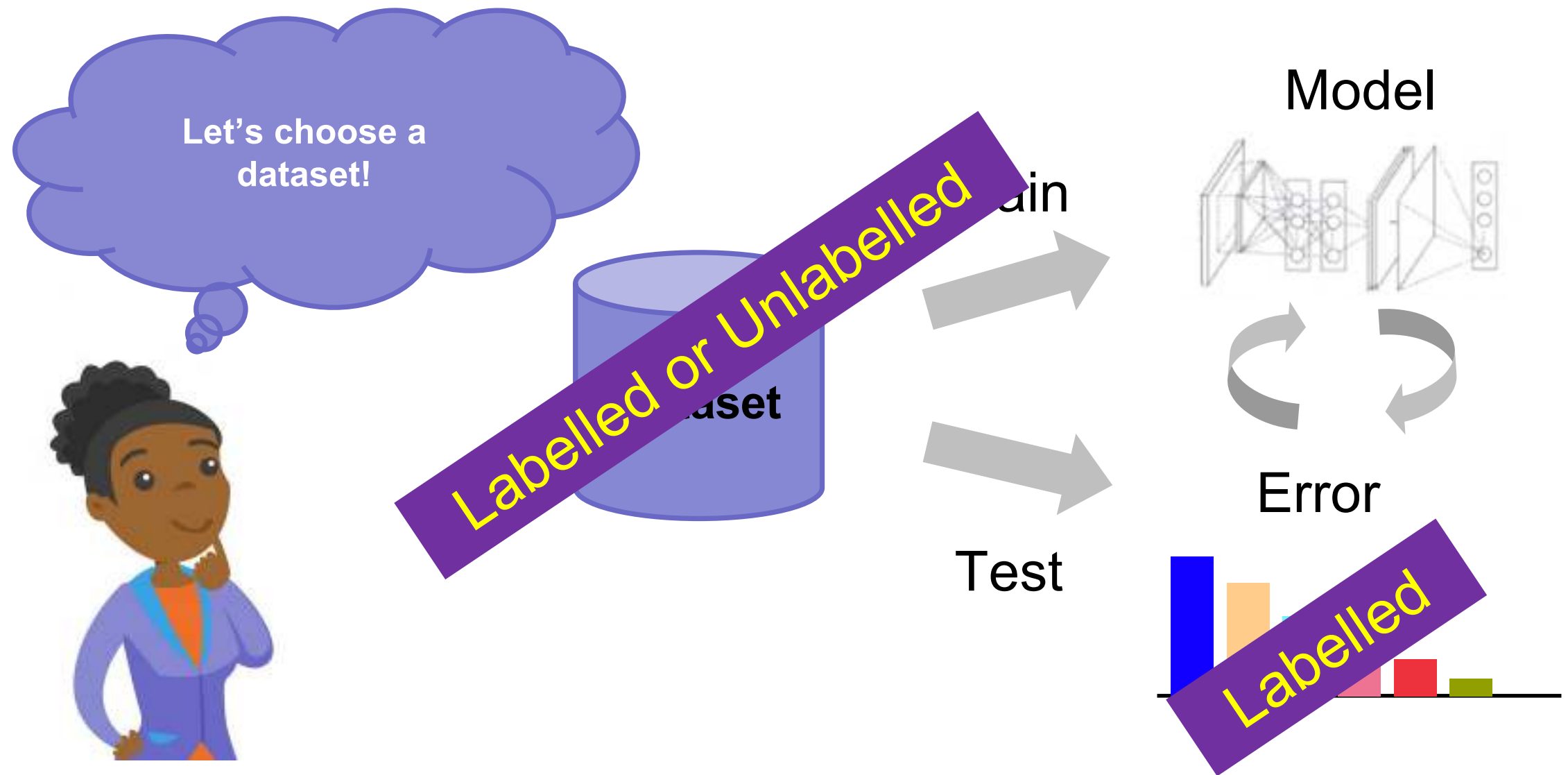
The current paradigm of Computer Vision Research



The current paradigm of Computer Vision Research

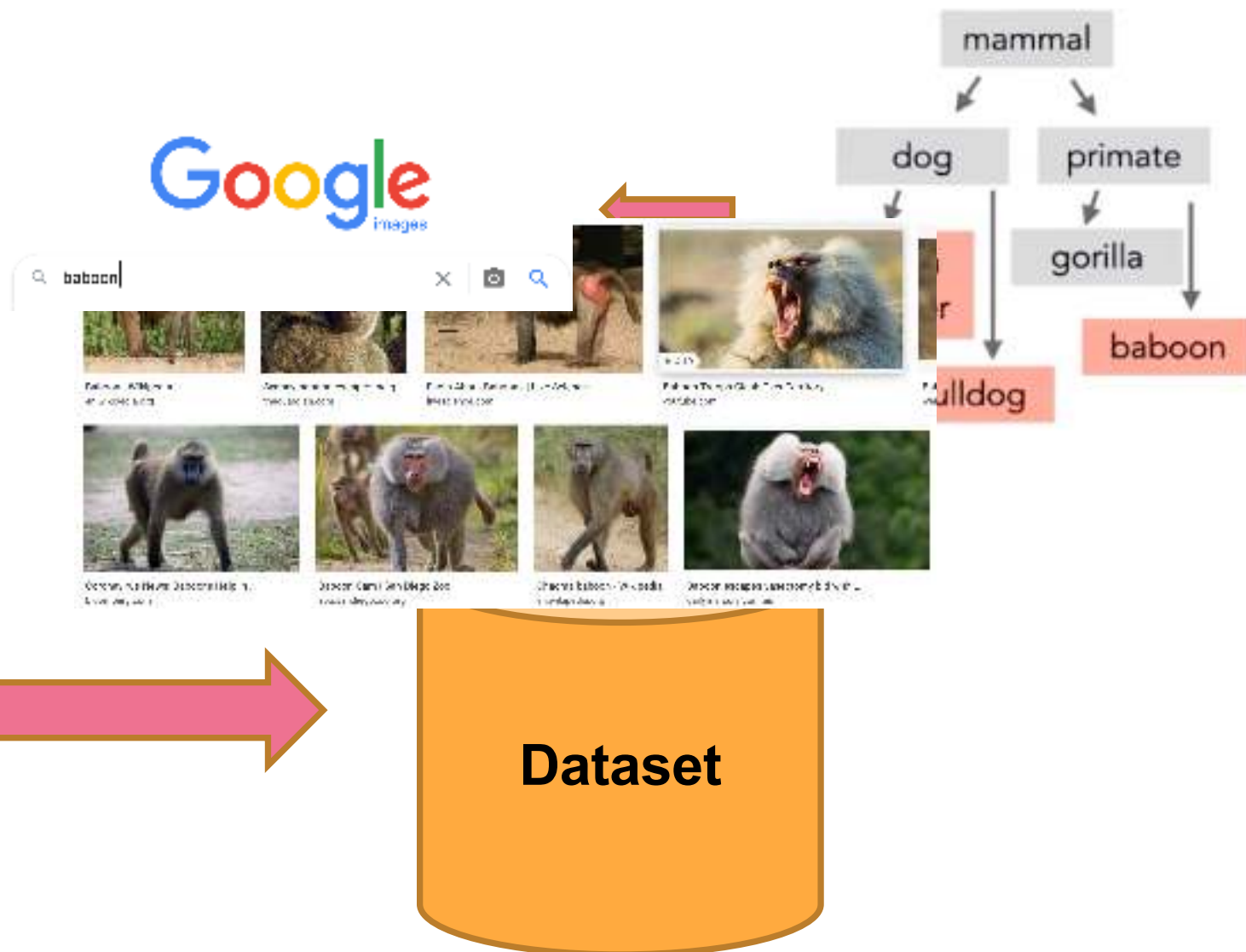


The current paradigm of Computer Vision Research



Machine Learning in Practice

Real World Task....
Object Recognition



Machine Learning in Practice

- Applies to Most ML research at the moment
 - Object Recognition (Pascal, ImageNet, Places, ...)
 - Action Recognition (Kinetics-400, -600, -700, AVA, SS, ...)
 - ...
- Datasets:
 - Methods overfit to the dataset
 - useful for **one** task
 - unnaturally balanced (or nearly balanced) – unrelated to priors outside the dataset itself

One Exception

Machine Learning in Practice

- Autonomous Driving...

Welcome to the KITTI Vision Benchmark Suite!

We take advantage of our [autonomous driving platform Annieway](#) to develop novel challenging real-world computer vision benchmarks. Our tasks of interest are: stereo, optical flow, visual odometry, 3D object detection and 3D tracking. For this purpose, we equipped a standard station wagon with two high-resolution color and grayscale video cameras. Accurate ground truth is provided by a Velodyne laser scanner and a GPS localization system. Our datasets are captured by driving around the mid-size city of [Karlsruhe](#), in rural areas and on highways. Up to 15 cars and 30 pedestrians are visible per image. Besides providing all data in raw format, we extract benchmarks for each task. For each of our benchmarks, we also provide an evaluation metric and this evaluation website. Preliminary experiments show that methods ranking high on established benchmarks such as [Middlebury](#) perform below average when being moved outside the laboratory to the real world. Our goal is to reduce this bias and complement existing benchmarks by providing real-world benchmarks with novel difficulties to the community.

 Share



To get started, grab a cup of your favorite beverage and watch our video trailer (5 minutes):

stereo flow sceneflow depth odometry object tracking road semantics raw data

Machine Learning in Practice

Object Recognition

Let's collect Data!



EPIC
KITCHENS-100

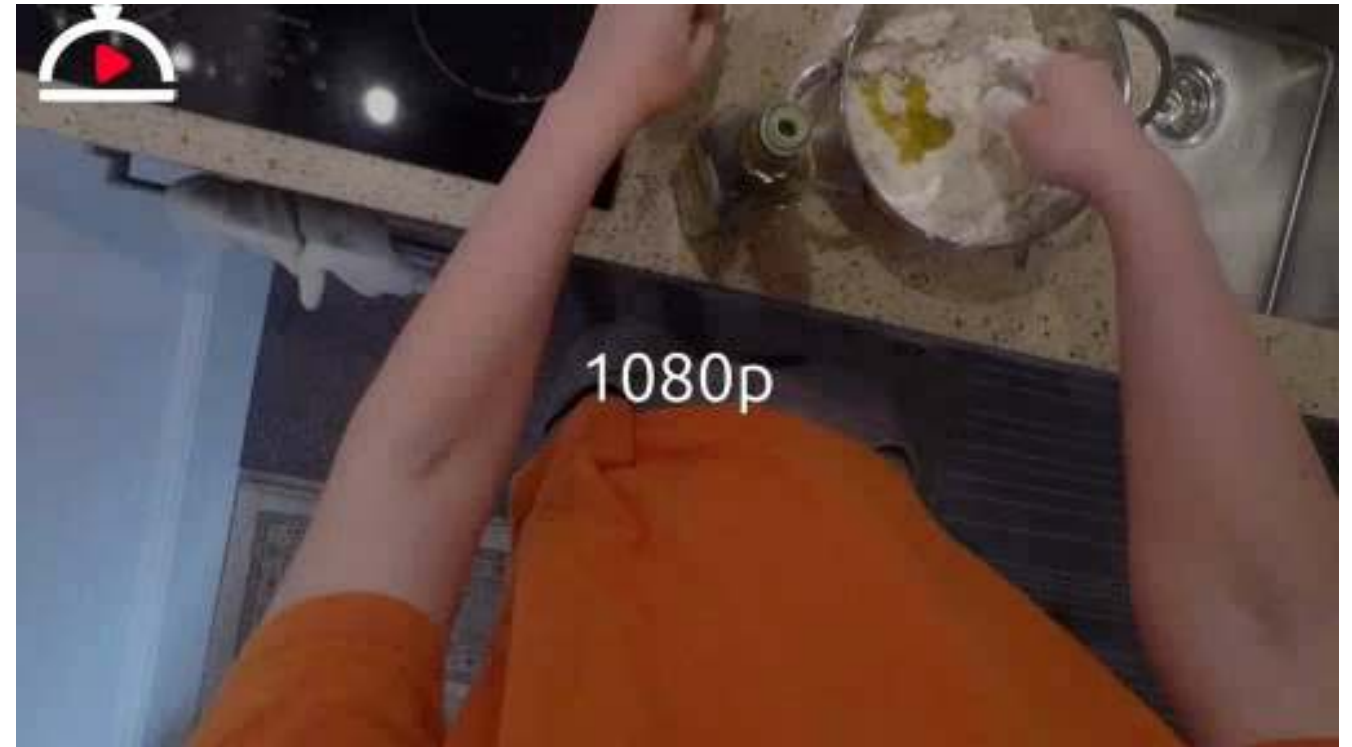


EPIC-KITCHENS



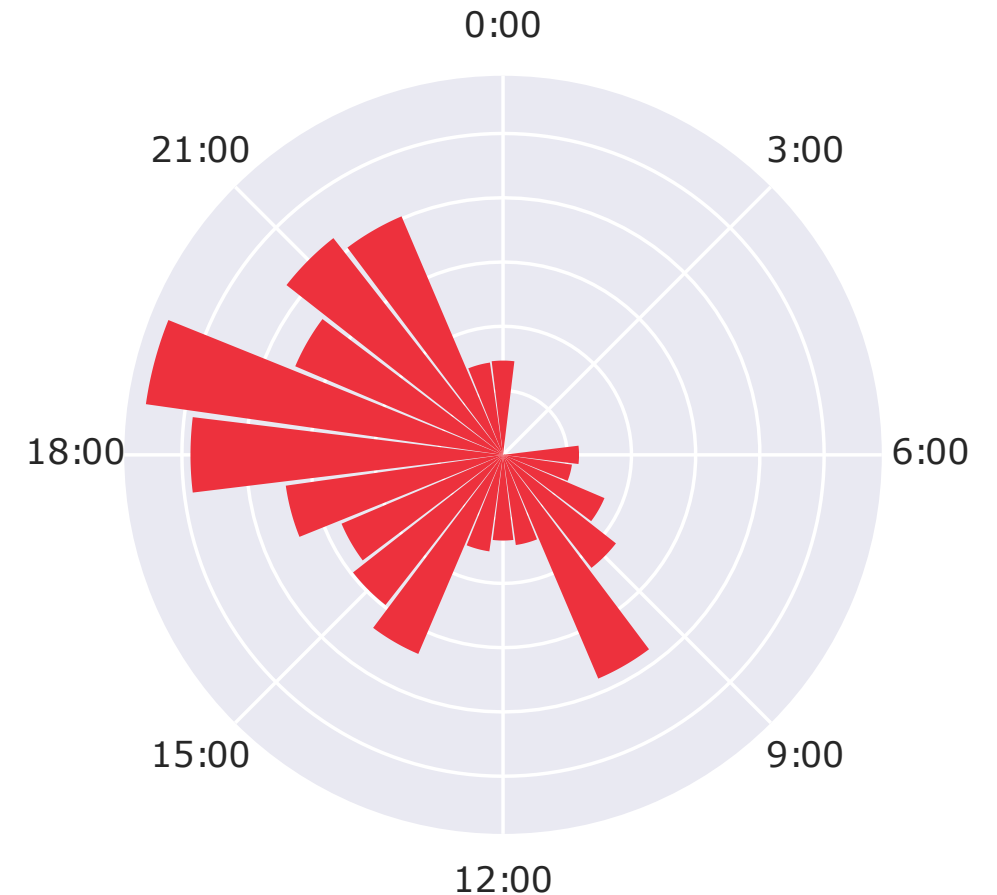
Scaling and Rescaling Egocentric Vision

- Head-Mounted Go-Pro, adjustable mounting
- Recording starts immediately before entering the kitchen
- Only stopped before leaving the kitchen



Scaling and Rescaling Egocentric Vision

- 45 kitchens
- Single-person environments
- 4 cities
- May – Nov 2017 – 55 hours
- May – Dec 2019 – 45 hours
- 10 nationalities
- 3 days - all kitchen activities



EPIC-KITCHENS



EPIC-KITCHENS

Epic Narrator

File Select microphone Settings Info



Recordings

00:26:21.604	▶	🗑️
00:26:24.099	▶	🗑️
00:26:40.849	▶	🗑️
00:26:42.101	▶	🗑️
00:26:43.851	▶	🗑️
00:26:47.851	▶	🗑️
00:26:49.351	▶	🗑️
00:26:51.052	▶	🗑️
00:26:54.601	▶	🗑️
00:26:56.099	▶	🗑️
00:27:05.878	▶	🗑️
00:27:07.111	▶	🗑️
00:27:08.359	▶	🗑️
00:27:09.361	▶	🗑️
00:27:11.351	▶	🗑️
00:27:19.599	▶	🗑️
00:27:21.349	▶	🗑️
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00:27:24.001	▶	🗑️

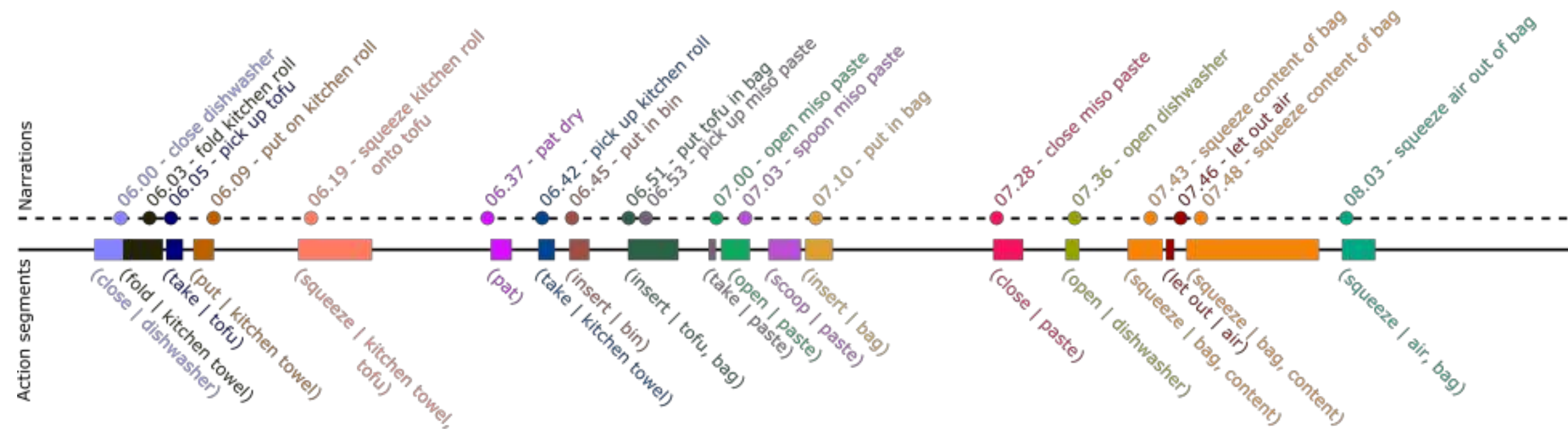
Playback speed ☒ 0.50 ☐ 0.75 ☐ 1.00 ☐ 1.50 ☐ 2.00 ☐ Play recordings with video 00:27:24.001 / 00:35:20.362

