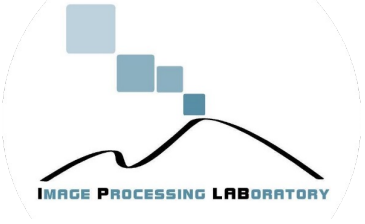

Università di Catania

Dipartimento di
Matematica e Informatica




# Artificial Vision Algorithms for Industry

Giovanni Maria Farinella, Antonino Furnari

FPV@Image Processing Laboratory - http://iplab.dmi.unict.it/fpv

Next Vision - http://www.nextvisionlab.it/

Department of Mathematics and Computer Science - University of Catania

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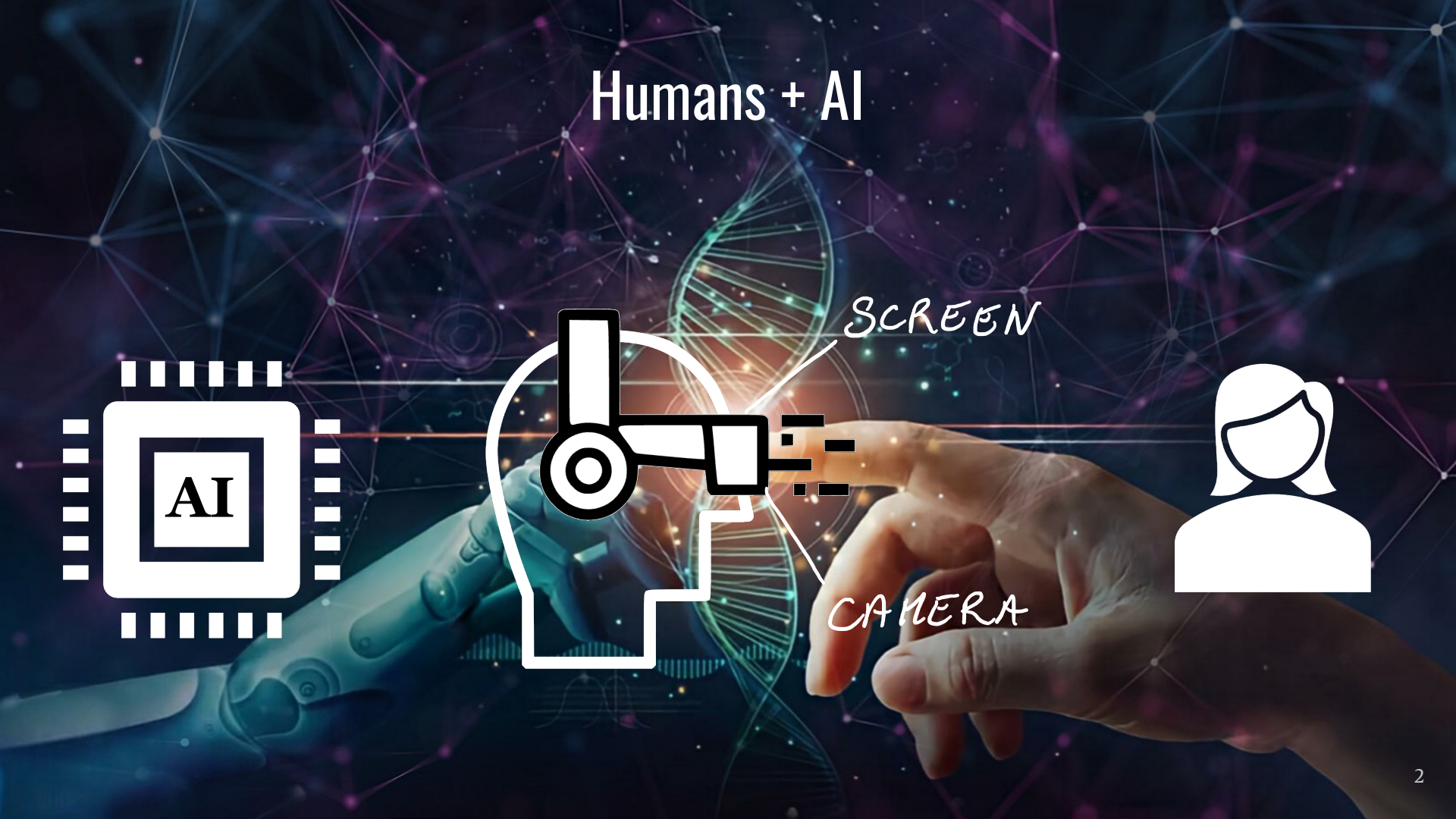
# Humans + AI