Microphone level

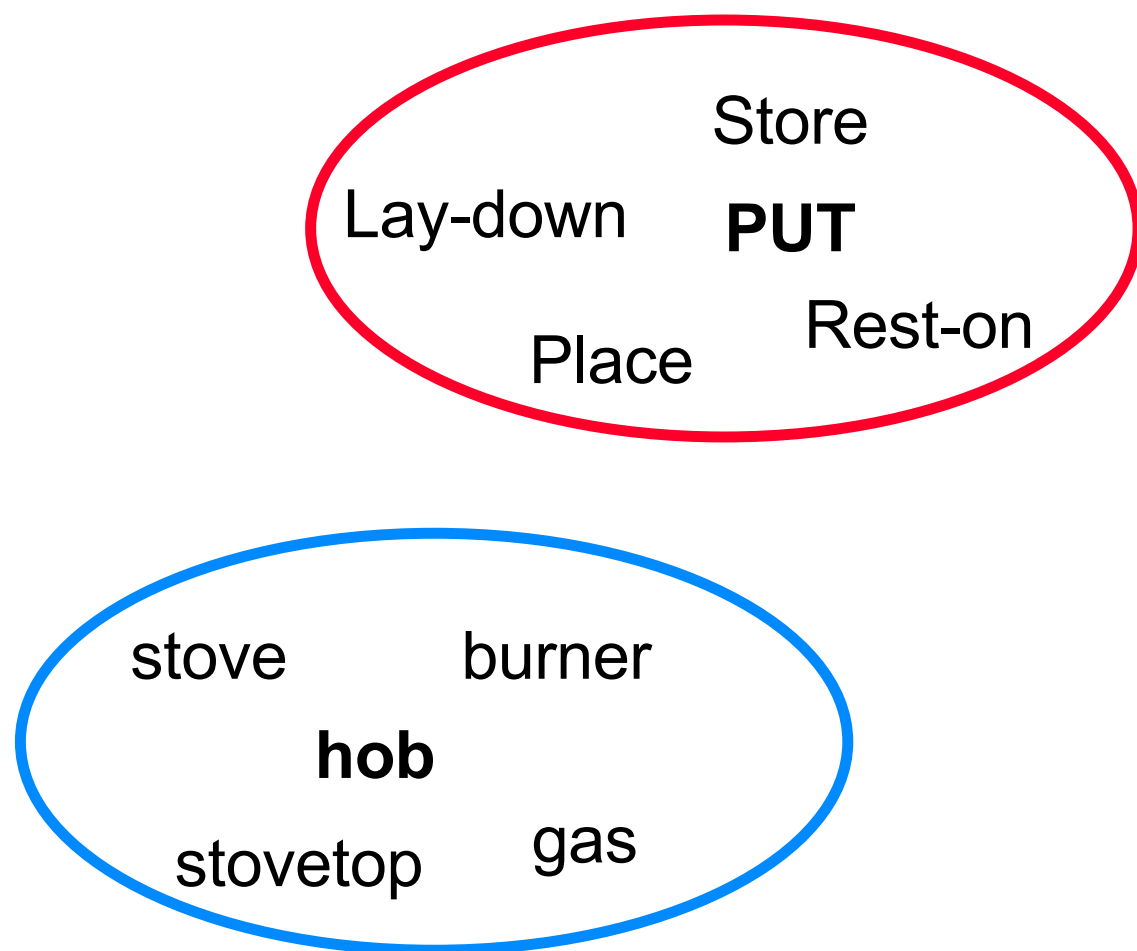


Video path: /videos/asdf.MP4 Output path: /audio

EPIC-KITCHENS



EPIC-KITCHENS and Ego4D



open vocab

lay-down

stovetop

closed vocab

put

hob

category

leave

appliance



open oven



put spoon on counter

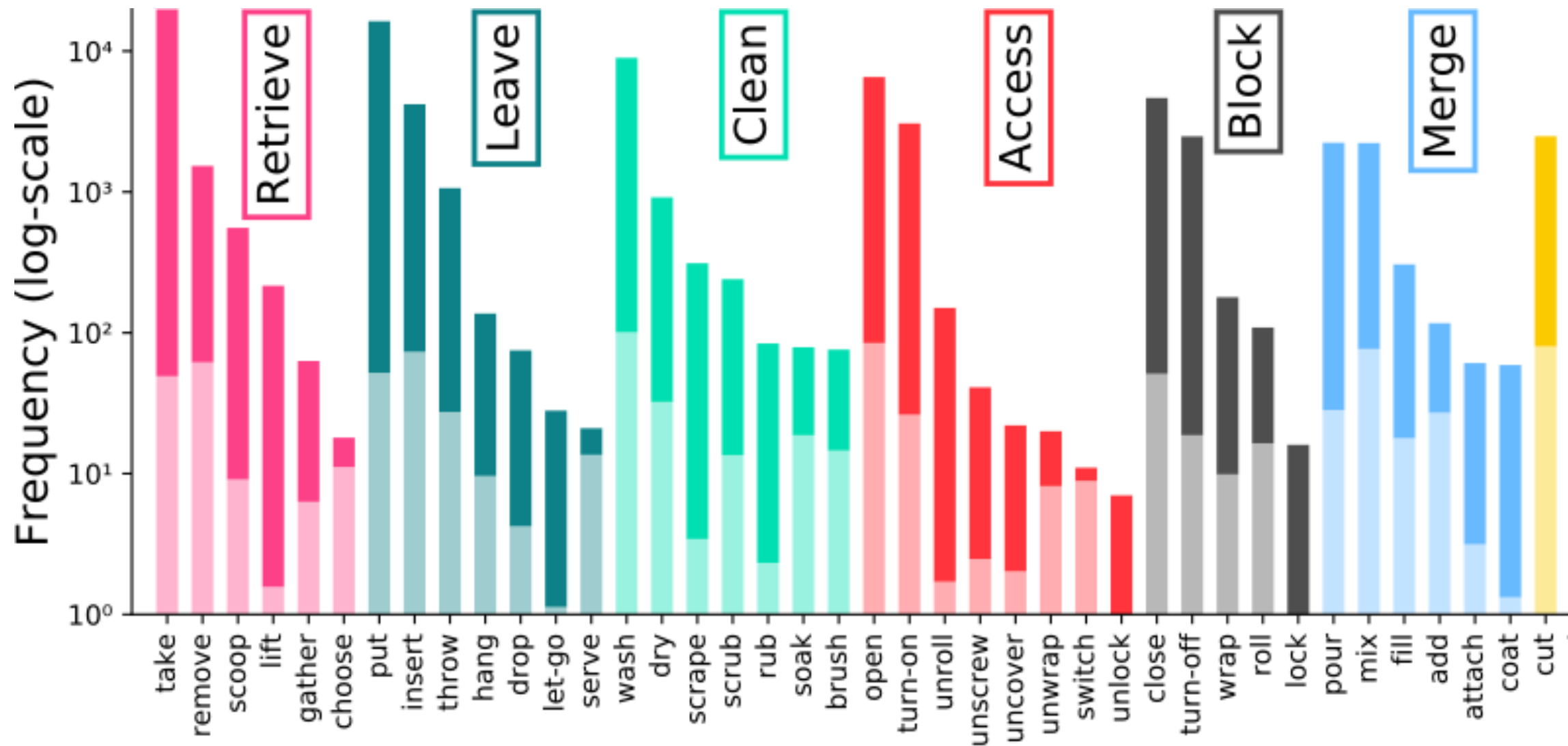


put on glove



pick up fork

EPIC-KITCHENS-100 Statistics



The Data....



2017 - now

100 hours
45 kitchens
4 countries
Long-term recording
Kitchen-based activities



2020 - now

6730 hours
923 participants
74 cities
9 countries
Short-term recording
All daily activities

Narration

C: camera wearer

#C C scraps off wood filler from one putty knife with the other putty knife

#C C picks up another putty knife from the white board

13.2 sentences/min
3.8 M sentences

1,772 verbs

remove place open close
ad just thr pass pull
put pick move
take hit turn
hold drop
clean rough

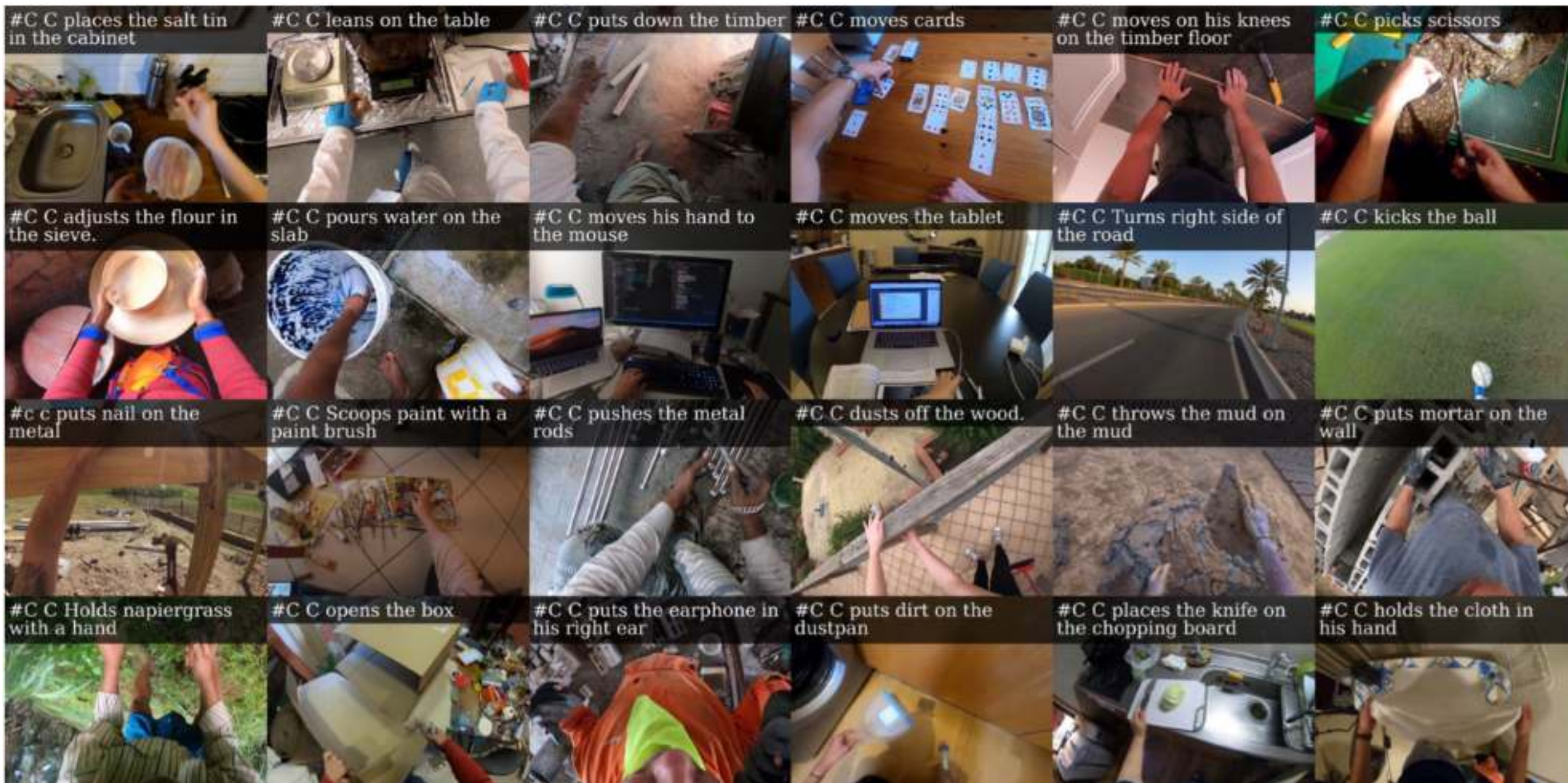
4,336 nouns

card cloth
bottle hand
paper wood
container



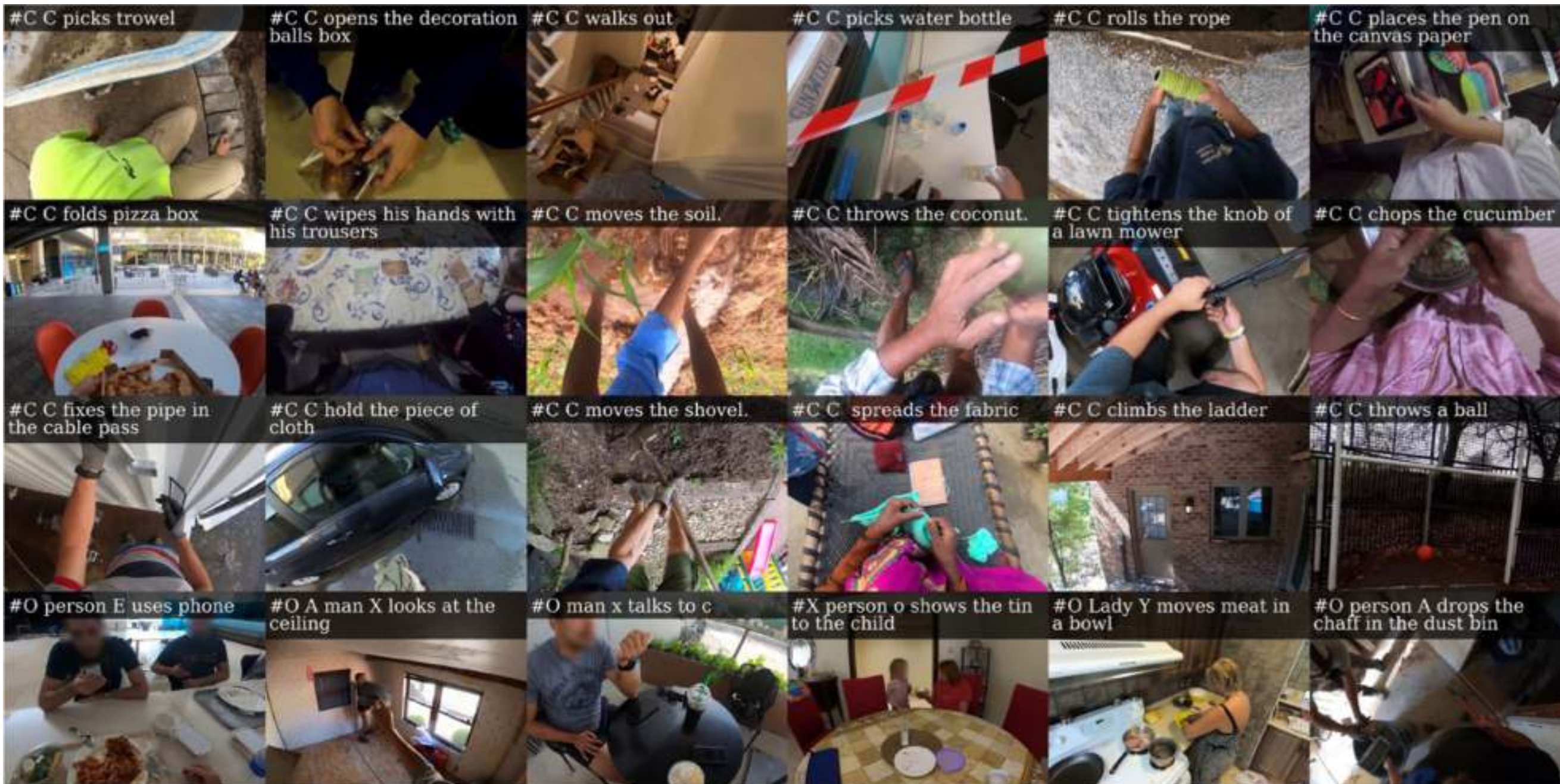
Ego4D

with: Kristen Grauman
+83 authors



Ego4D

with: Kristen Grauman
+83 authors



Data Collection Exercise



2024 - now

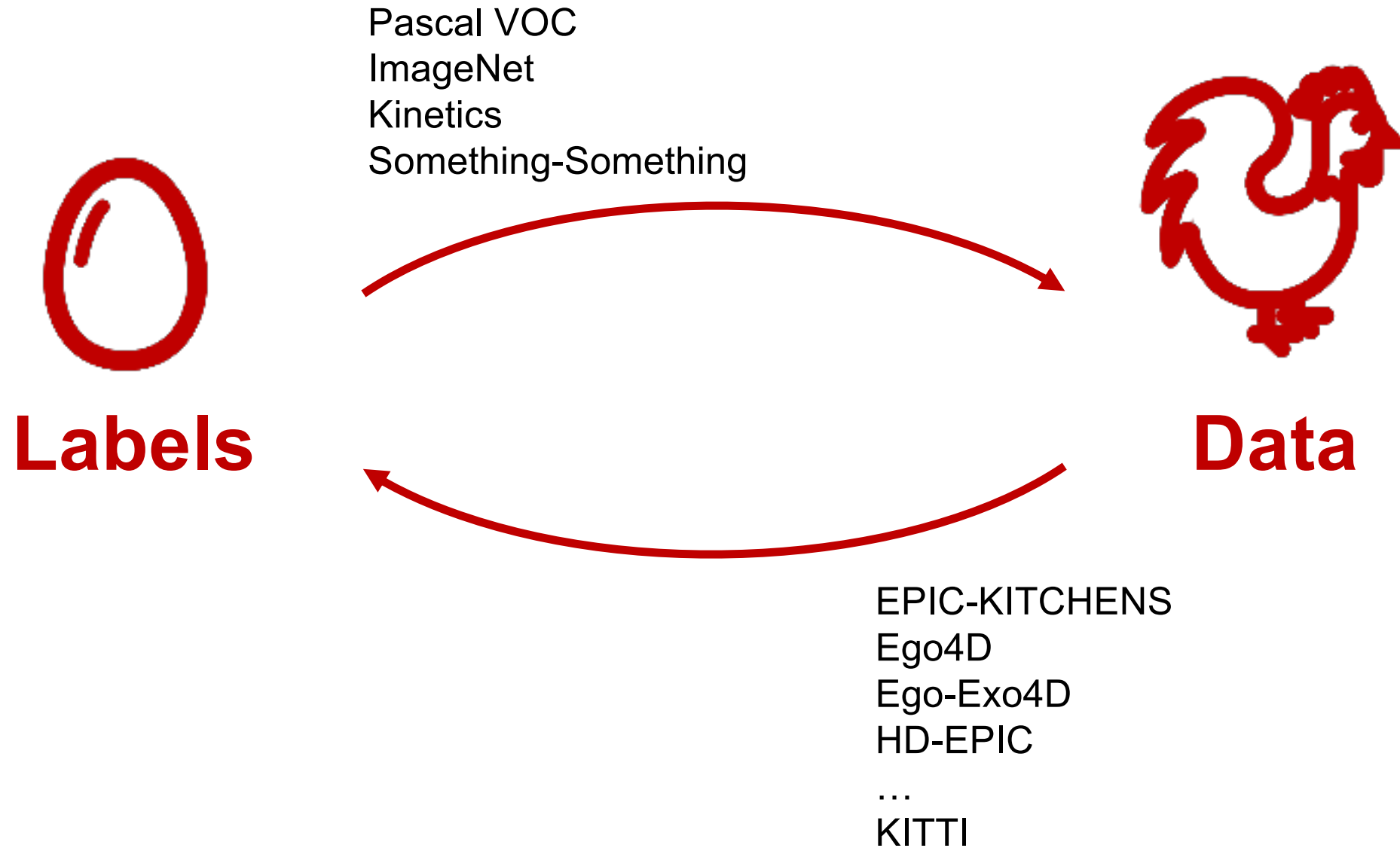
1286 hours
740 camera wearers
Skilled activities



2025 - now

Validation dataset
41 hours
9 participants
Highly-Detailed
Digital Twin

Data Collection Exercise



The chicken or the egg...

Data



Naturally unbalanced

Harder to label (exposes ambiguity)

Closer to application

Multiple tasks

Labels



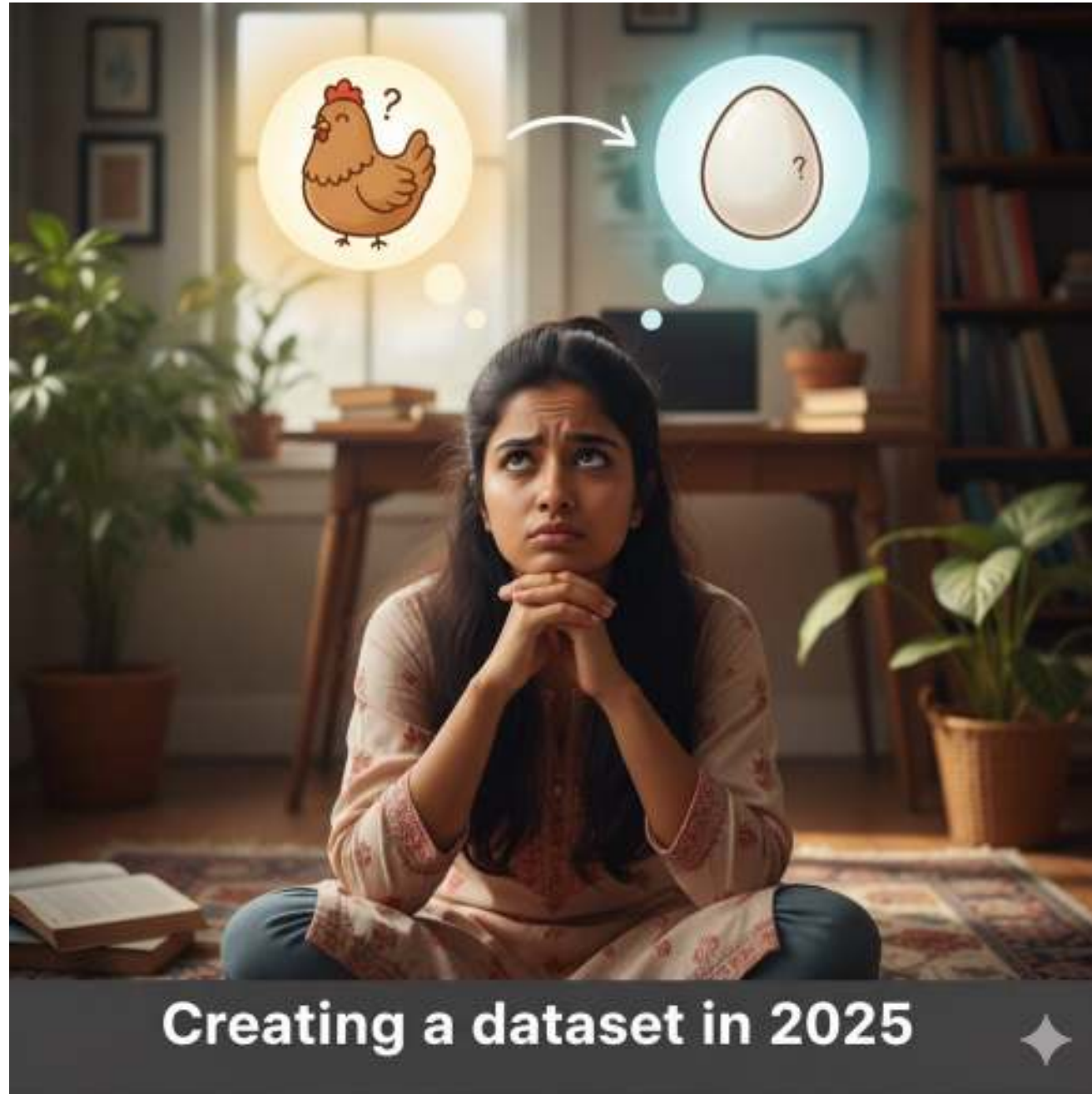
Unnaturally balanced (or nearly)

Easier to label (hides ambiguity)

Can be expanded

Single task

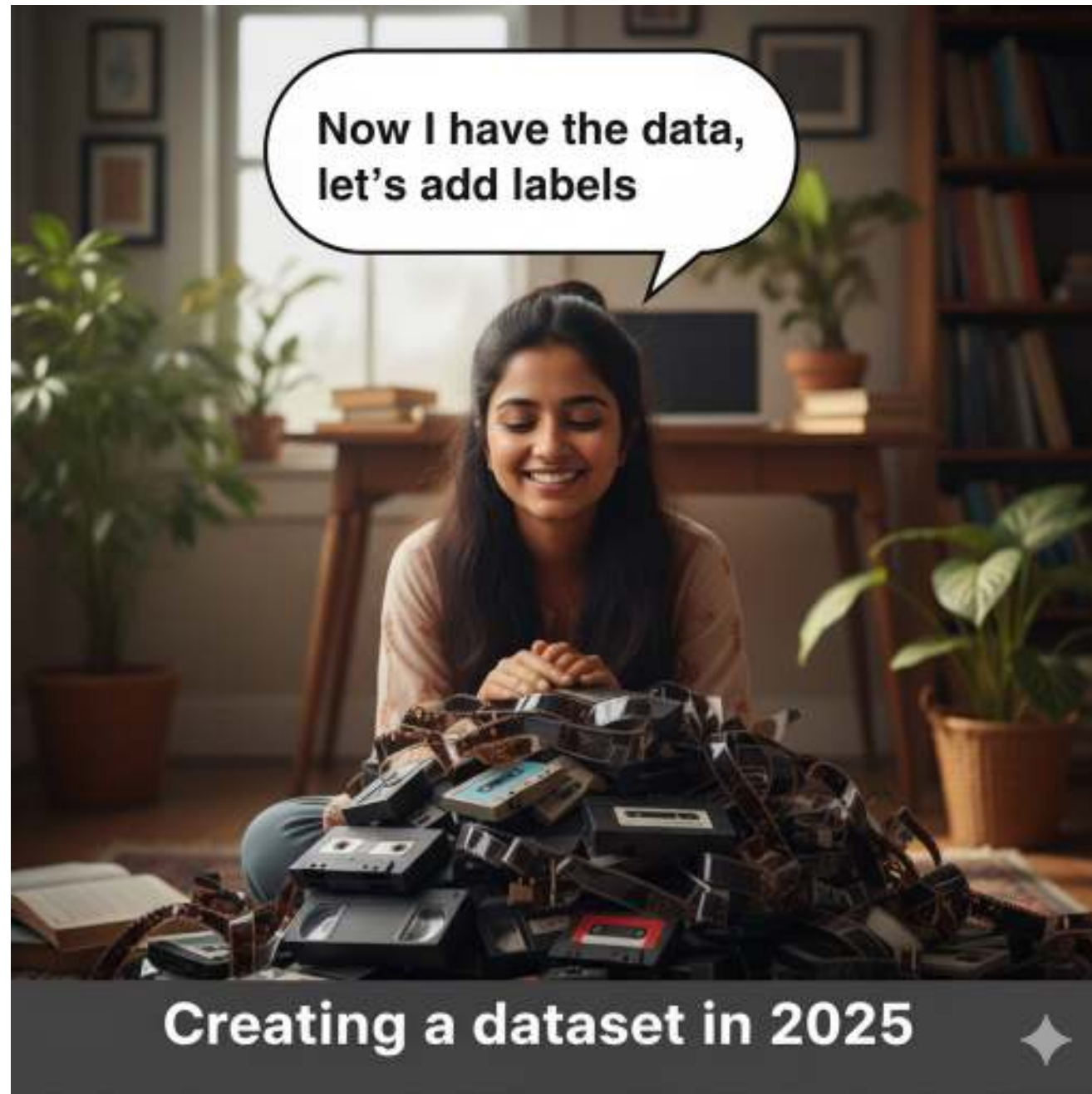
The chicken or the egg...



Creating a dataset in 2025



And then?





Do
It
Yourself

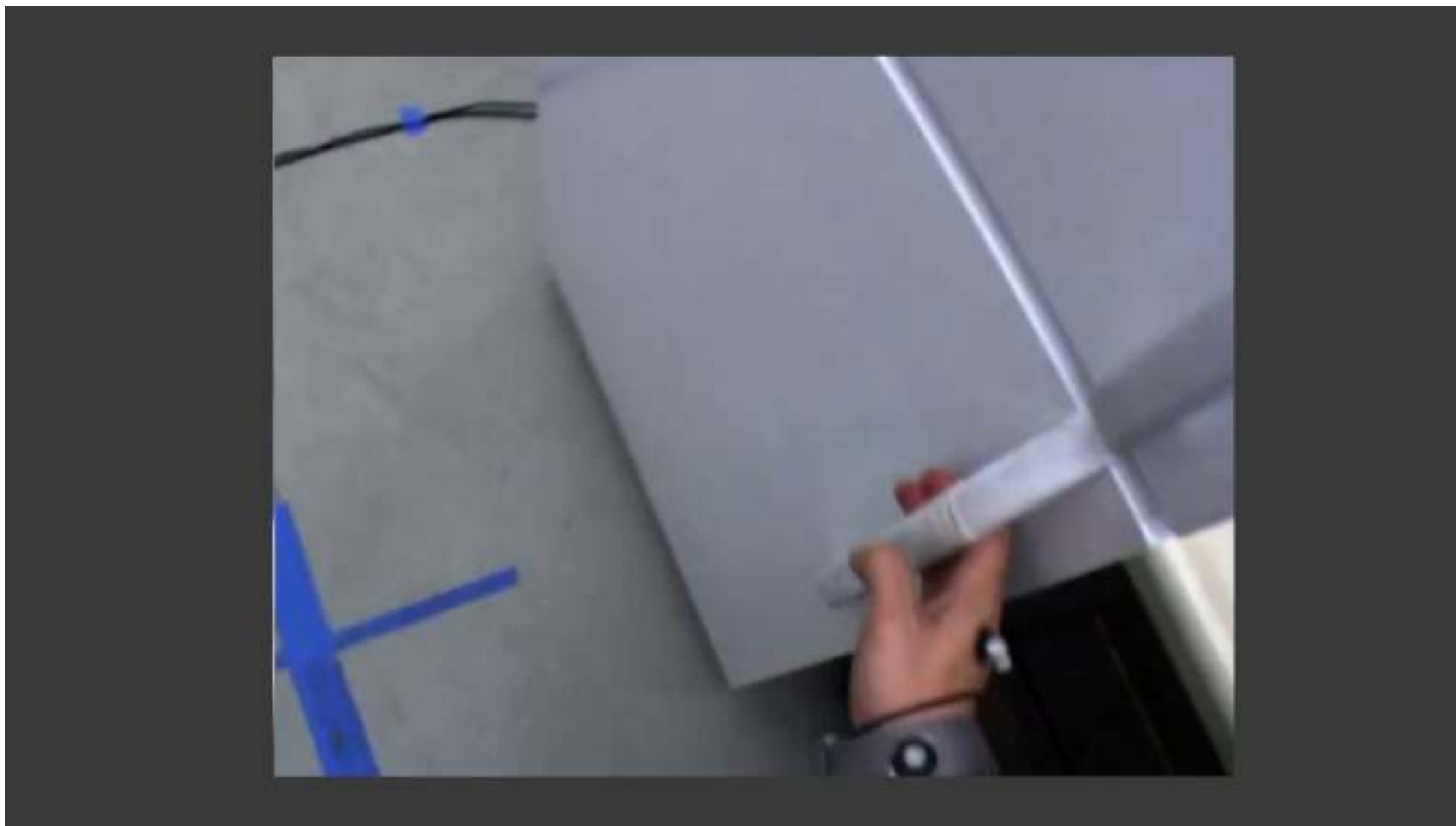


Verb?

Noun?



sprinkle salt
season meat



Open



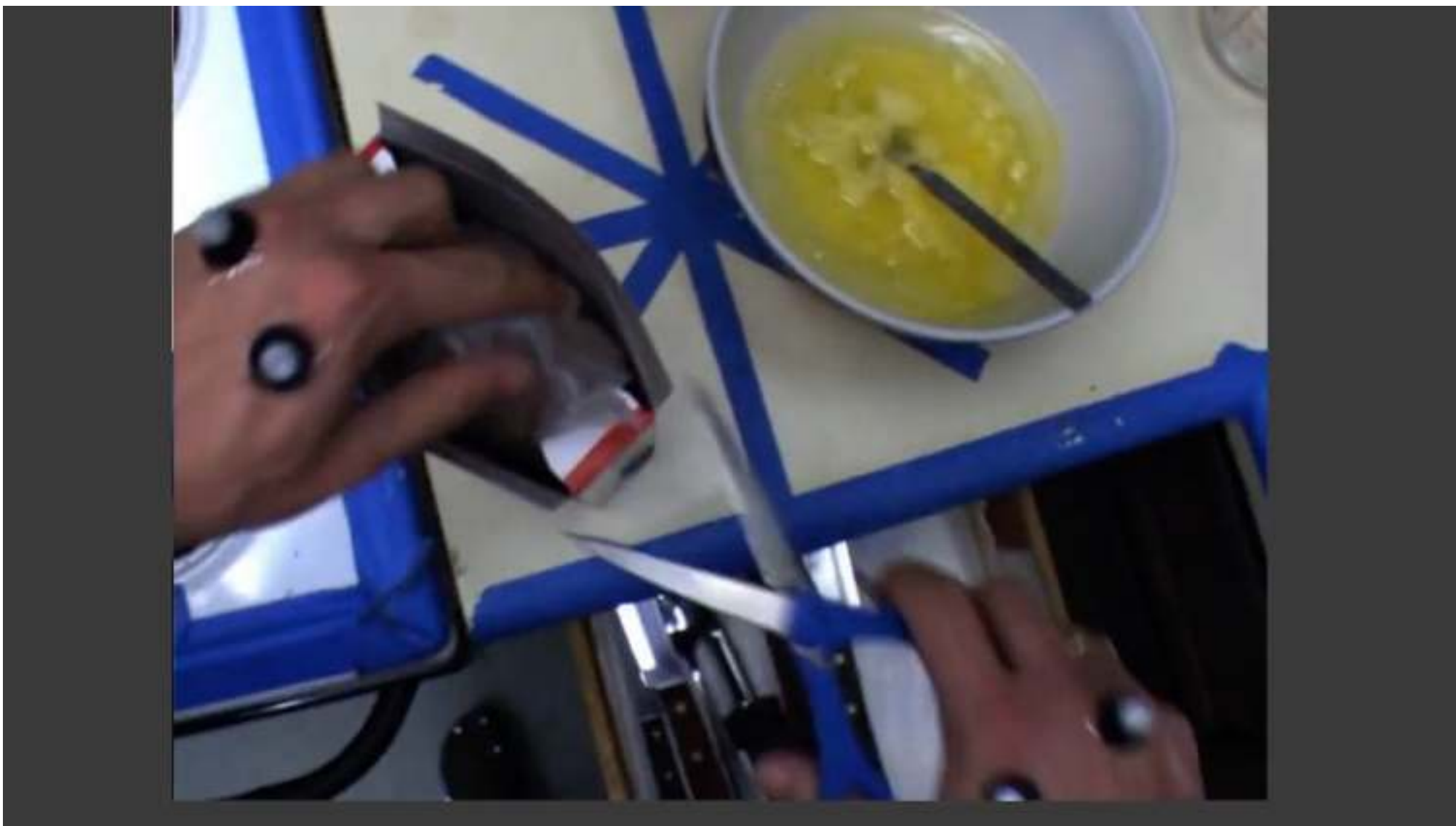


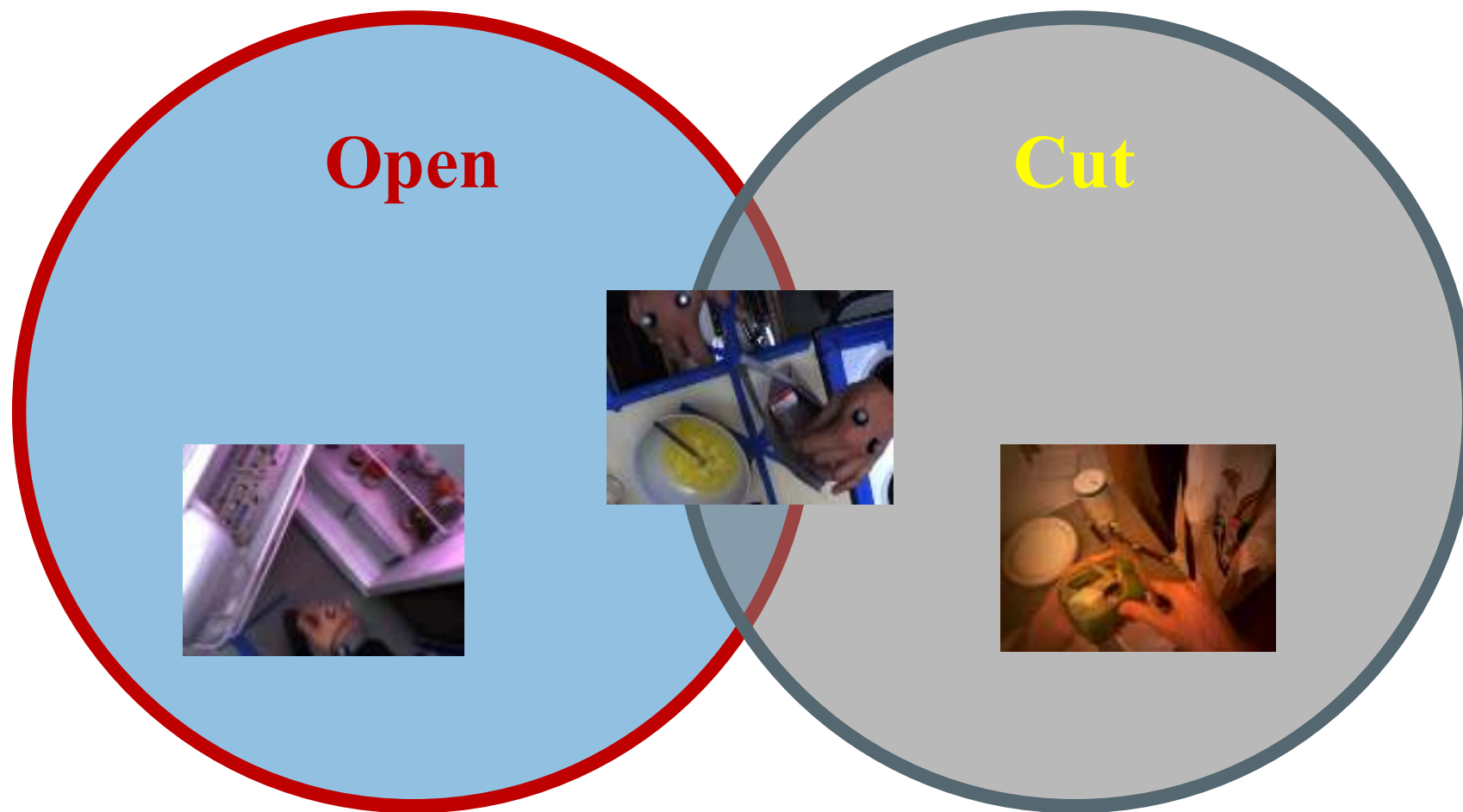
Open



Cut







EPIC-KITCHENS VISOR

with: Ahmad Darkhalil, Dandan Shan, Bin Zhu, Jian Ma,
Amlan Kar, Richard Higgins, David Fouhey, Sanja Fidler



EPIC-KITCHENS VISOR

with: Ahmad Darkhalil, Dandan Shan, Bin Zhu, Jian Ma,
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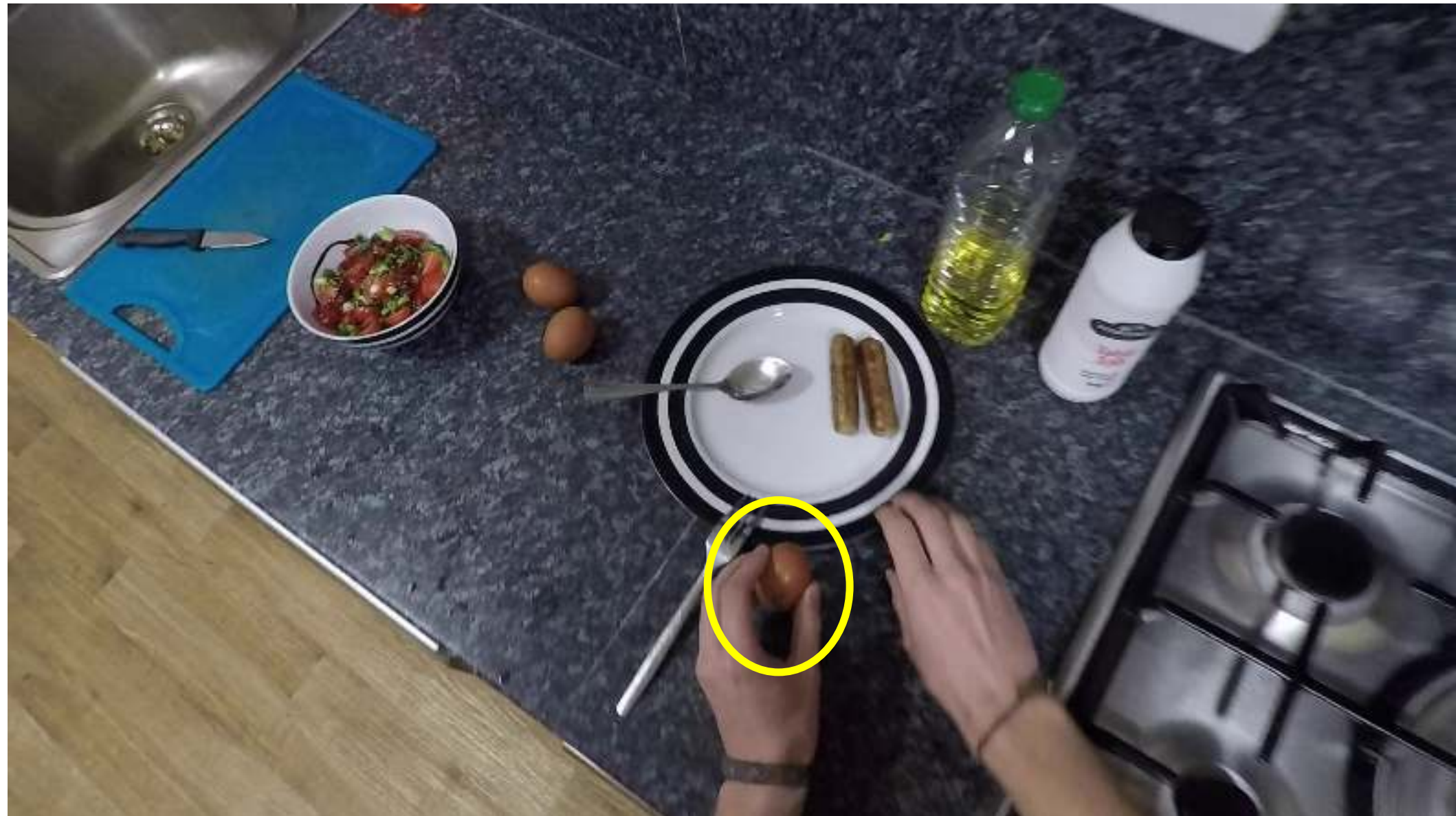
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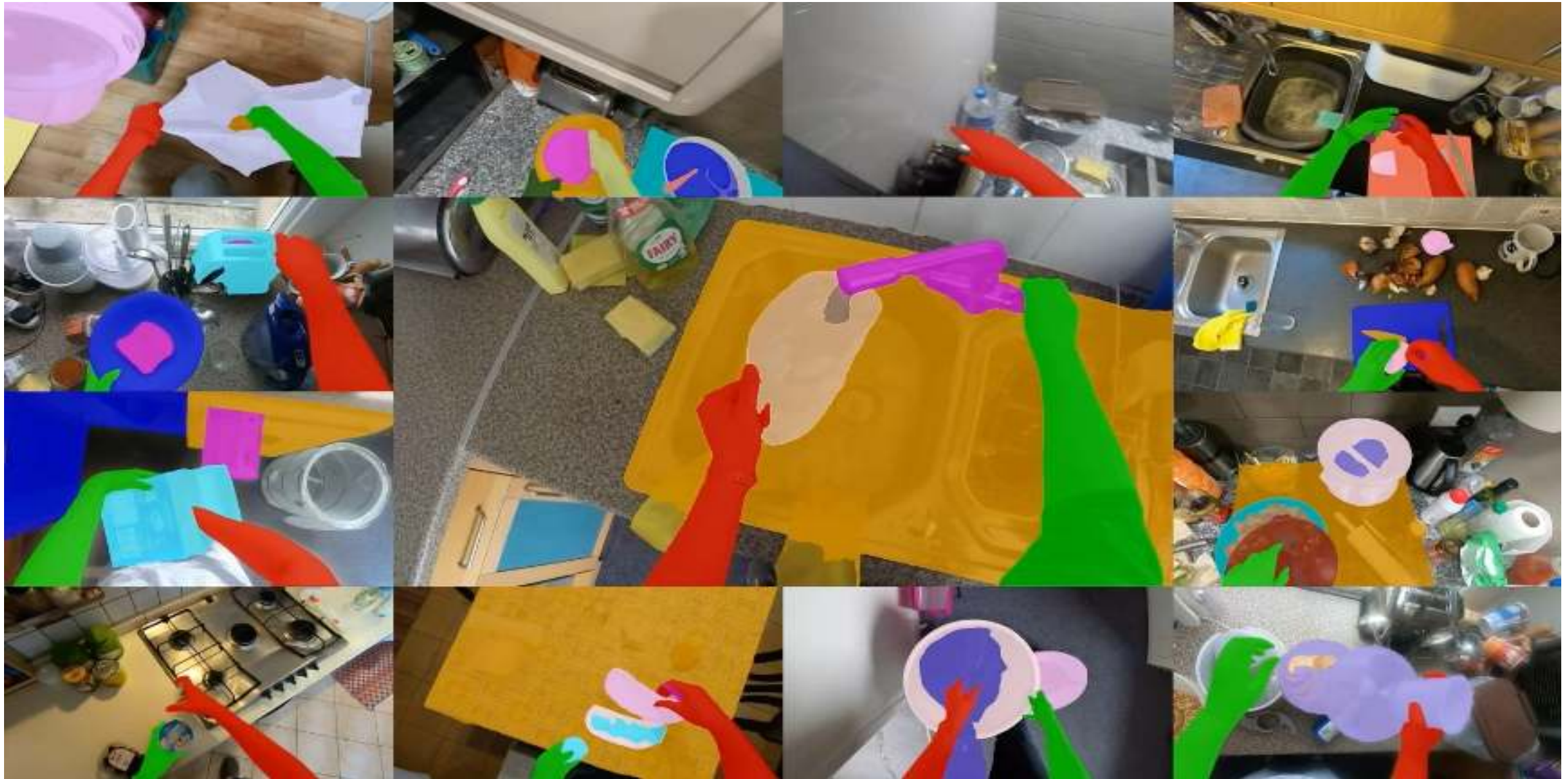
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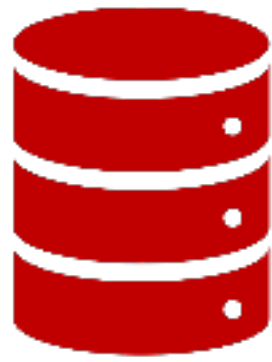
EPIC-KITCHENS VISOR