# Bringing AI to Industrial Workplaces

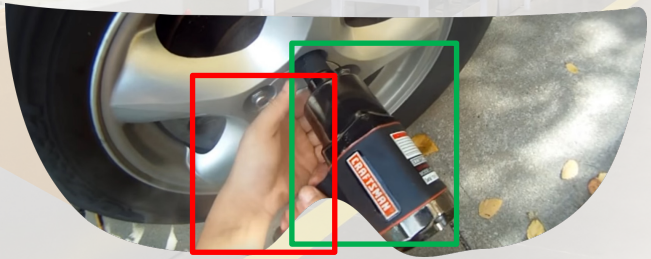
## User-Object Interaction Anticipation

Next Action: "Open Locker"

## Localization and Navigation

"Where am I?"

## User-Object Interaction Understanding



"UNSCREW BOLT"

# Context-Based Localization

http://iplab.dmi.unict.it/PersonalLocationSegmentation/

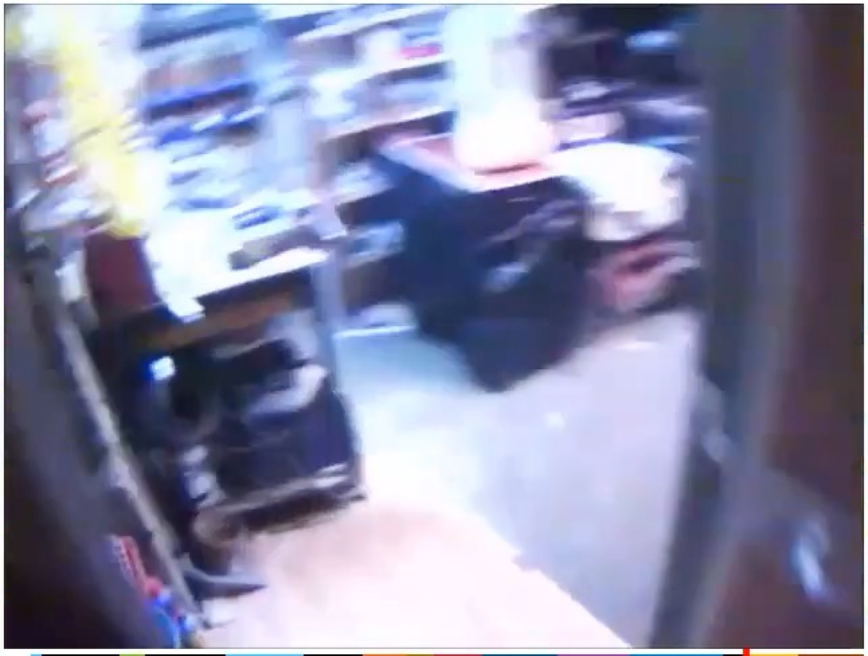
IMAGE PROCESSING LABORATORY

**Personal-Location-Based Temporal Segmentation of Egocentric Video for Lifelogging Applications**

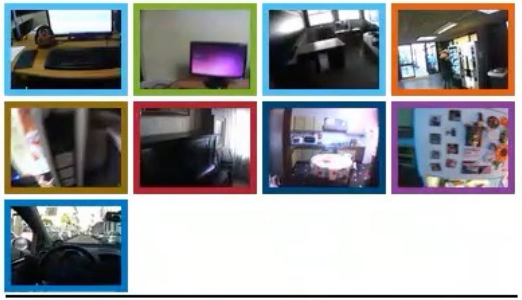
A. Furnari, S. Battiato, G. M. Farinella

Time Spent at Location

| LOC | EST | GT |
|---|---|---|
| car | 01:26 | 01:27 |
| cvm | 00:41 | 00:40 |
| garage | 00:00 | 00:00 |
| k. top | 01:08 | 01:07 |
| l. office | 00:23 | 00:29 |
| office | 01:24 | 01:09 |
| piano | 00:45 | 00:41 |
| sink | 01:10 | 01:05 |
| studio | 00:00 | 00:00 |
| l. room | 00:24 | 00:20 |
| negative | 03:44 | 04:07 |