with: Ahmad Darkhalil, Dandan Shan, Bin Zhu, Jian Ma,
Amlan Kar, Richard Higgins, David Fouhey, Sanja Fidler





Semantics are harder than
you think...
There are significant
ambiguities



From Data to Video



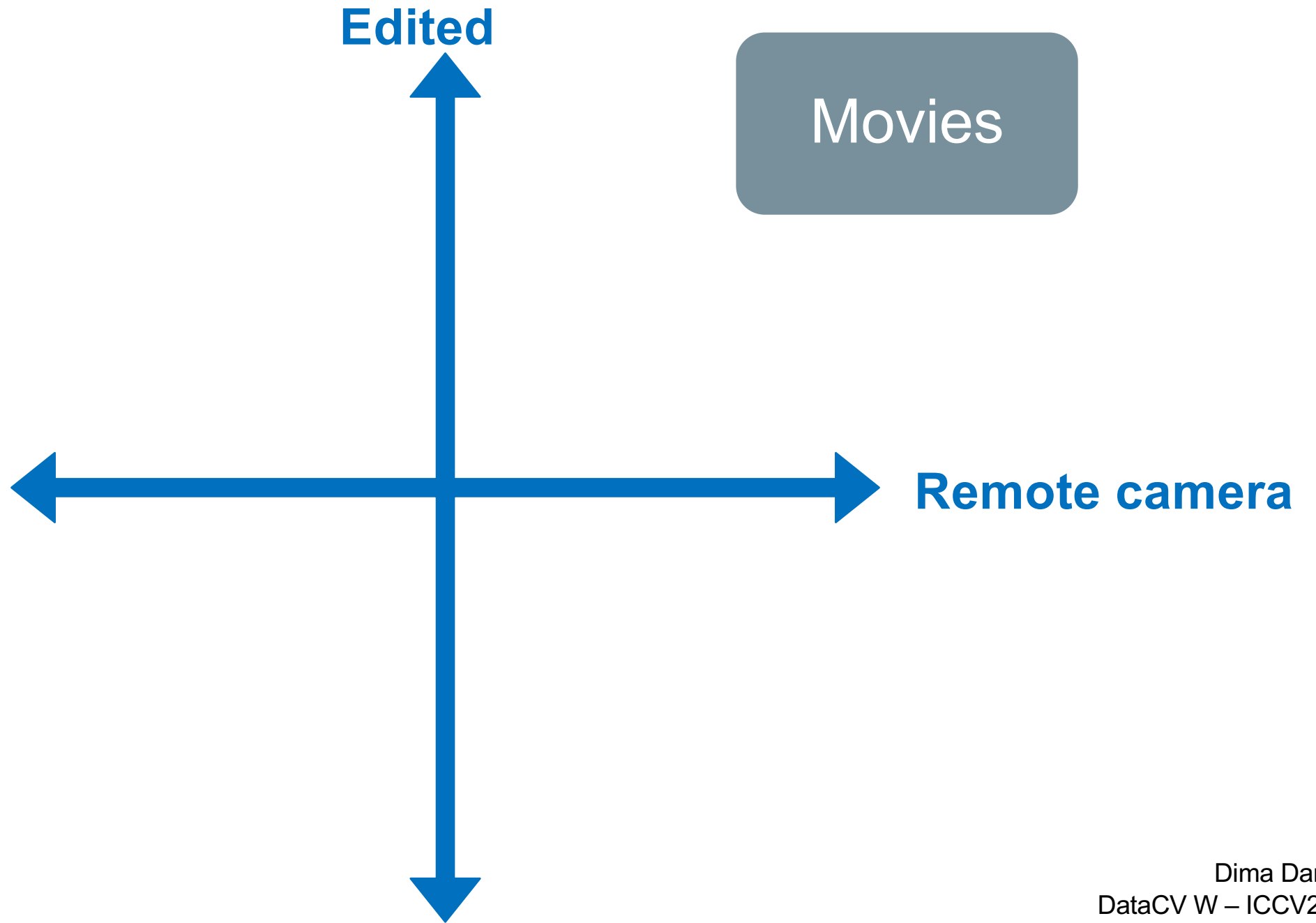
The history of VIDEO



The history of VIDEO



The history of *VIDEO understanding*



The history of VIDEO understanding



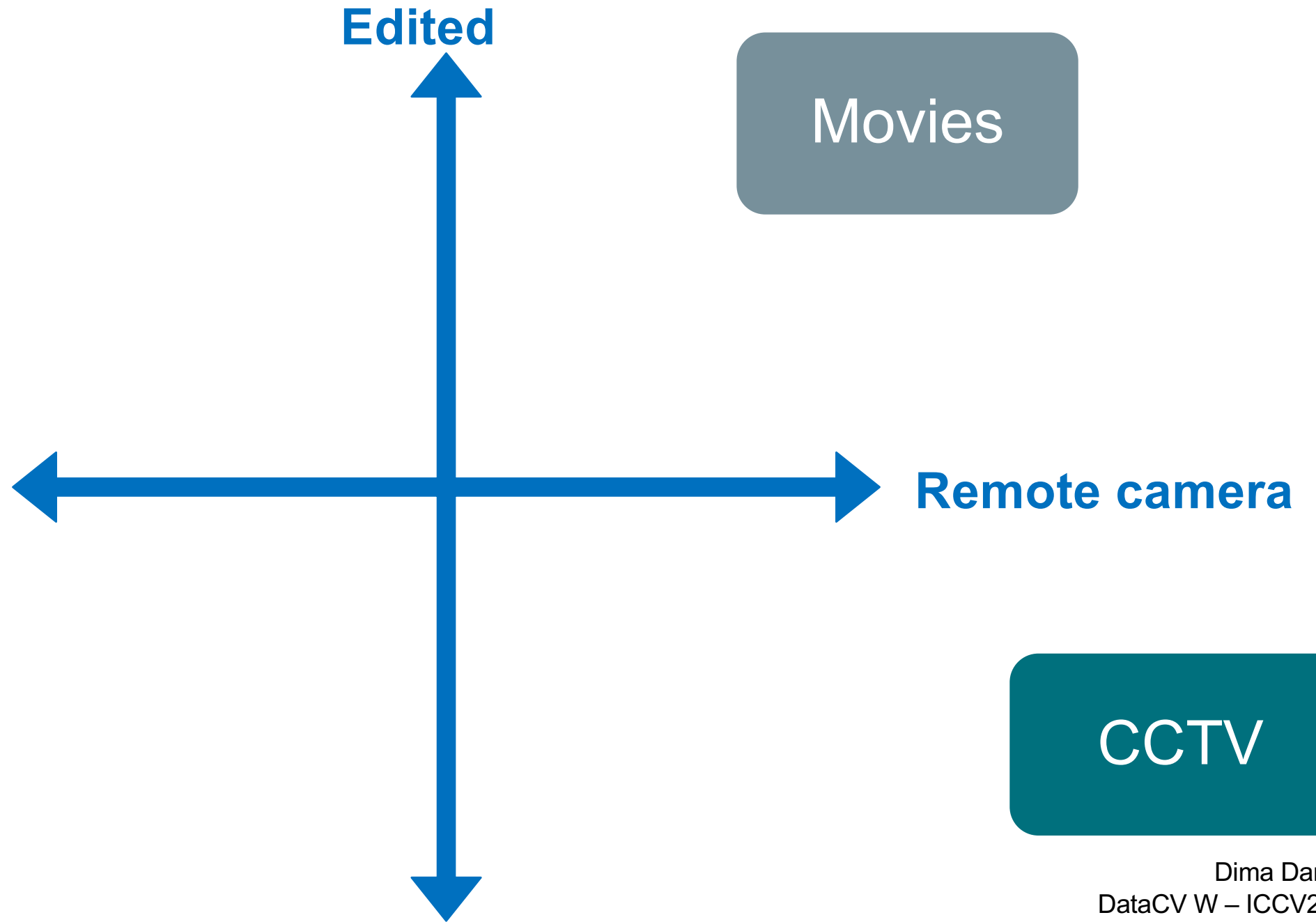
Figure 1. Examples of two action classes (drinking and smoking) from the movie “Coffee and Cigarettes”. Note the high within-

Laptev and Perez (2007)

The history of VIDEO understanding



The history of *VIDEO understanding*



The history of VIDEO understanding



The history of VIDEO understanding





Videos are not **one** thing



Multi-modal learning...

with: Vangelis Kazakos Jaesung Huh
Arsha Nagrani. Jacob Chalk
Andrew Zisserman

- The magic of audio-visual understanding...
- Object-Object interactions



Multi-modal learning...

with: Vangelis Kazakos
Arsha Nagrani.
Andrew Zisserman

Jaesung Huh
Jacob Chalk

- The magic of audio-visual understanding...
- Object-Object interactions
- Material sounds



Multi-modal learning...

with: Vangelis Kazakos
Arsha Nagrani.
Andrew Zisserman

Jaesung Huh
Jacob Chalk

- The magic of audio-visual understanding...
- Object-Object interactions
- Material sounds
- Sound-emitting objects



with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman



EPIC-Sounds: A Large-scale Dataset of Actions That Sound

Jaesung Huh*, Jacob Chalk*, Evangelos Kazakos, Dima Damen, Andrew Zisserman
* : Equal contribution



University of
BRISTOL

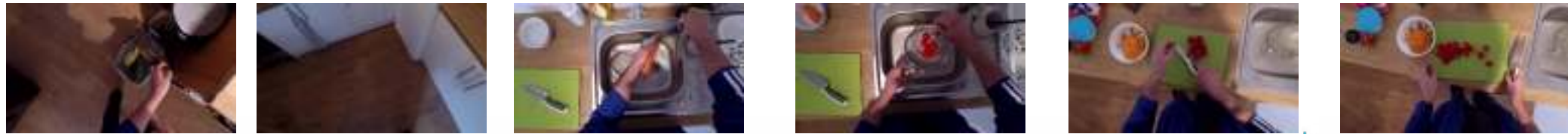


Dima Damen
DataCV W – ICCV2025

Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman

Video



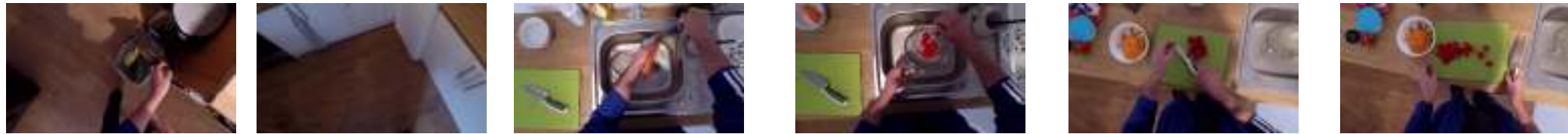
Audio



Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman

Video



Close bin Close bag

Wash carrot

Wash tomato

Take knife

Cut tomato



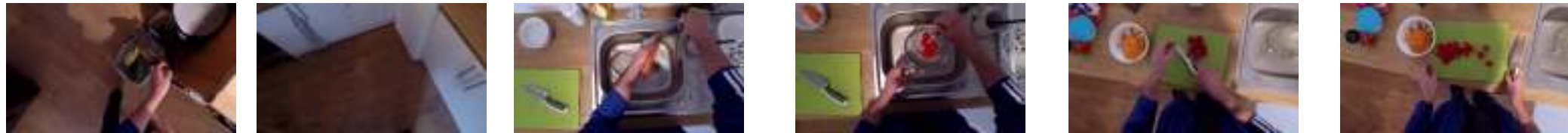
Audio



Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman

Video



Close bin Close bag

Wash carrot

Wash tomato

Take knife

Cut tomato

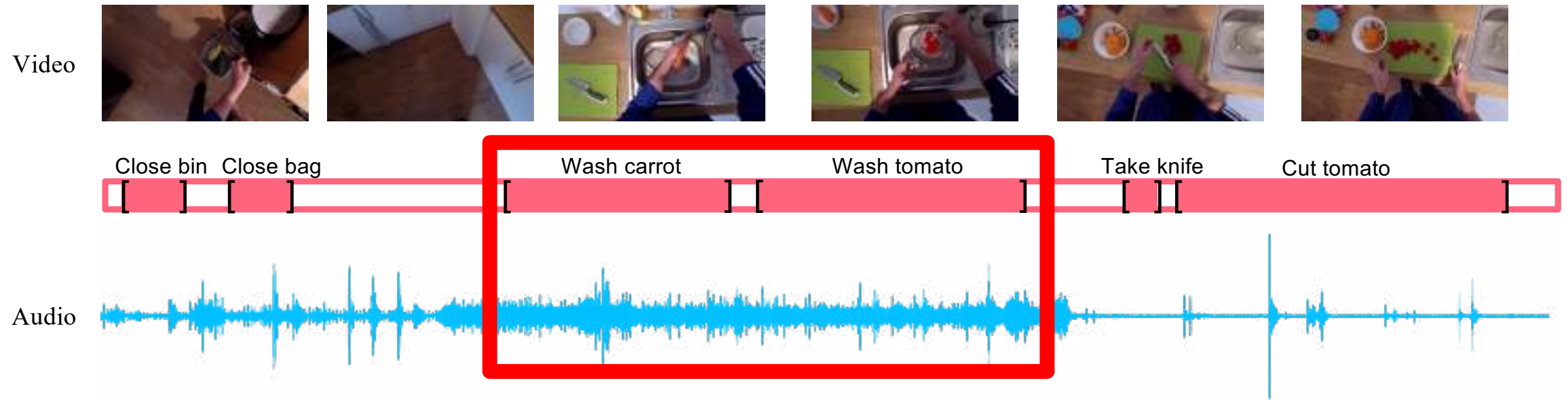


Audio



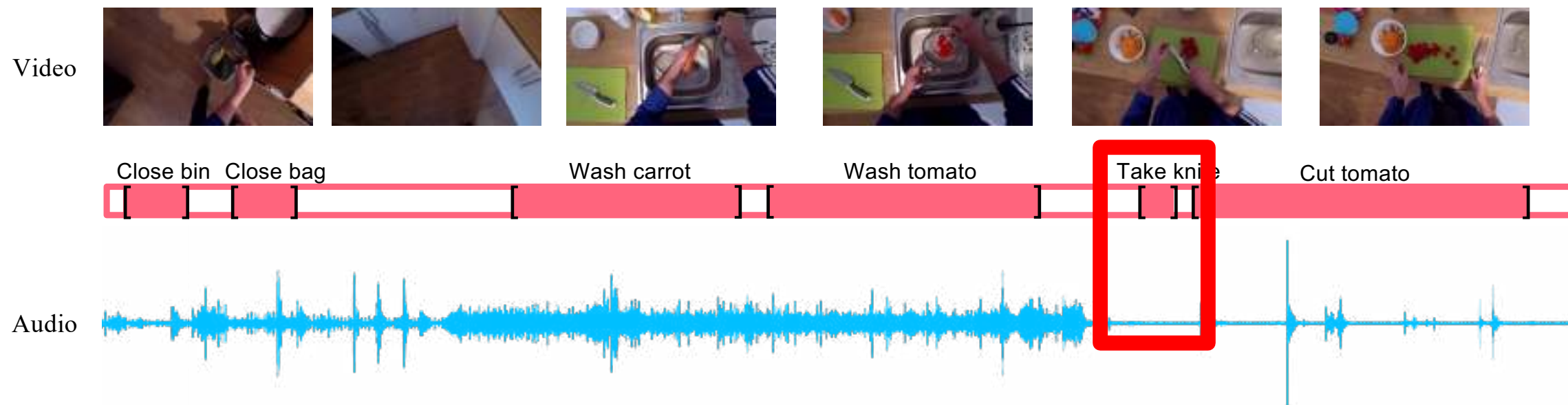
Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman



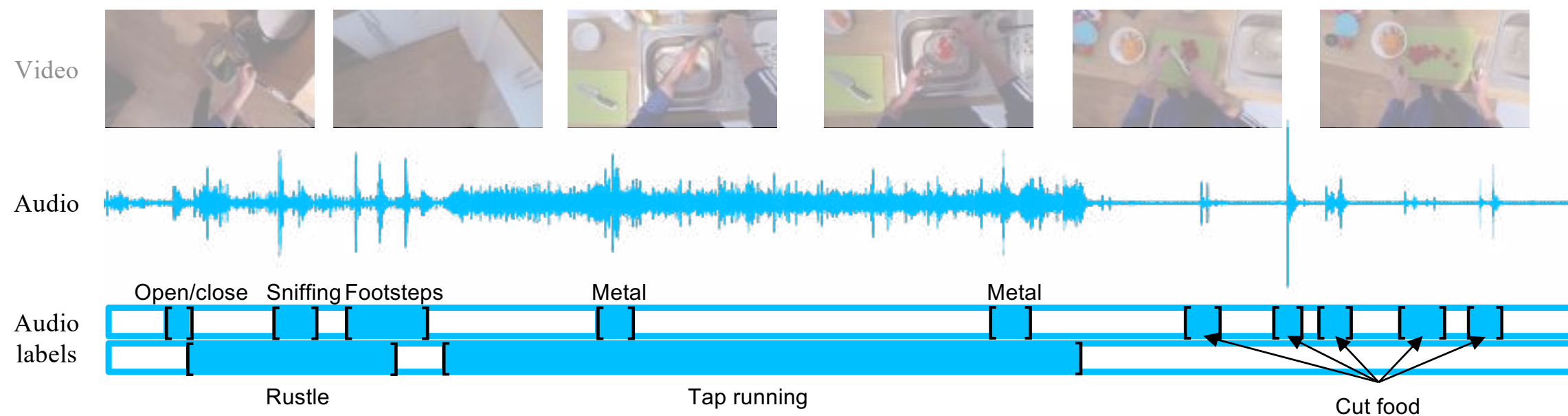
Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman



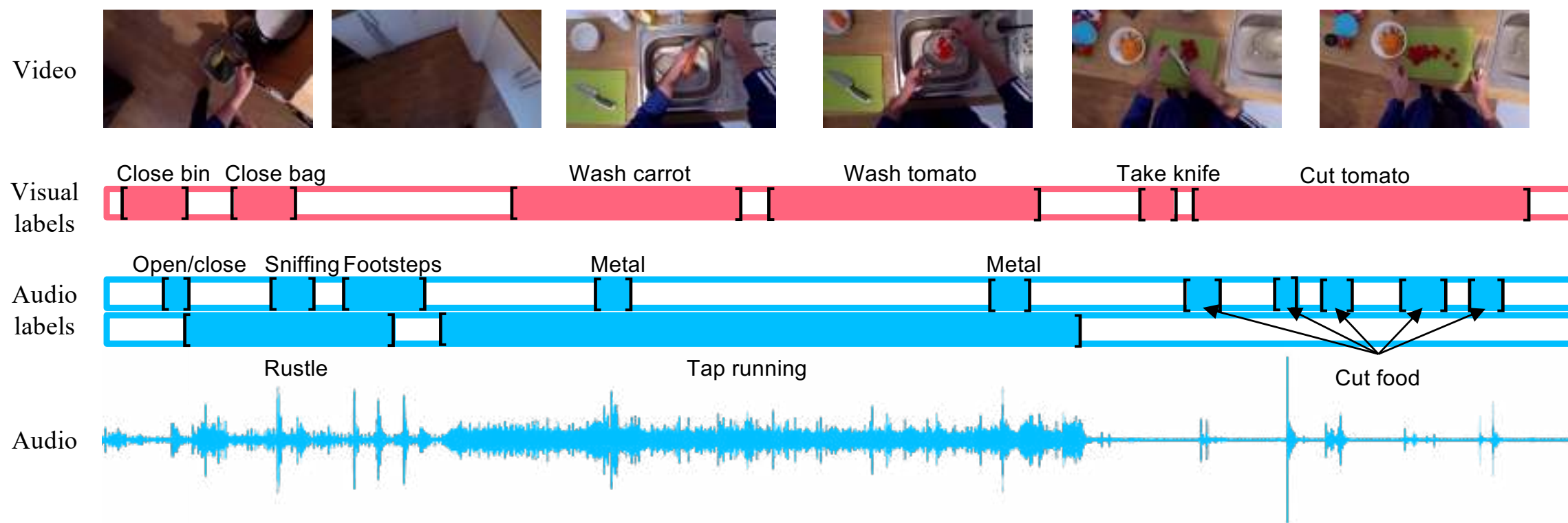
Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman



Motivation

with: Jaesung Huh* & Jacob Chalk*
Vangelis Kazakos Andrew Zisserman





spray





with: Jacob Chalk* Jaesung Huh*
Vangelis Kazakos Andrew Zisserman



TIM: A Time Interval Machine for Audio-Visual Action Recognition

Jacob Chalk*, Jaesung Huh*, Evangelos Kazakos, Andrew Zisserman, Dima Damen

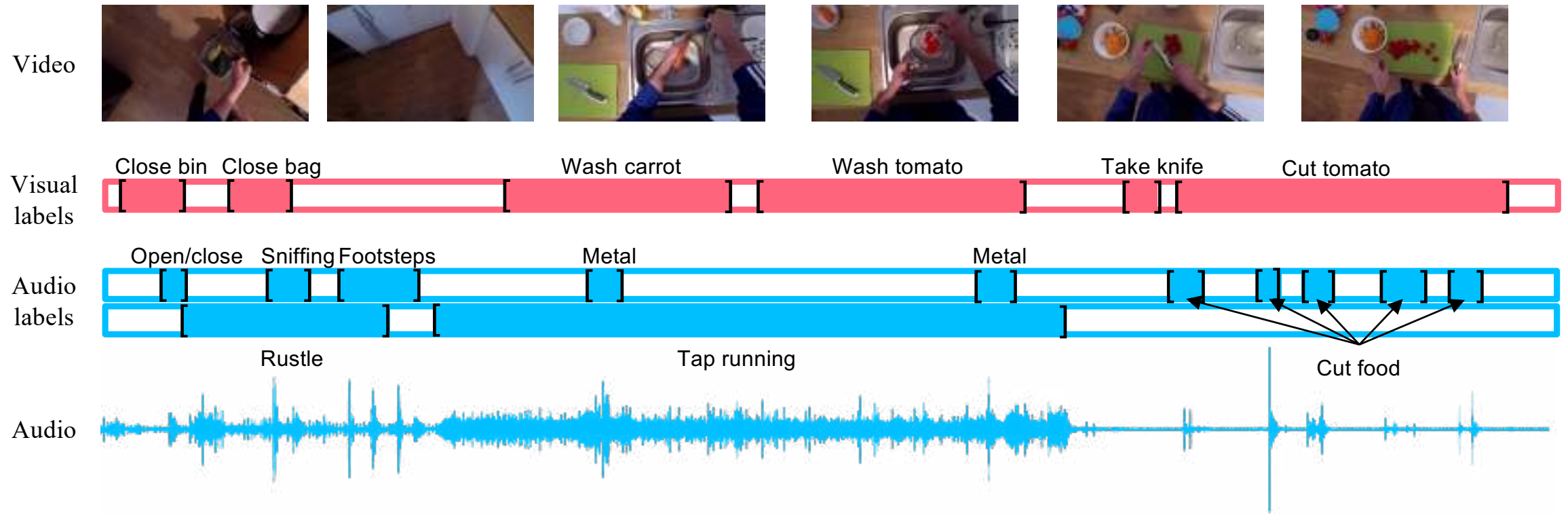
* : Equal contribution



Dima Damen
DataCV W – ICCV2025

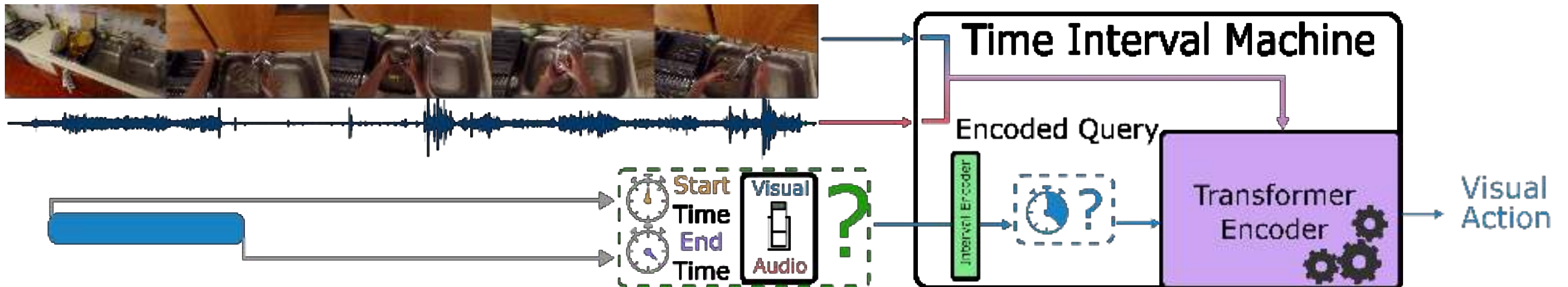
Multi-Modal Long-Form Dataset

with: Jacob Chalk* Jaesung Huh*
Vangelis Kazakos Andrew Zisserman



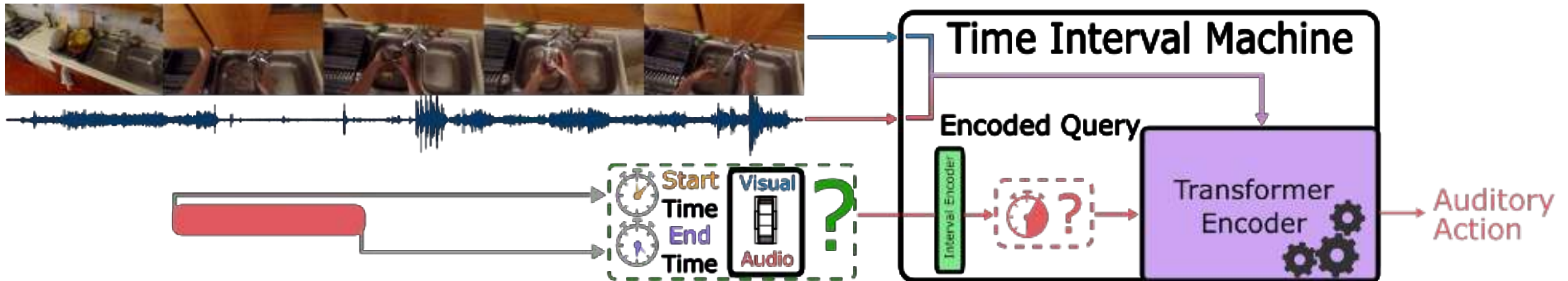
TIM: A Time-Interval Audio-Visual Machine

with: Jacob Chalk* Jaesung Huh*
Vangelis Kazakos Andrew Zisserman



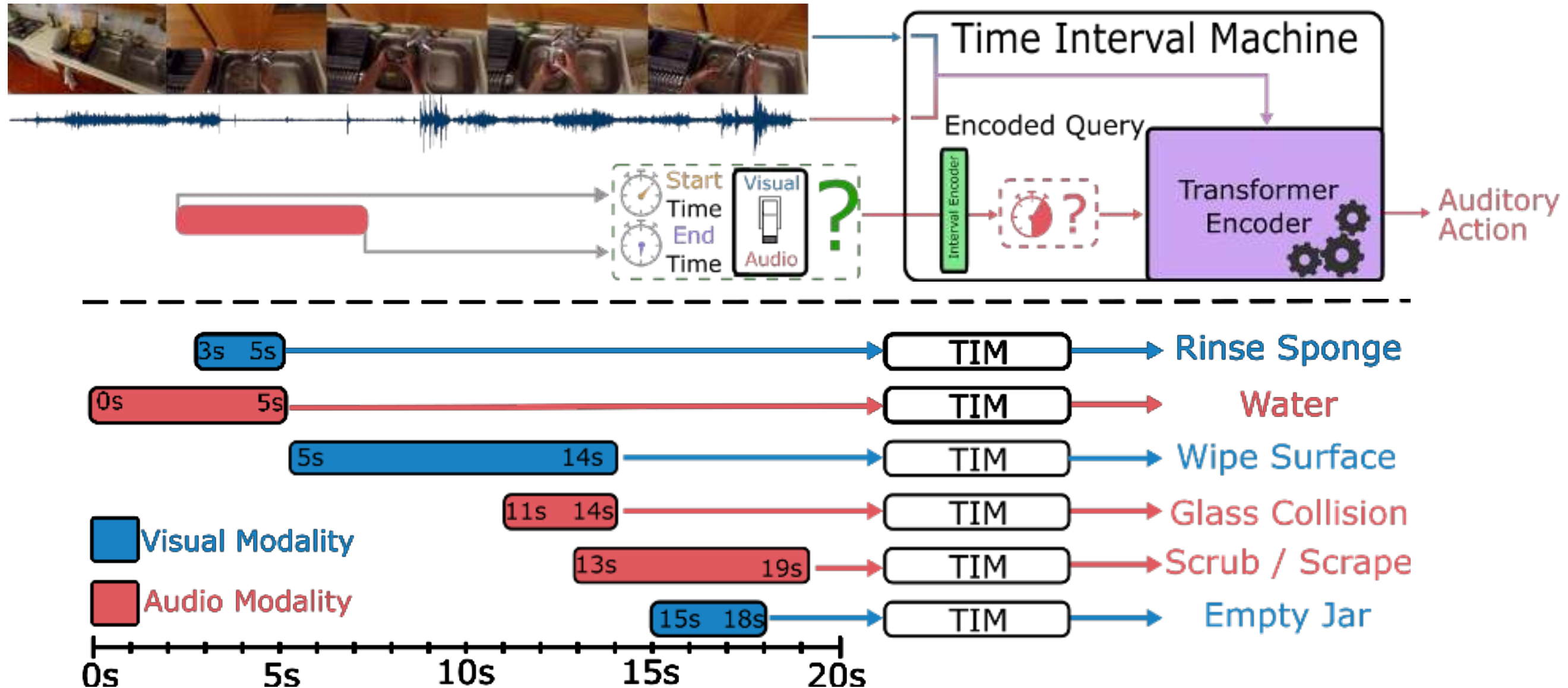
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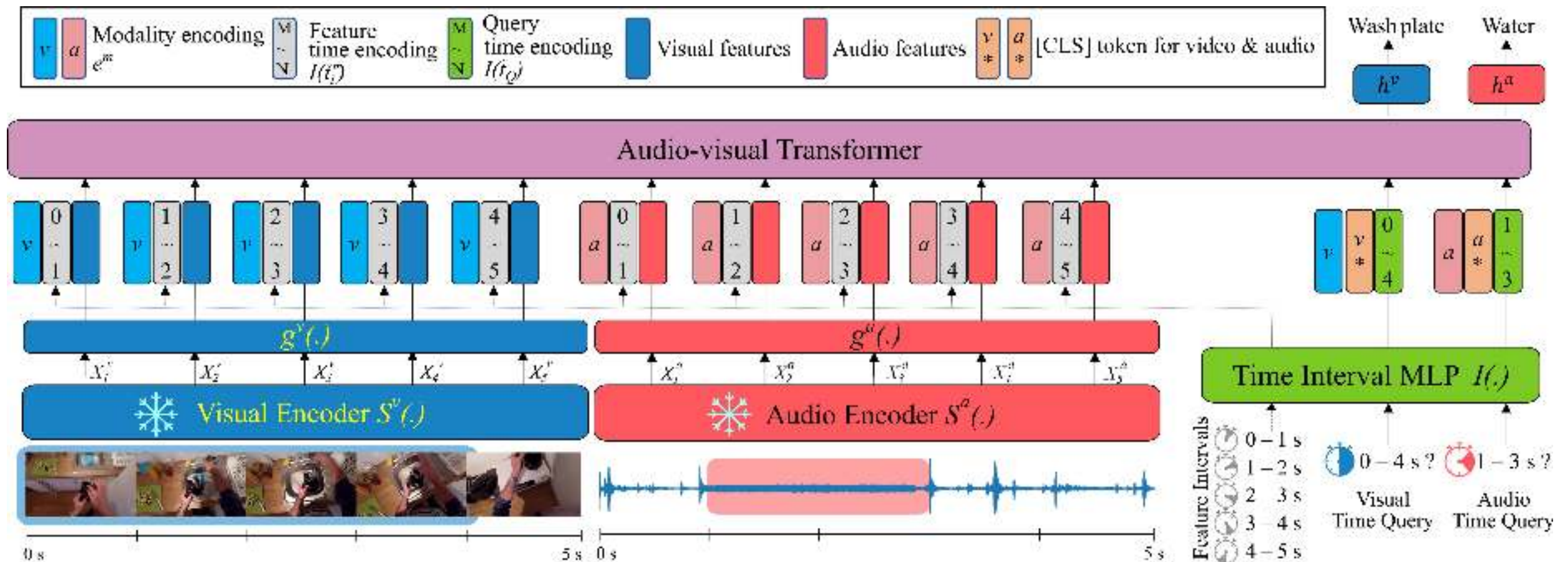
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TIM: A Time-Interval Audio-Visual Machine

with: Jacob Chalk* Jaesung Huh*
Vangelis Kazakos Andrew Zisserman

Model	x_p	LLM	Verb	Noun	Action
<i>Visual-only models</i>					
MFormer-HR [37]	336p	✗	67.0	58.5	44.5
MoViNet-A6 [27]	320p	✗	72.2	57.3	47.7
MeMViT [55]	224p	✗	71.4	60.3	48.4
Omnivore [14]	224p	✗	69.5	61.7	49.9
MTV [59]	280p	✗	69.9	63.9	50.5
LaViLa (TSF-L) [63]	224p	✓	72.0	62.9	51.0
AVION (ViT-L) [62]	224p	✓	73.0	65.4	54.4
TIM (ours)	224p	✗	76.2	66.4	56.4
<i>Audio-visual models</i>					
TBN [24]	224p	✗	66.0	47.2	36.7
MBT [34]	224p	✗	64.8	58.0	43.4
MTCN [25]	336p	✗	70.7	62.1	49.6
M&M [57]	420p	✗	72.0	66.3	53.6
TIM (ours)	224p	✗	77.5	67.4	57.9

<i>Perception Test Action</i>				
Model	MLP (V)	MTCN [25](A+V)	TIM (V)	TIM (A+V)
Top-1 acc	43.7	51.2	56.1	61.1
<i>Perception Test Sound</i>				
Model	MLP (A)	MTCN [25](A+V)	TIM (A)	TIM (A+V)
Top-1 acc	50.6	52.9	54.8	56.1

Table 5. Comparisons to trained recognition baselines on the Perception Test validation split. We show both action and sound recognition and the benefit of including audio-visual in TIM for both challenges. **V** : visual and **A** : audio input features. MLP is the result by training an MLP classifier with the features directly.



Labelling Multi-modalities
is under-explored



COLLECTING A DATASET IN 2025





HD-EPIC: A Highly-Detailed Egocentric Video Dataset



Toby Perrett



Ahmad Darkhalil



Saptarshi Sinha



Omar Emara



Sam Pollard



Kranti Parida



Kaiting Liu



Prajwal Gatti



Siddhant Bansal



Kevin Flanagan



Jacob Chalk



Zhifan Zhu



Rhodri Guerrier



Fahd Abdelazim



Bin Zhu



Davide Moltisanti



Michael Wray



Hazel Doughty



Dima Damen

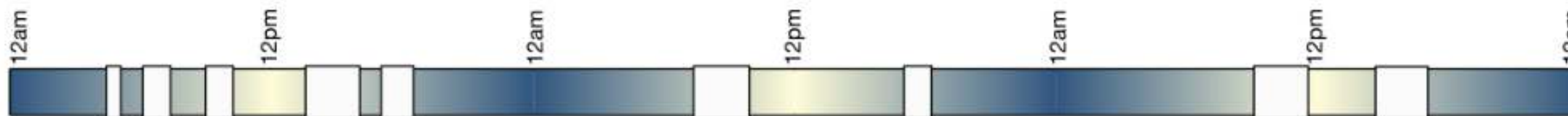


HD-EPIC





HD-EPIC



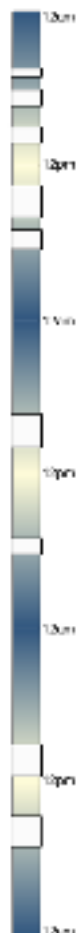


Recorded over 3 days



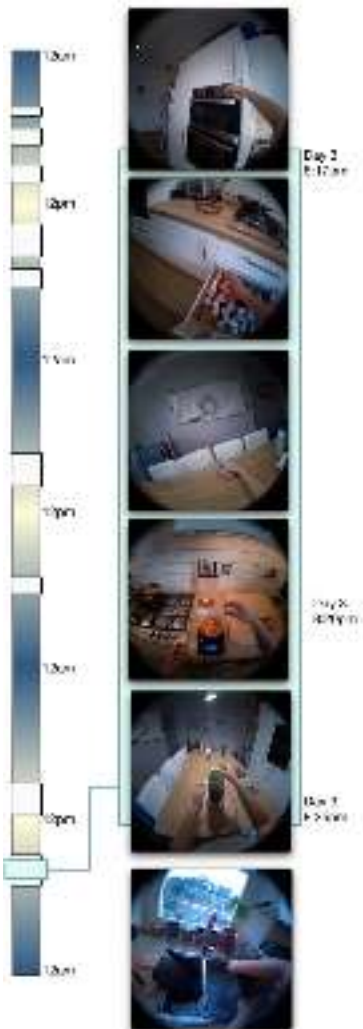


HD-EPIC





HD-EPIC





Recipe: Southwestern Salad

1: Preheat the oven to 400F

2: Wash and peel the sweet potatoes and chop into bite-sized pieces. Put the sweet potatoes in a bowl and add the olive oil, cumin, and chili powder. Pour onto tray and roast for 10 mins.

3: Pulse all the dressing ingredients in a food processor until mostly smooth.