Detected Shots



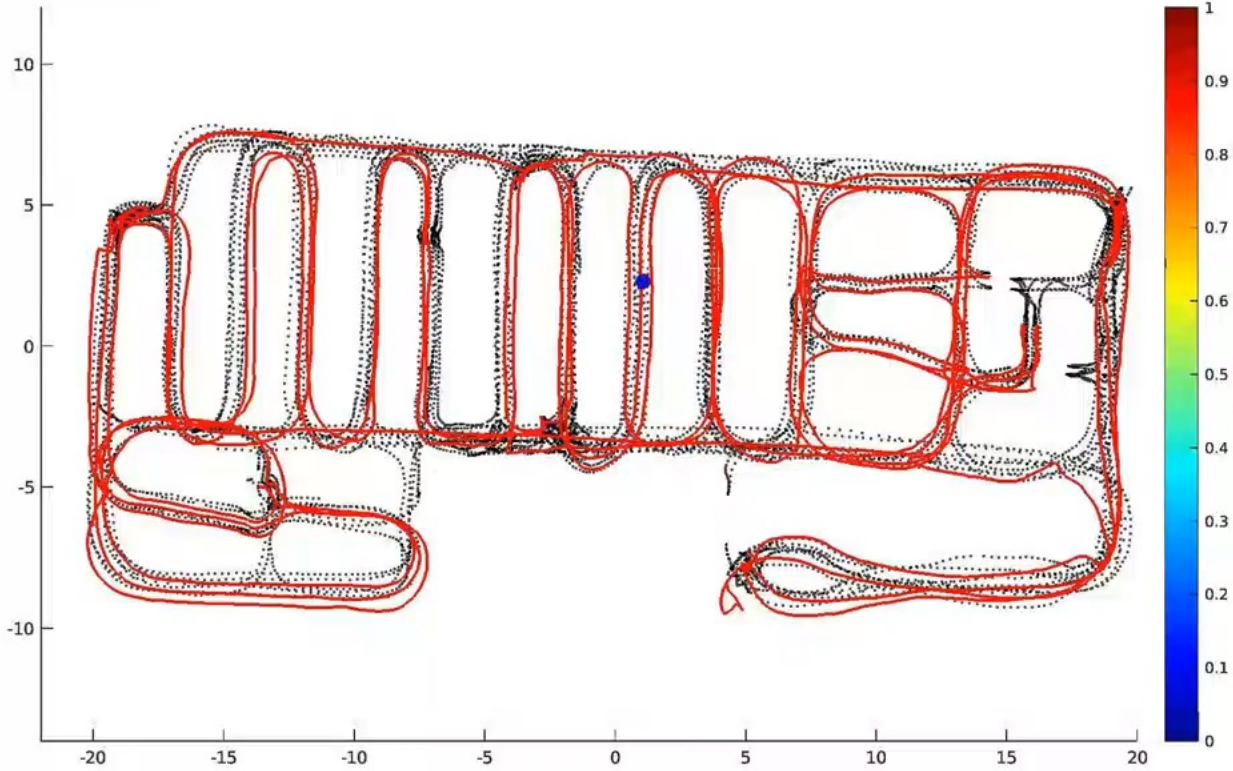
| Estimated Probabilities | Predicted Class | GT Class |
|---|---|---|
| car | | |
| coffee v. machine | | |
| garage | | |
| kitchen top | | |
| lab office | | |
| office | | |
| piano | | |
| sink | | |
| studio | | |
| living room | | |
| negative | | |

# Camera Pose Estimation

## EGOCENTRIC SHOPPING CART LOCALIZATION

Emiliano Spera, Antonino Furnari, Sebastiano Battiato, Giovanni Maria Farinella

http://iplab.dmi.unict.it/EgocentricShoppingCartLocalization/

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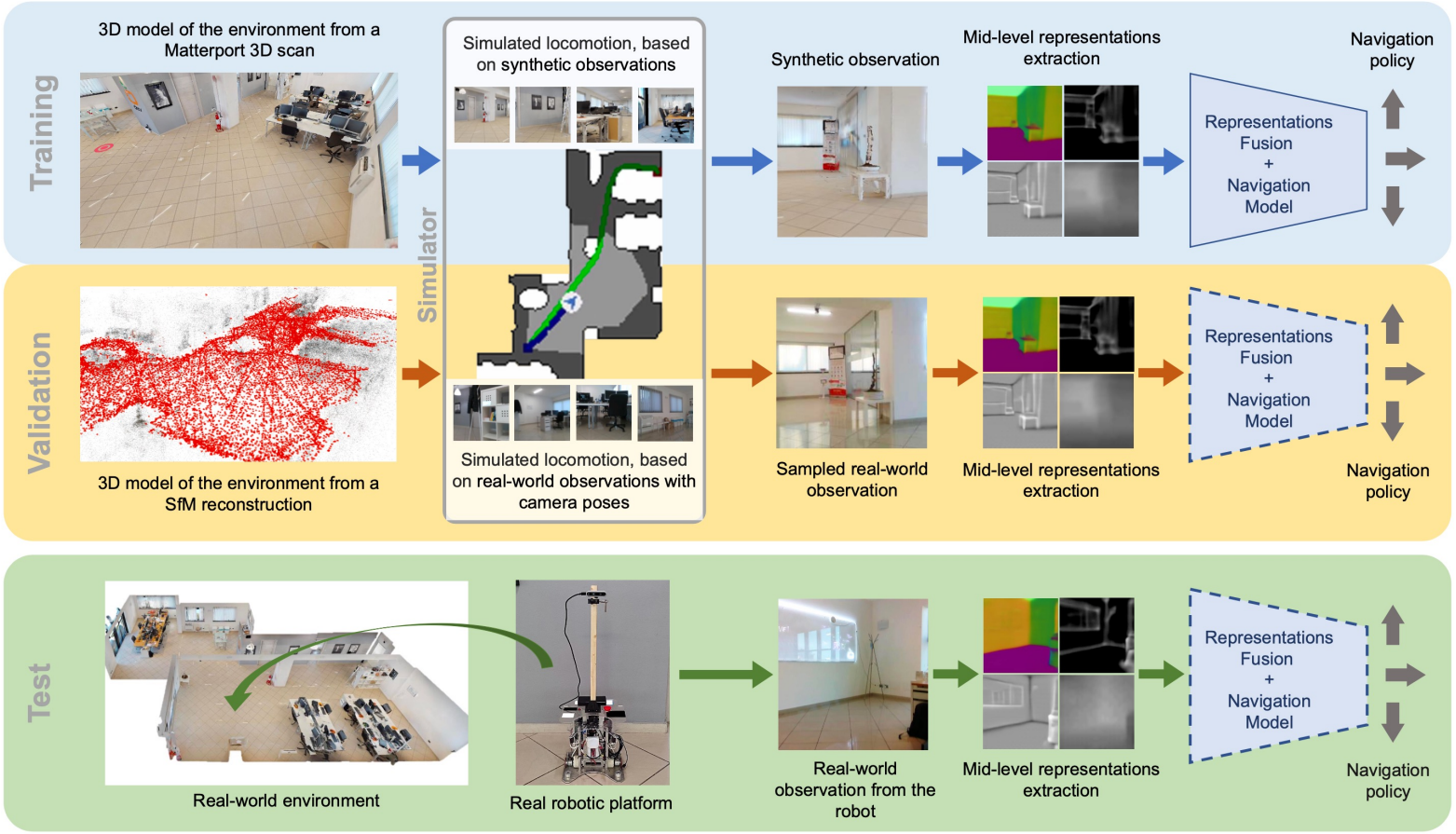
TEST IMAGE