**Recipe
and nutrition**



- Prep



- Step



pick up kettle from its base on the counter with my right hand



pick up packet of bacon



pour water from kettle into the pan with my right hand

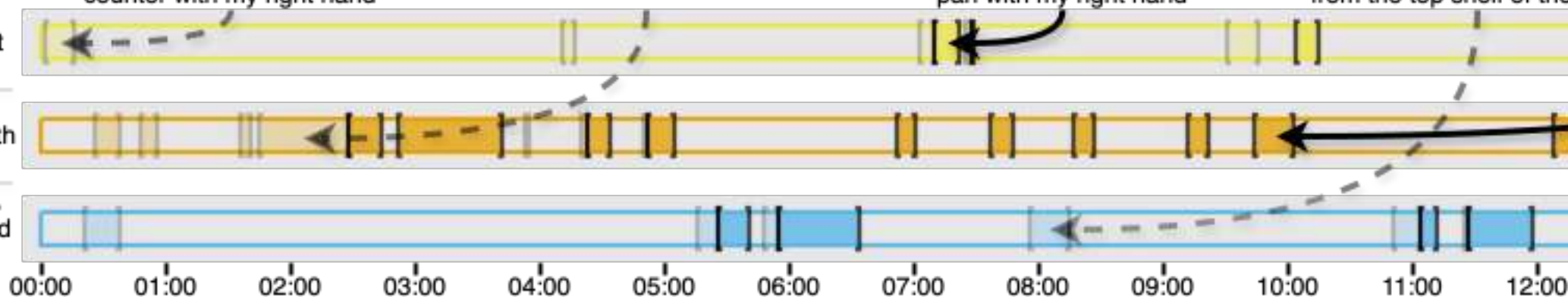


pick up block of cheese that from the top shelf of the

Cook the pasta in a pan of boiling salted water according to the packet instructions.

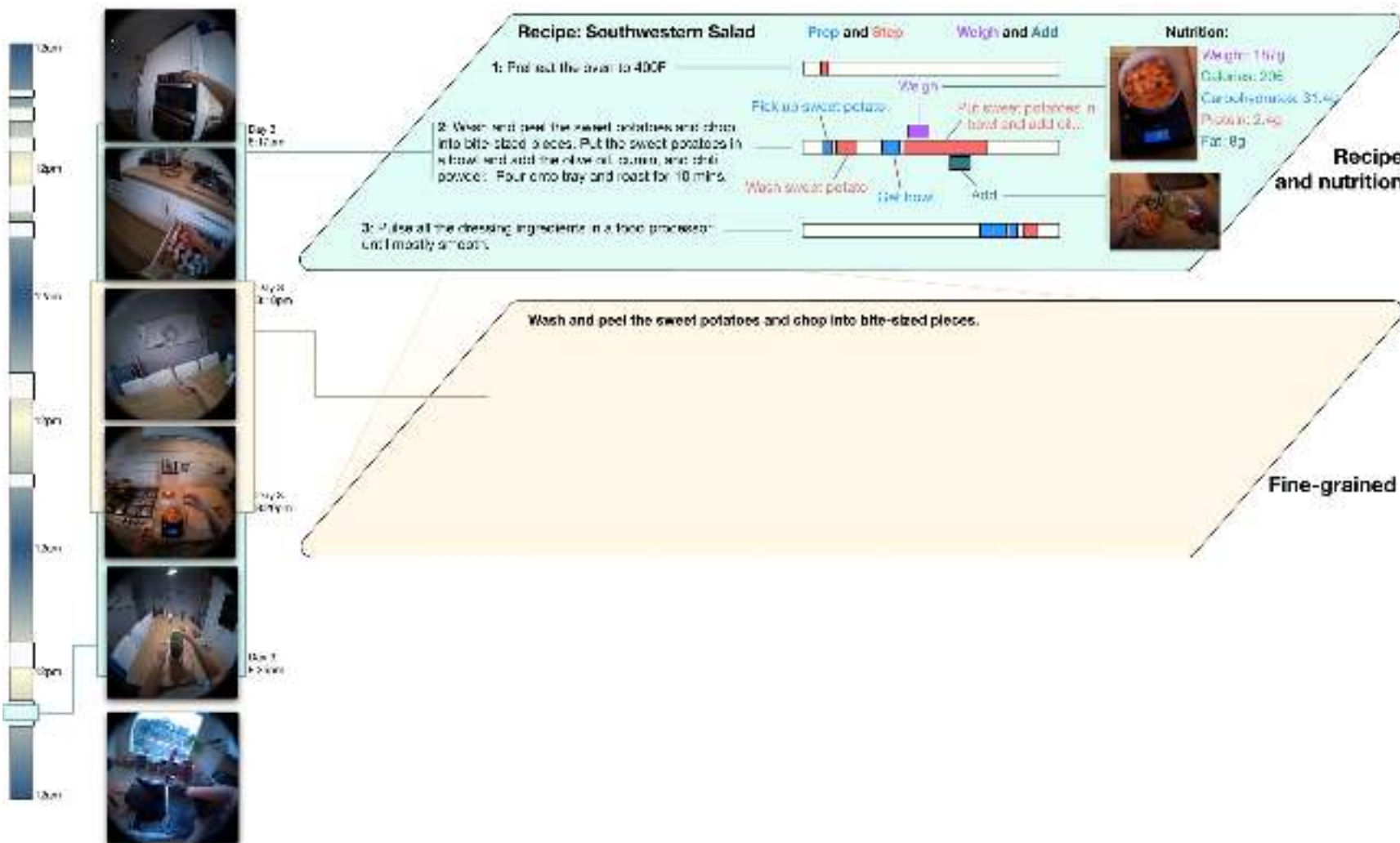
Slice the bacon and place in a non-stick frying pan on a medium heat with half a tablespoon of olive oil and ...

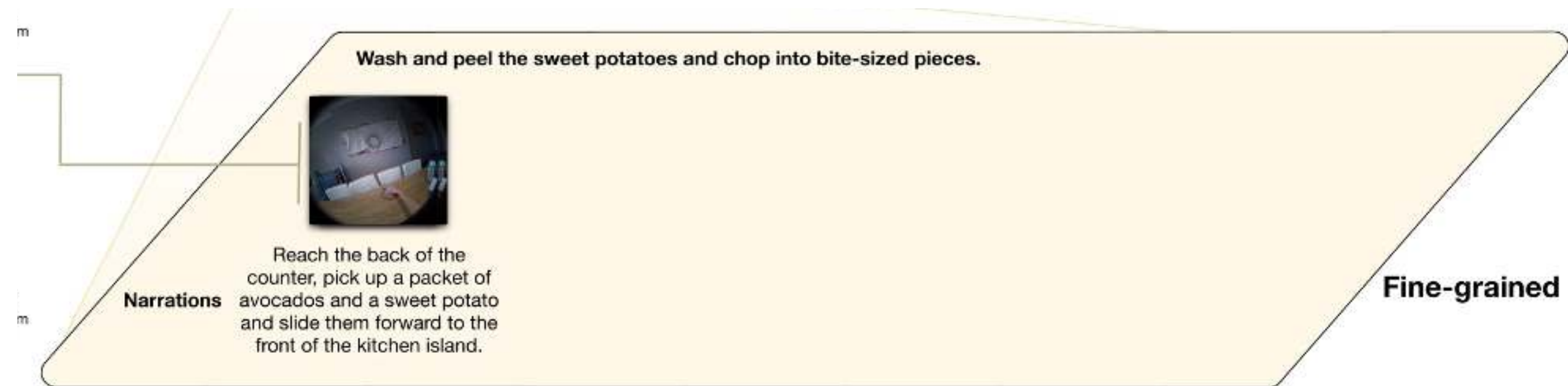
Meanwhile, beat the eggs in a bowl, then finely grate in the Parmesan and mix well.





HD-EPIC



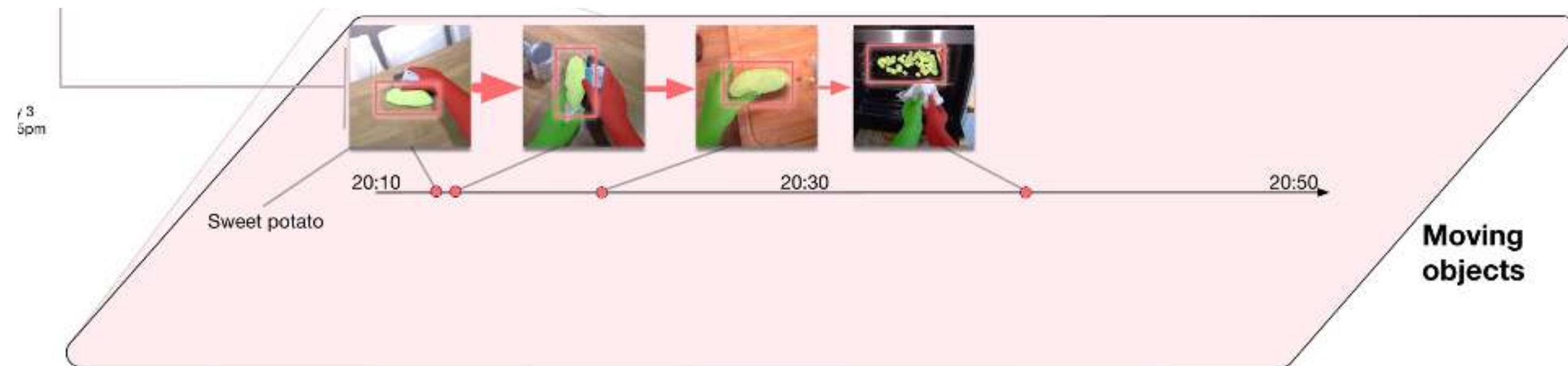


Highly-Detailed Narrations



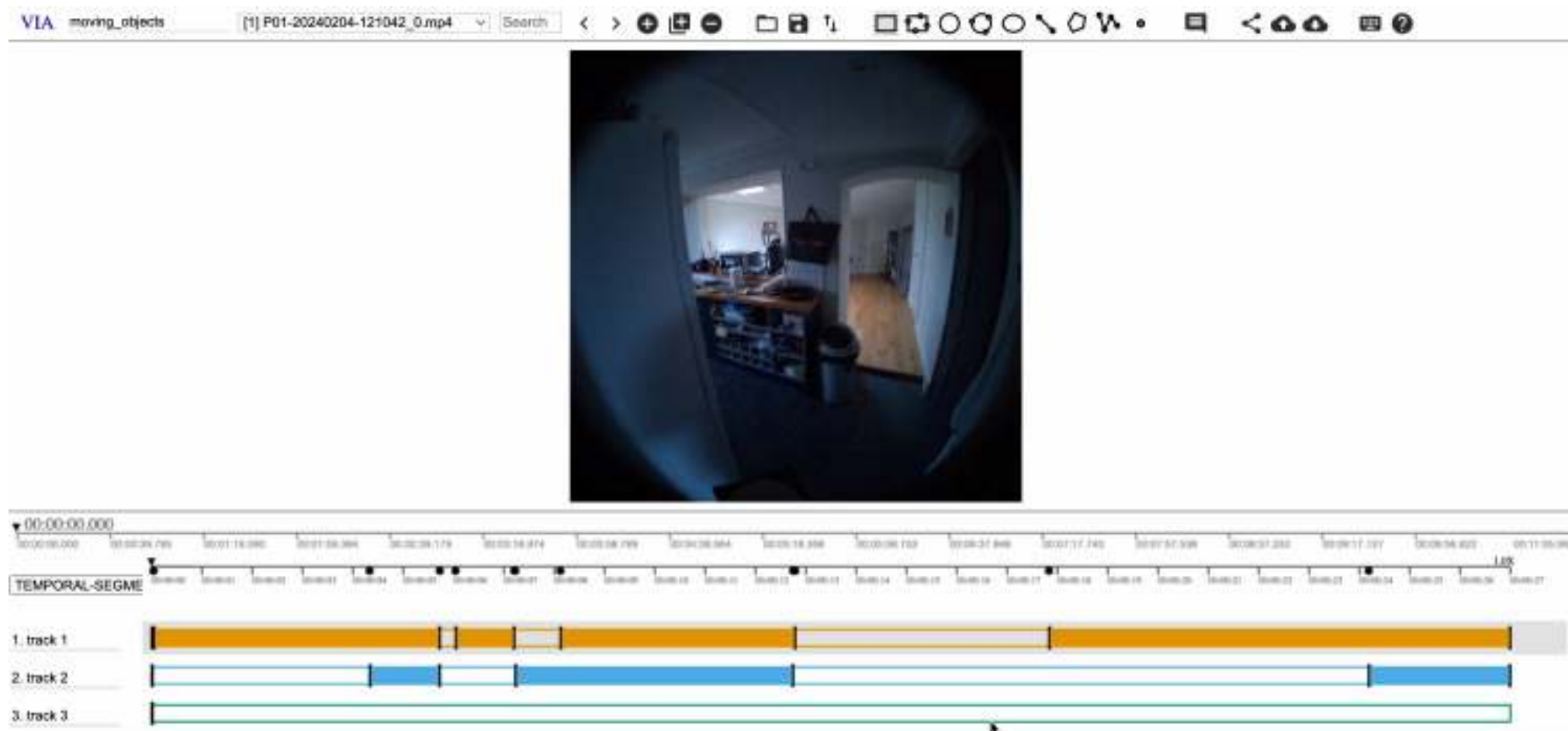


HD-EPIC



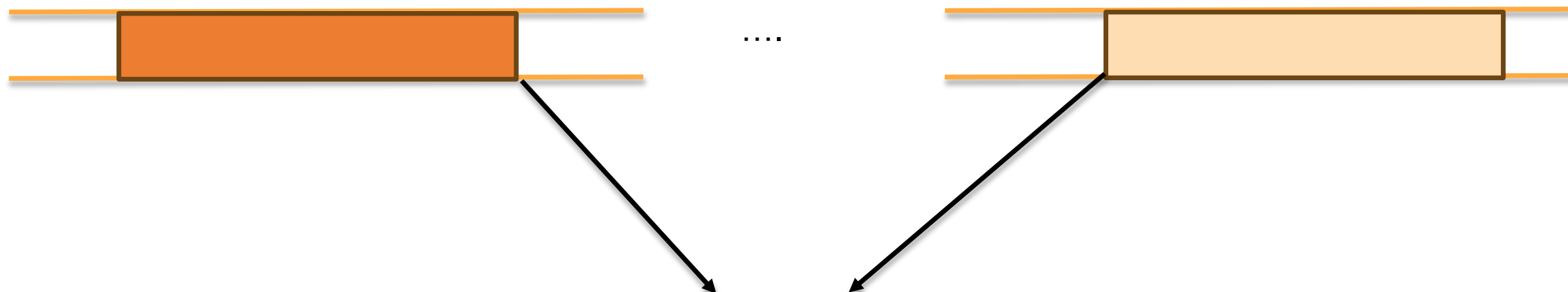


- How to minimize the annotations for tracking objects...





- How to minimize the annotations for tracking objects...



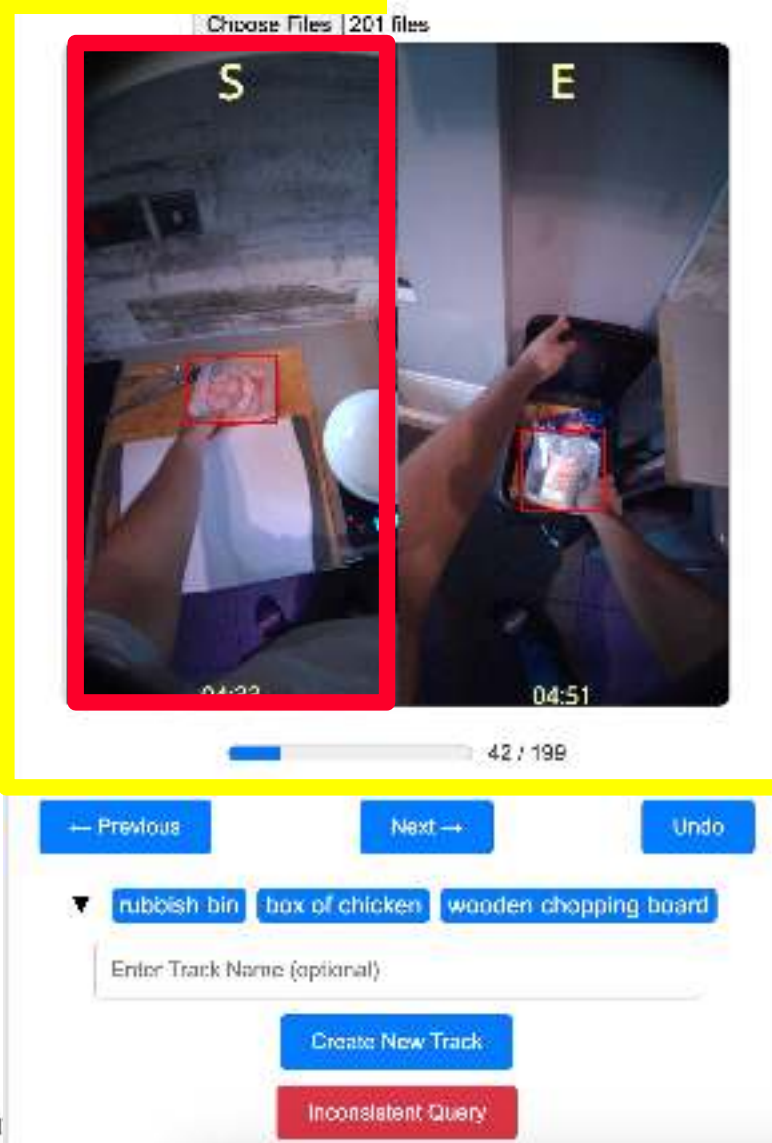
Using appearance & 3D location information to match
Manual confirmation in cases of confusion...





Current Track

Choose Files | 201 files



← Previous Next → Undo

▼ rubbish bin box of chicken wooden chopping board

Enter Track Name (optional)