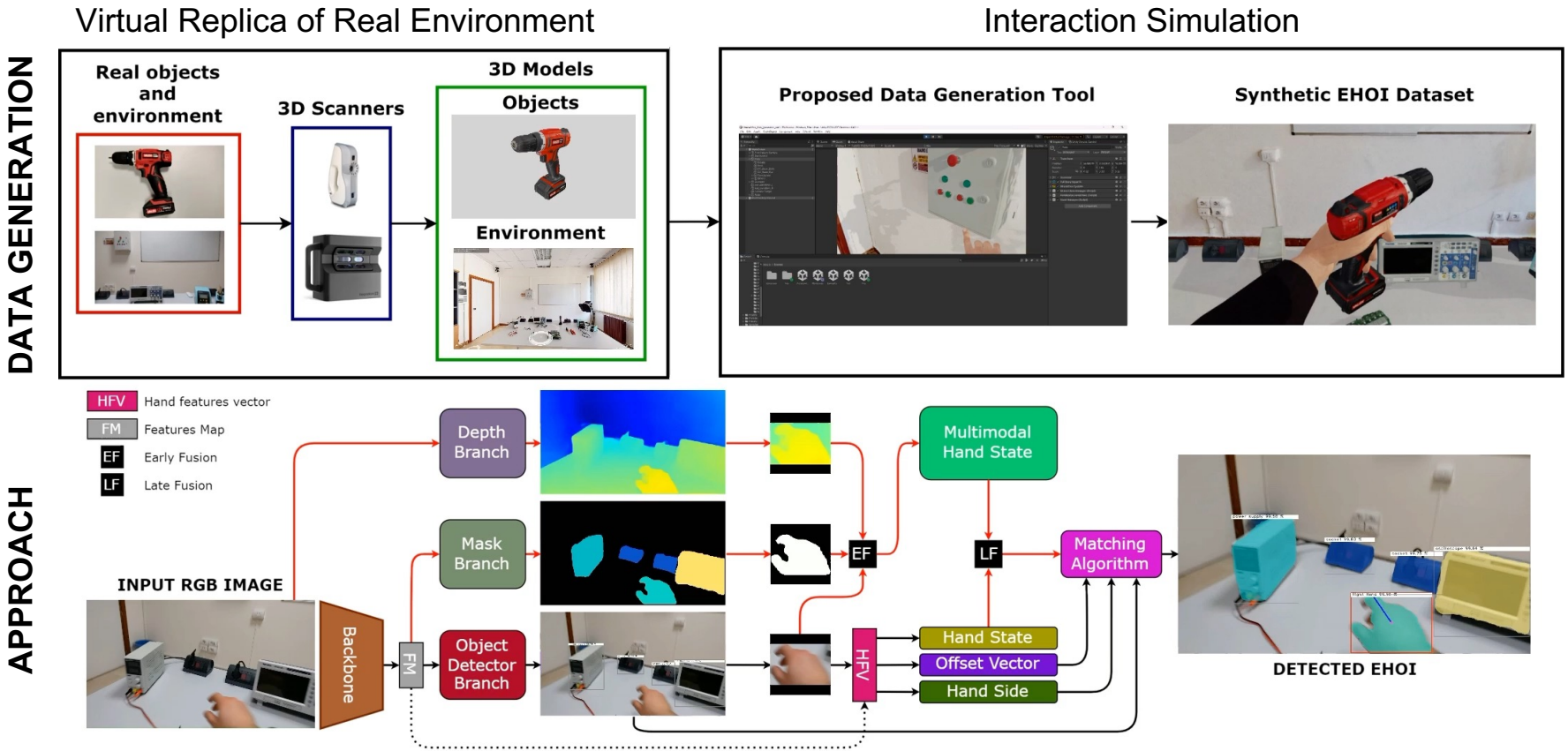
ASSOCIATED IMAGE

# Navigation




Rosano, M., Furnari, A., Gulino, L., Santoro, C., & Farinella, G. M. (2022). Image-based Navigation in Real-World Environments via Multiple Mid-level Representations: Fusion Models, Benchmark and Efficient Evaluation. *arXiv preprint arXiv:2202.01069*.

# User-Object Interaction Understanding





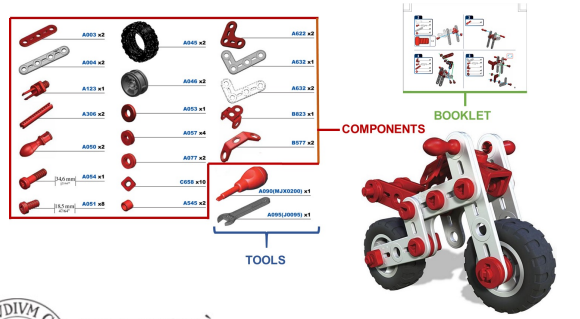

Rosario Leonardi, Francesco Ragusa, Antonino Furnari, Giovanni Maria Farinella (2022). Egocentric Human-Object Interaction Detection Exploiting Synthetic Data . In International Conference on Image Analysis and Processing (ICIAP)