Create New Track

Inconsistent Query

Previous Tracks

Sort by Distance ☒ Save Tracks

box of chicken (0.0m) Add

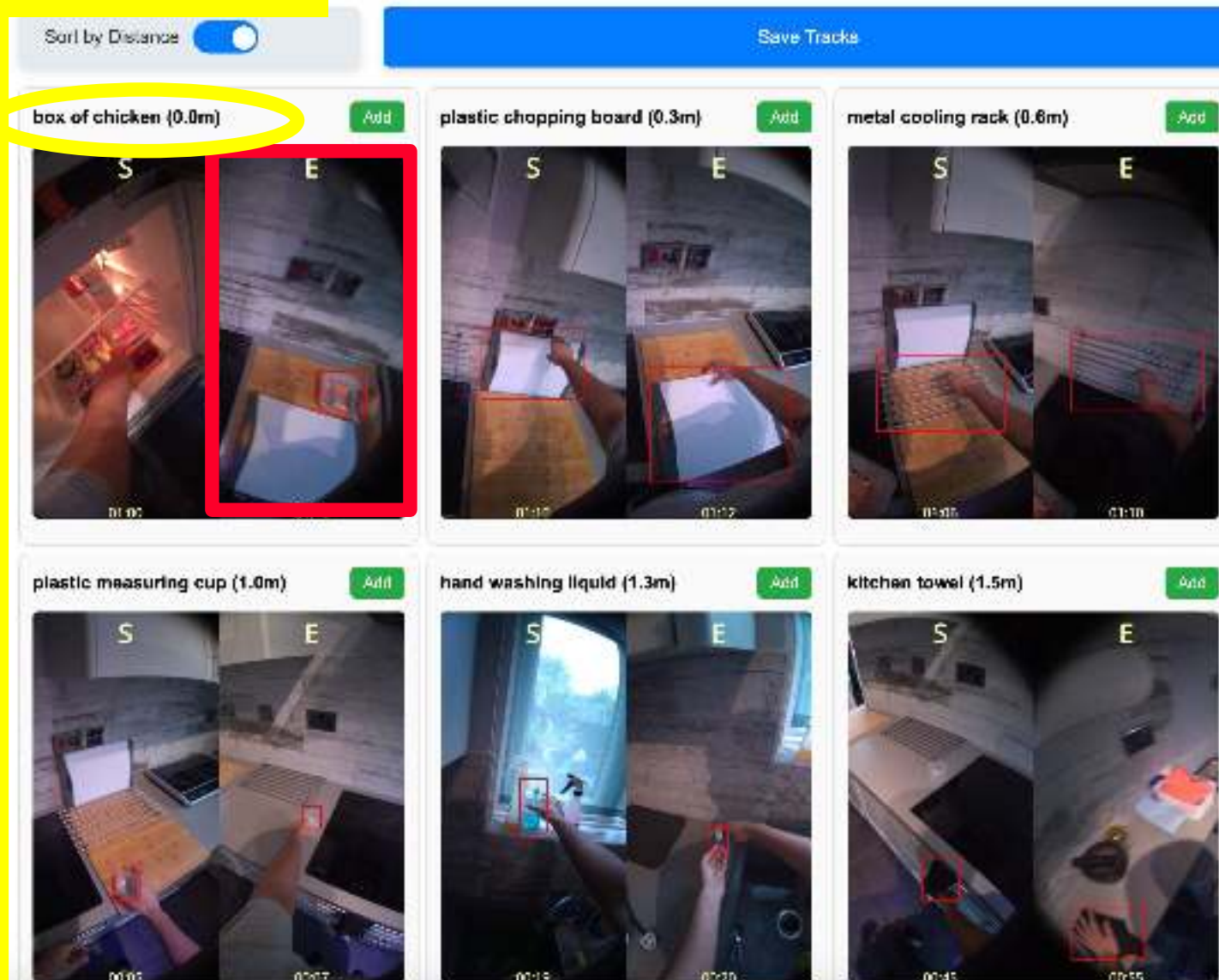
plastic chopping board (0.3m) Add

metal cooling rack (0.6m) Add

plastic measuring cup (1.0m) Add

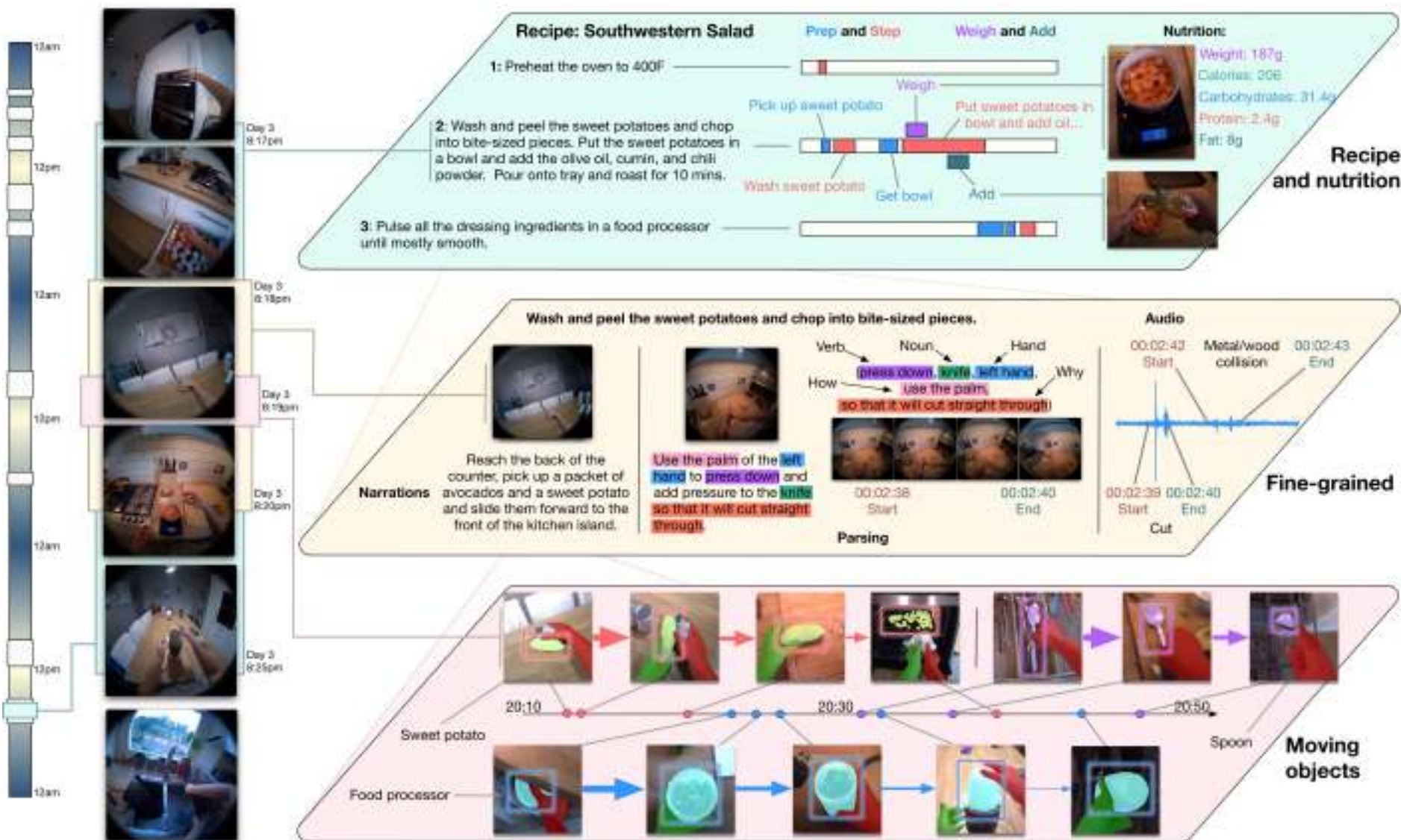
hand washing liquid (1.3m) Add

kitchen towel (1.5m) Add



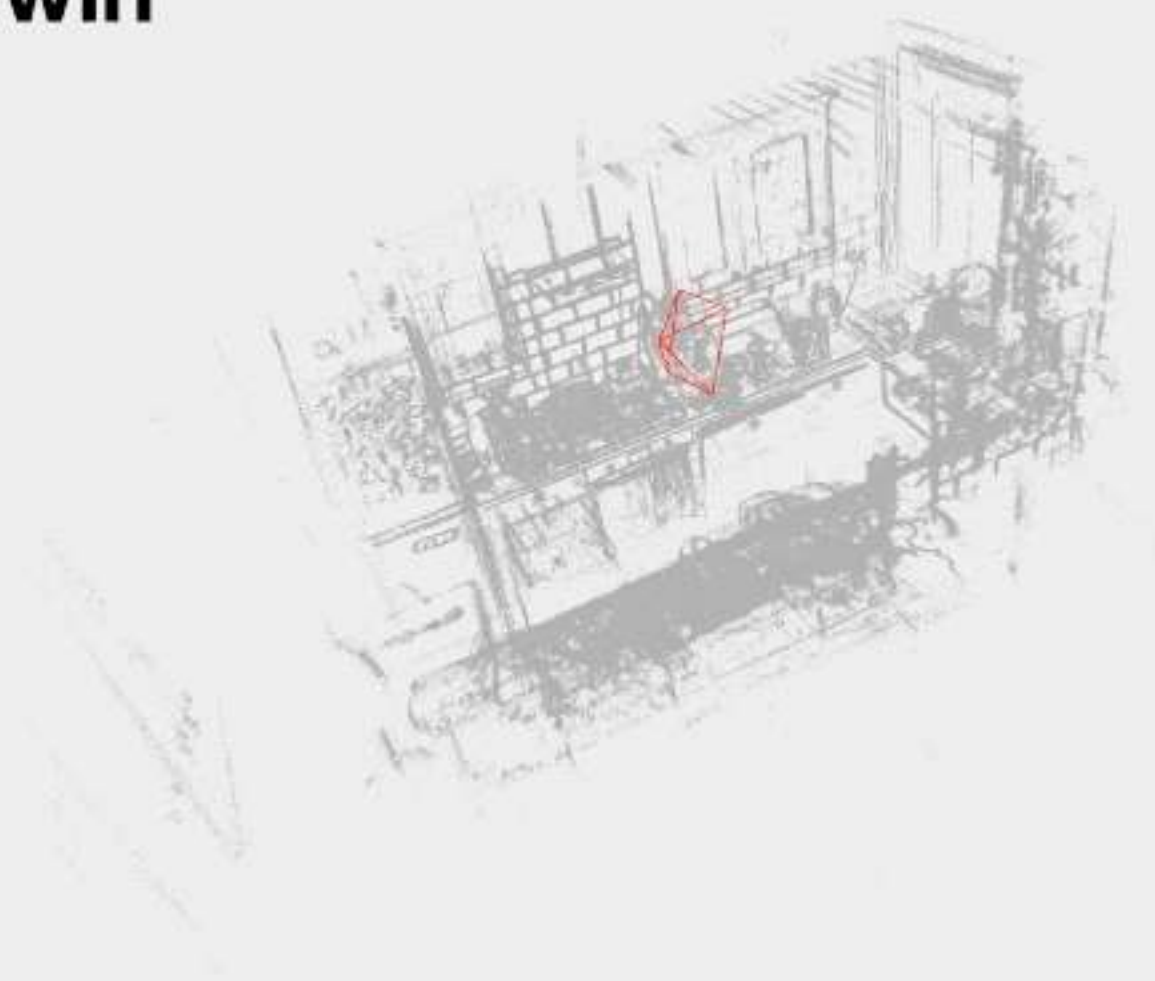


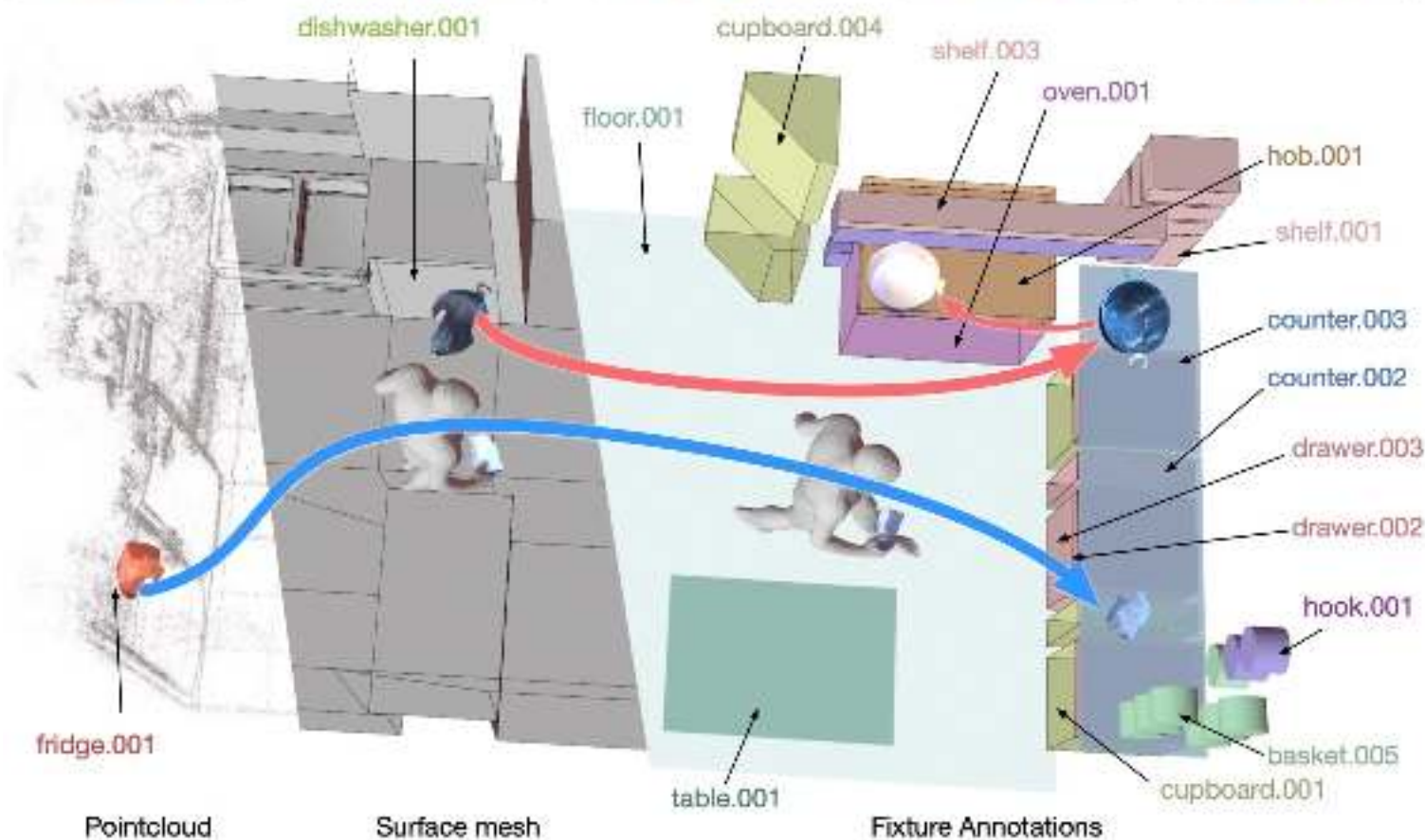
HD-EPIC

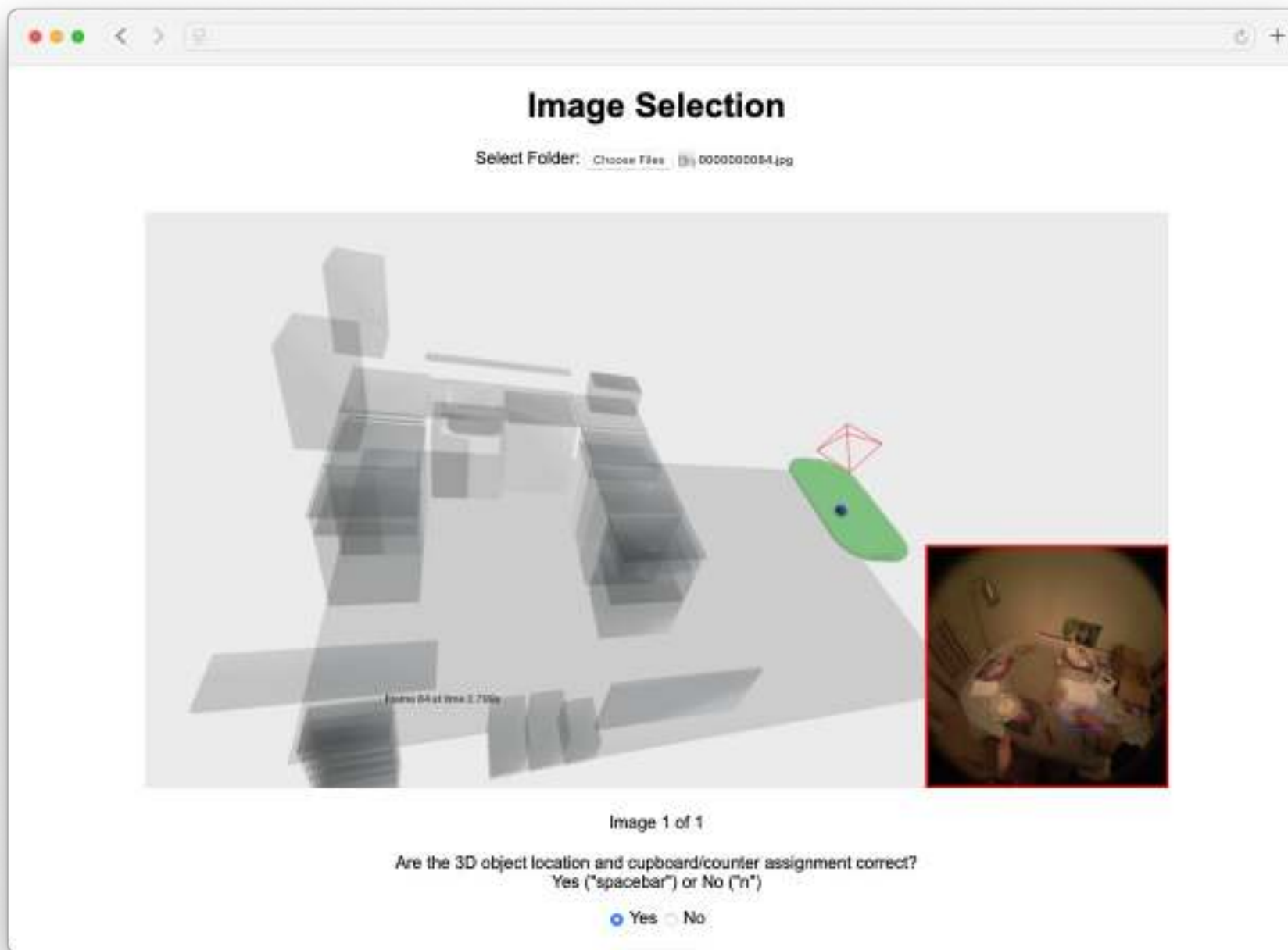


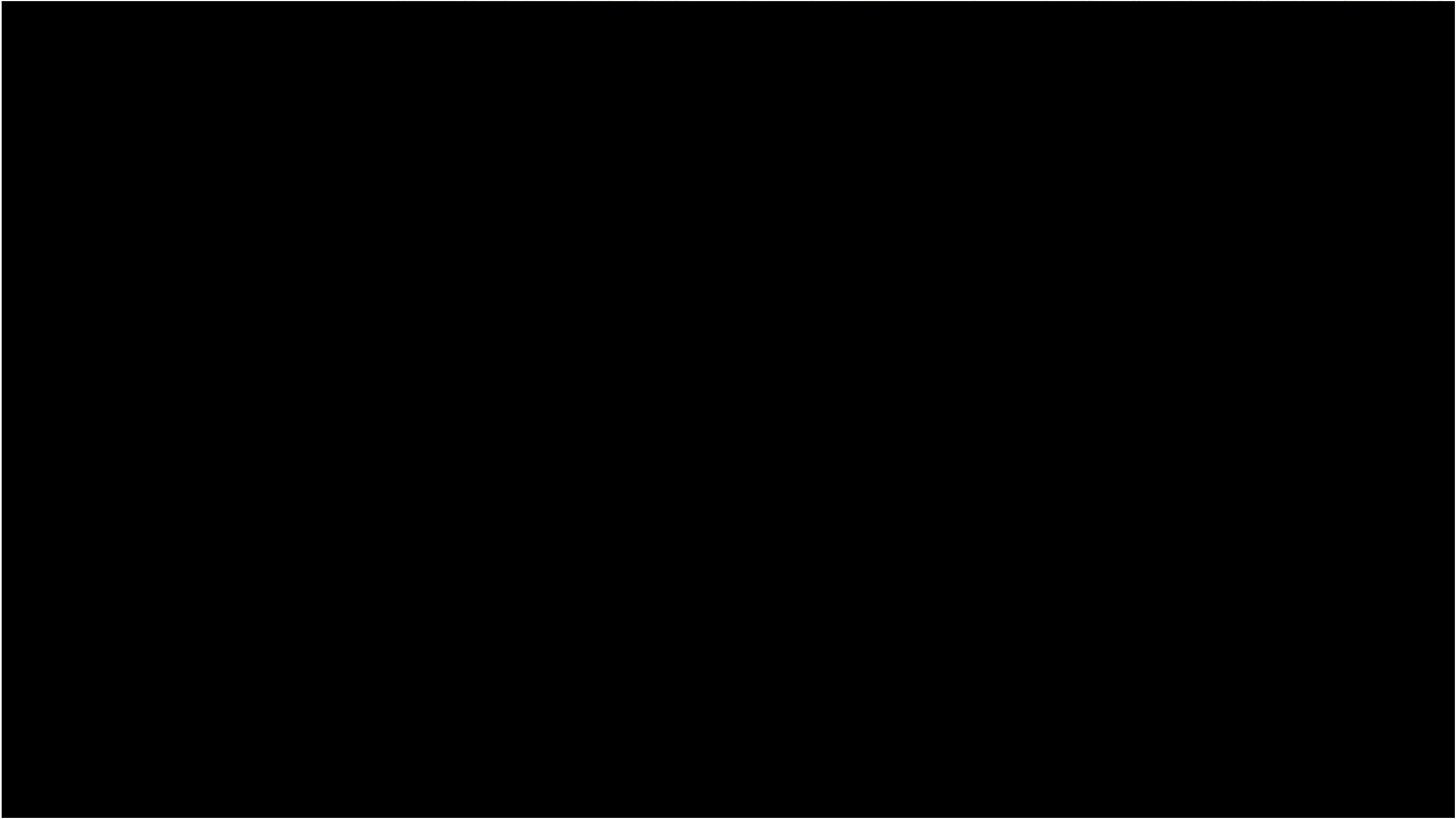


Digital Twin



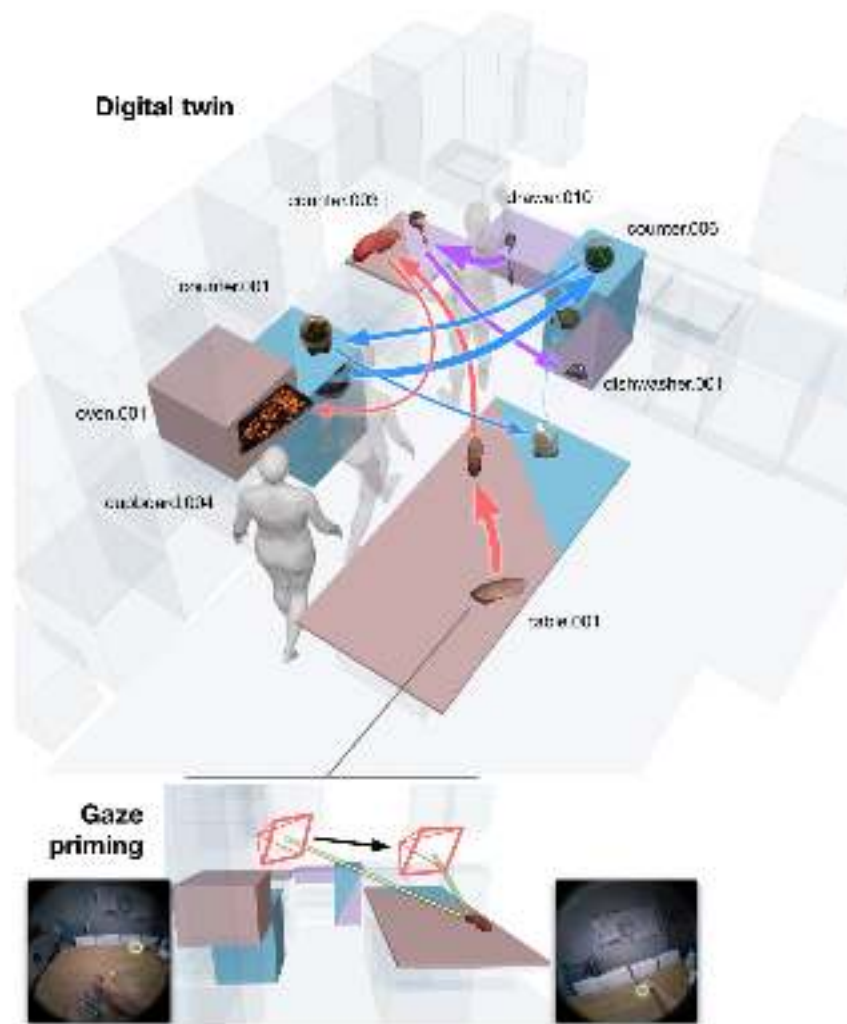
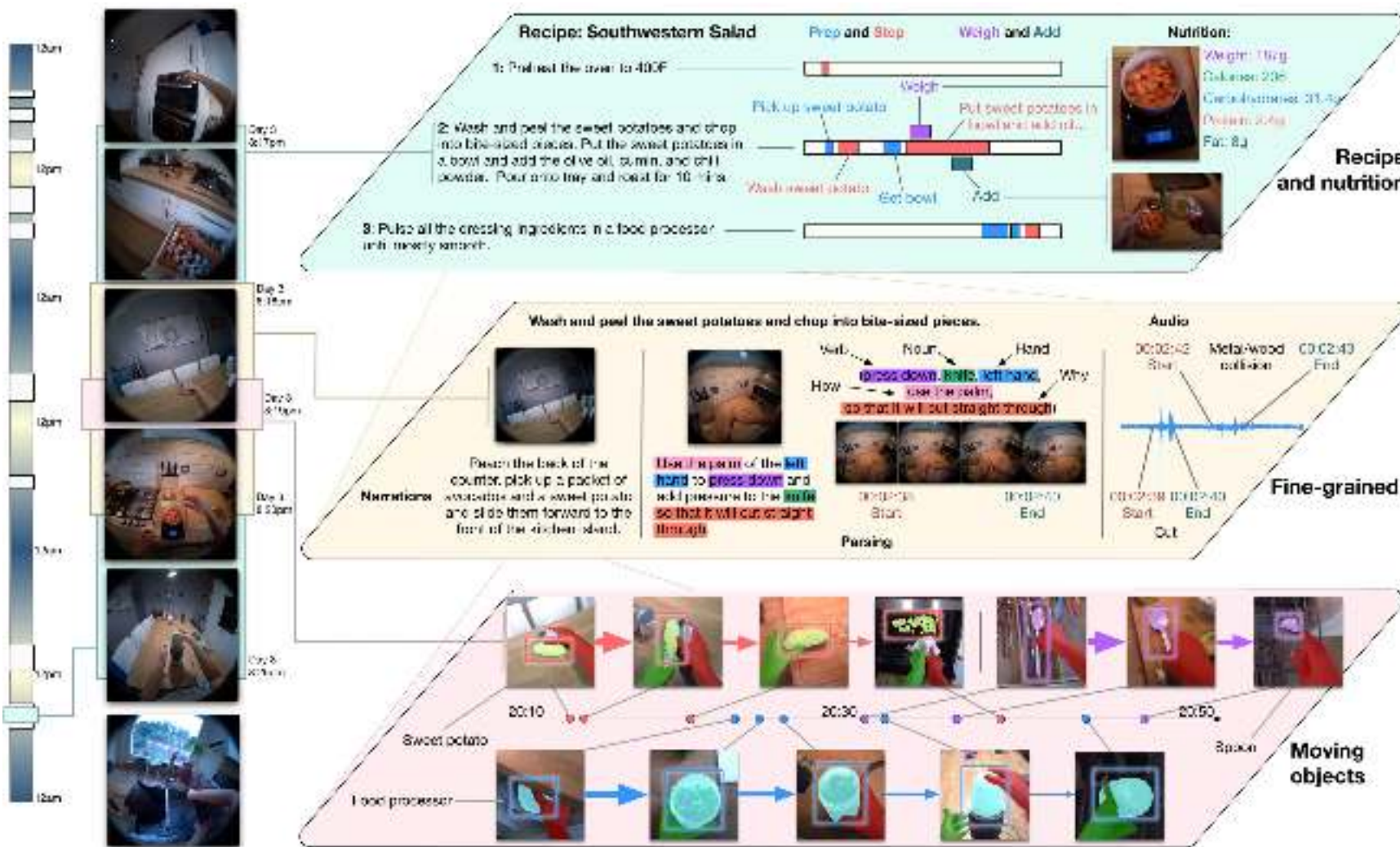








HD-EPIC





HD-EPIC

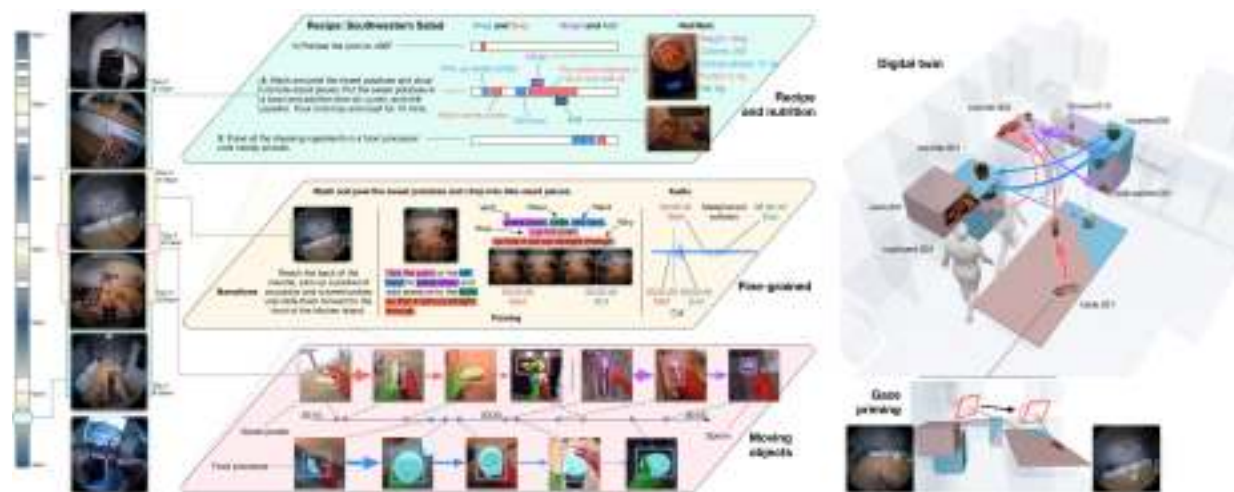


Annotation Type	Total annotations	Annotations/min
Narrations	59,454	24.0
Parsing (Verbs + Nouns + Hands + How + Why)	303,968	122.7
Recipes (Preps + Steps)	4,052	1.6
Sound	50,968	20.6
Action boundaries	59,454	24.0
Object Motion (Pick up + Put down + Fixtures + Bboxes + Masks)	153,480	62.0
Object Itinerary	4,881	2.0
Object Priming (Starts + Ends)	18,264	7.4
Total		263.2

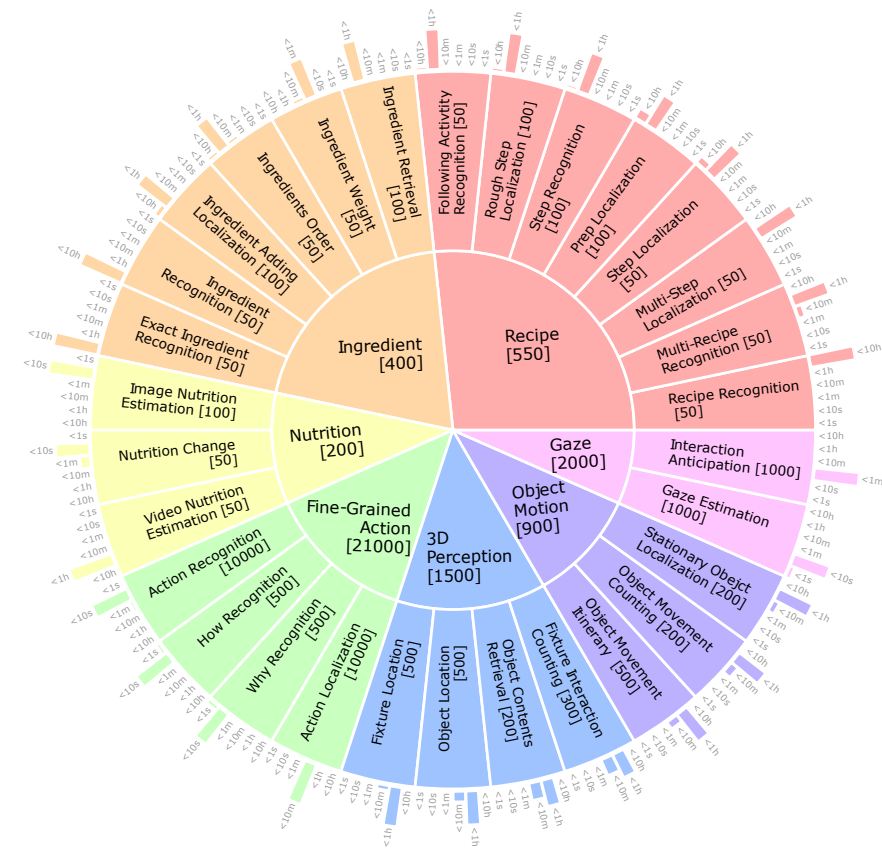
Table A3. HD-EPIC annotations per minute



HD-EPIC



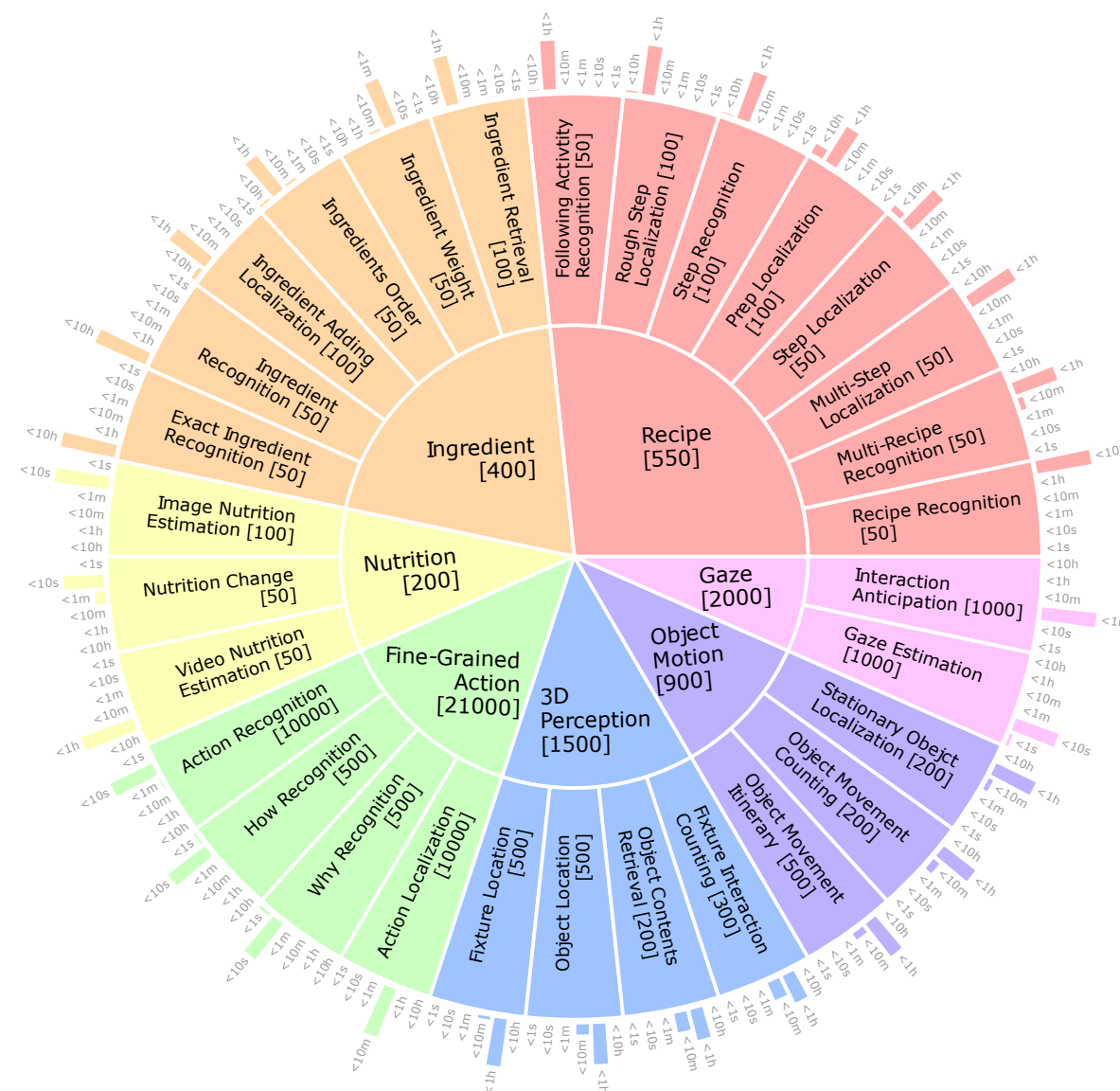
Sec 1: Highly-Detailed Dataset

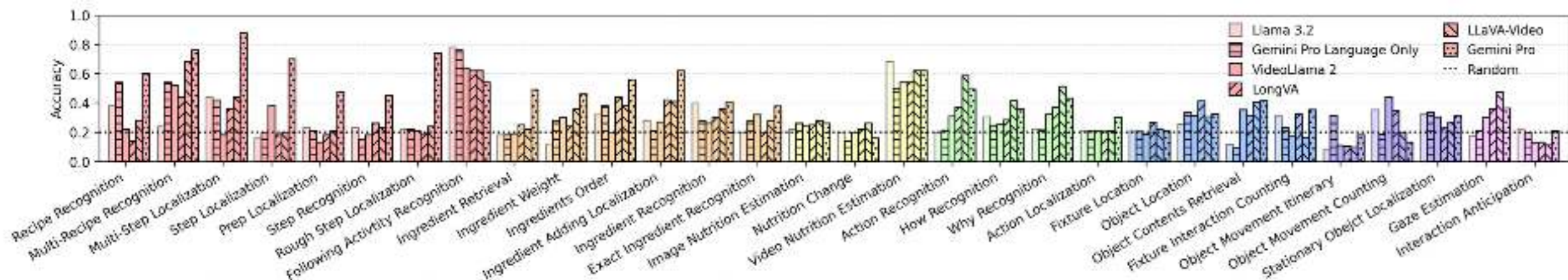


Sec 2: HD-EPIC VQA Benchmark

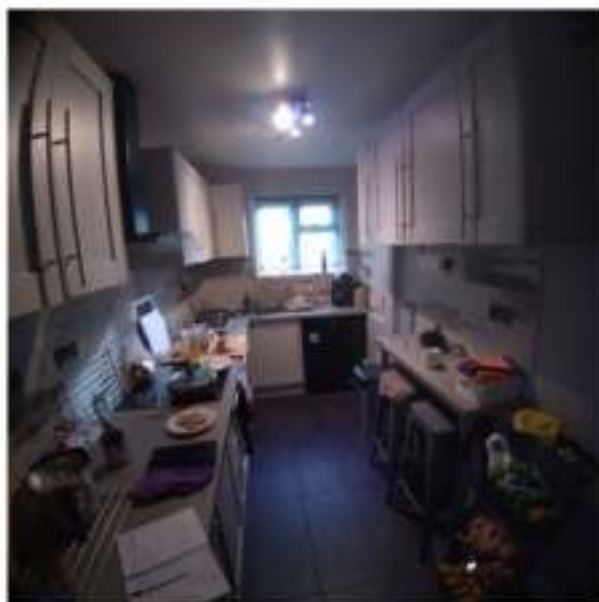


1. **Recipe**. Questions on temporally localising, retrieving, or recognising recipes and their steps.
2. **Ingredient**. Questions on the ingredients used, their weight, their adding time and order.
3. **Nutrition**. Questions on nutrition of ingredients and nutritional changes as ingredients are added to recipes.
4. **Fine-grained action**. What, how, and why of actions and their temporal localisation.
5. **3D perception**. Questions that require the understanding of relative positions of objects in the 3D scene.
6. **Object motion**. Questions on where, when and how many times objects are moved across long videos.
7. **Gaze**. Questions on estimating the fixation on large landmarks and anticipating future object interactions.





Model	Recipe	Ingredient	Nutrition	Action	3D	Motion	Gaze	Avg.
Blind - Language Only								
Llama 3.2	33.5	25.0	36.7	23.3	22.3	25.5	19.5	26.5
Gemini Pro	38.0	26.8	30.0	22.1	21.5	27.7	20.5	26.7
Video-Language								
VideoLlama 2	30.8	25.7	32.7	27.2	25.7	28.5	21.2	27.4
LongVA	29.6	30.8	33.7	30.7	32.9	22.7	24.5	29.3
LLaVA-Video	36.3	33.5	38.7	43.0	27.3	18.9	29.3	32.4
Gemini Pro	64.3	48.6	34.7	39.6	32.5	20.8	28.7	38.5
<i>Sample Human Baseline</i>	96.7	96.7	85.0	92.5	93.8	92.7	75.0	90.3



How many times did I **open** the item at bounding box (165, 452, 1408, 1408) in 00:00:57?

A. 3

 B. 1

C. 4

D. **5**

 E. 2



HD-EPIC





HD-EPIC



HD-EPIC

A Highly-Detailed Egocentric Video Dataset

[Paper \(ArXiv\)](#)

[The Dataset](#)

[Explore Samples](#)

[Watch Video](#)

[VQA benchmark](#)

[Explore VQA](#)

[Download](#)

[Team](#)



News

- **May 2025:** Eye-Gaze Priming data has now been released! [Annotations link](#)
- **April 2025:** VQA Challenge Benchmark is online now! [Challenge link](#)
- **April 2025:** Masks and object association annotations have now been released.
- **Feb 2025:** [HD-EPIC](#) accepted at **CVPR 2025!**

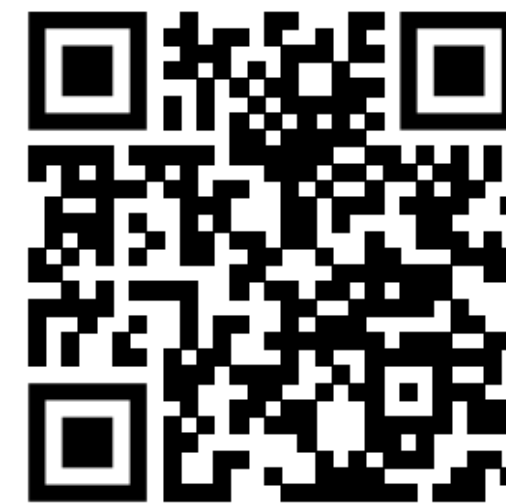


HD-EPIC



Try it Yourself

Use Wise to Search through HD-EPIC

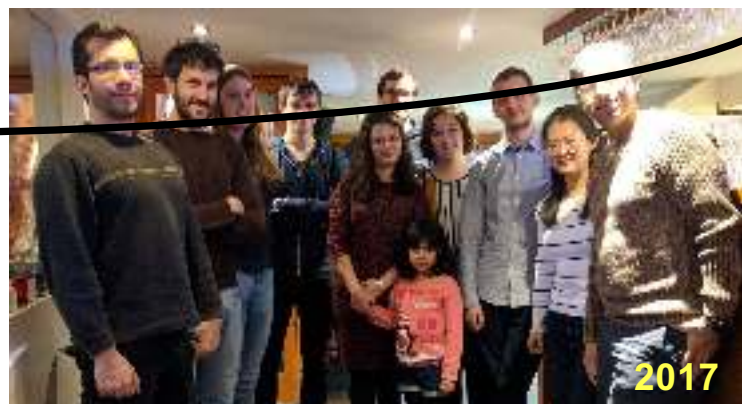


SCAN ME

<https://meru.robots.ox.ac.uk/HD-EPIC/>

My research team...

grateful



My research team...

grateful



Thank you

For further info, datasets, code, publications...

<http://dimadamen.github.io>



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<http://www.linkedin.com/in/dimadamen>

Q&A