# Datasets for Human Behavior Understanding

University of BRISTOL · UNIVERSITY OF TORONTO · UNIVERSITÀ degli STUDI di CATANIA


ECCV 2018, PAMI 2020, IJCV 2022

## MECCANO




UNIVERSITÀ degli STUDI di CATANIA · University of Hertfordshire UH

WACV 2021


CVPR 2022

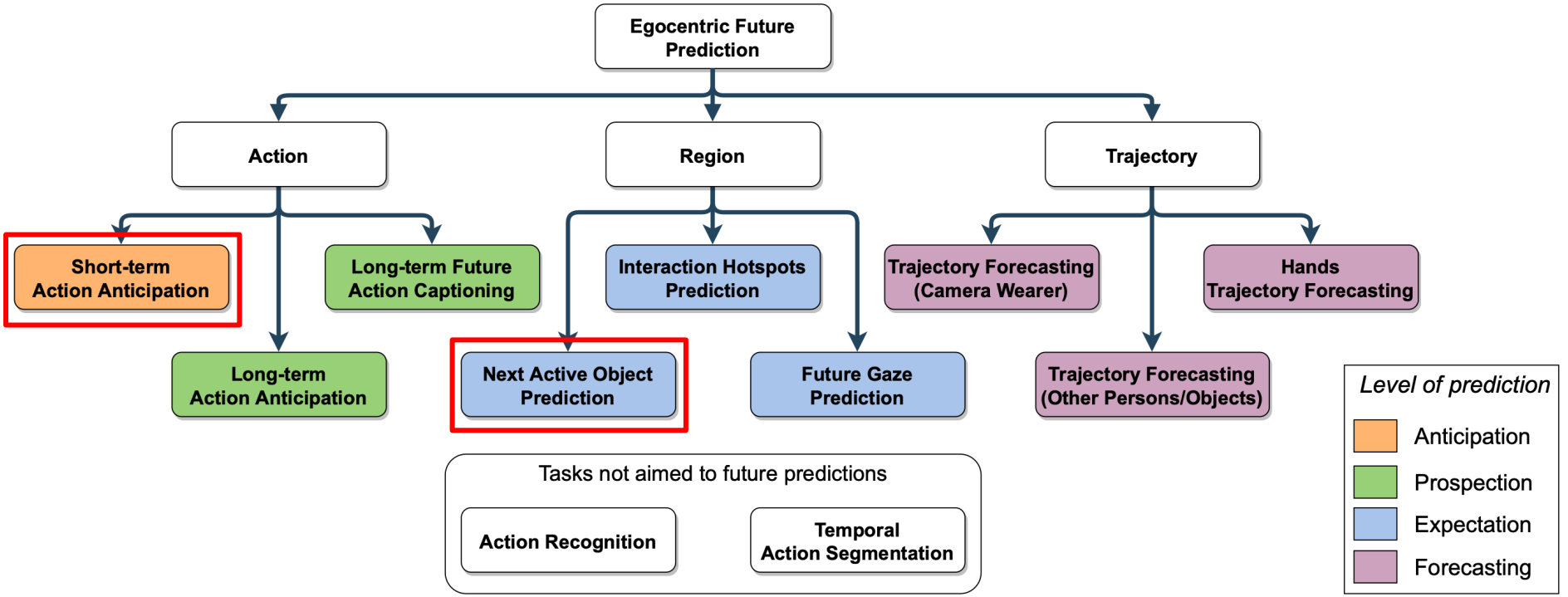
Carnegie Mellon University · Università di Catania · NUS National University of Singapore · King Abdullah University of Science and Technology

東京大学 THE UNIVERSITY OF TOKYO · University of BRISTOL · INDIANA UNIVERSITY BLOOMINGTON · UNIVERSITY OF MINNESOTA

MIT · Penn University of Pennsylvania · Georgia Institute of Technology · International Institute of Information Technology Hyderabad

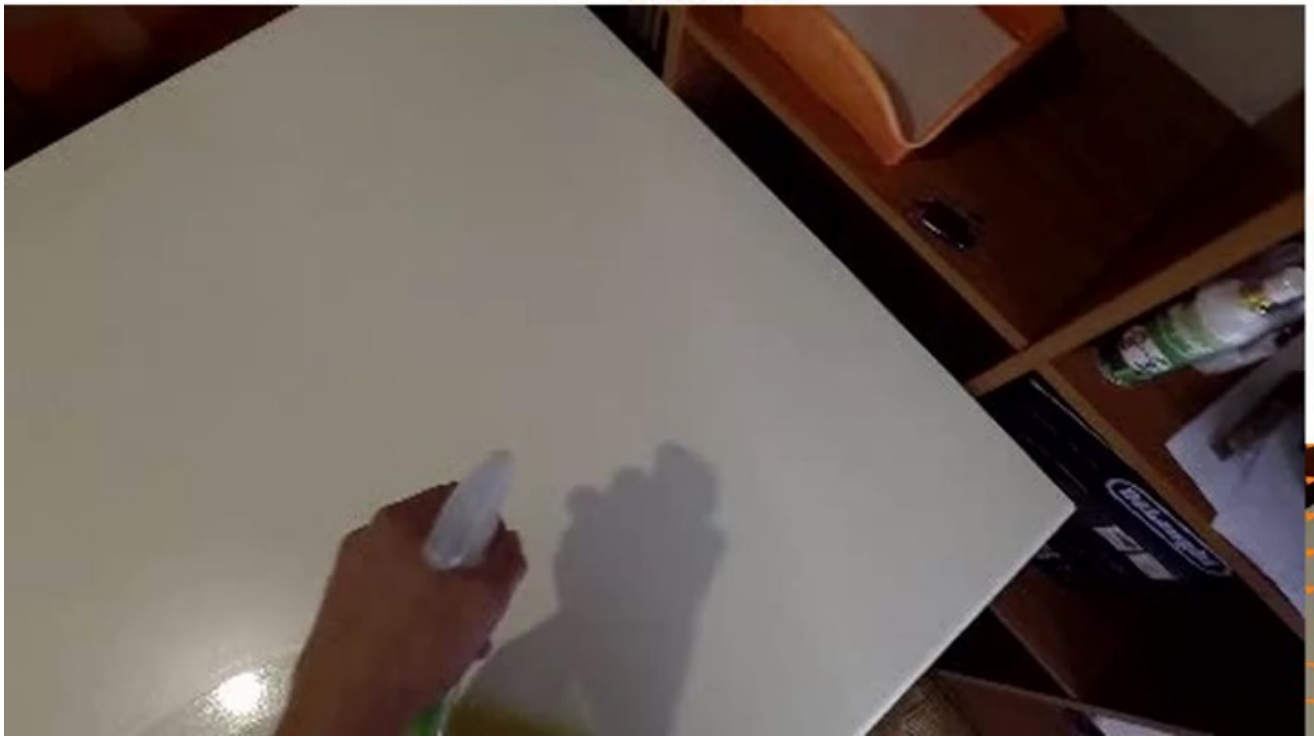
Carnegie Mellon University Africa · Universidad de los Andes Colombia · FACEBOOK AI

# User-Object Interaction Anticipation



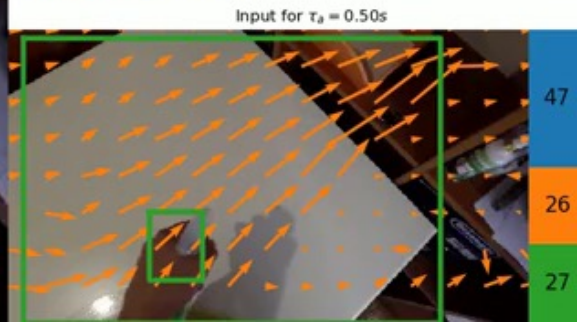

Ivan Rodin, Antonino Furnari, Dimitrios Mavroedis, Giovanni Maria Farinella (2021). Predicting the Future from First Person (Egocentric) Vision: A Survey. Computer Vision and Image Understanding, 211, pp. 103252.

# Demo Video: Egocentric Action Anticipation

Anticipated Actions (in 0.50s)

**WASH TABLE**
SPRAY LIQUID:WASHING
TAKE SHEETS
MOVE BOTTLE
PUT LIQUID:WASHING
PUT SHEETS
WASH TOP
OPEN TAP
CLOSE CUPBOARD
TAKE BAG
WASH SINK
MOVE BREAD



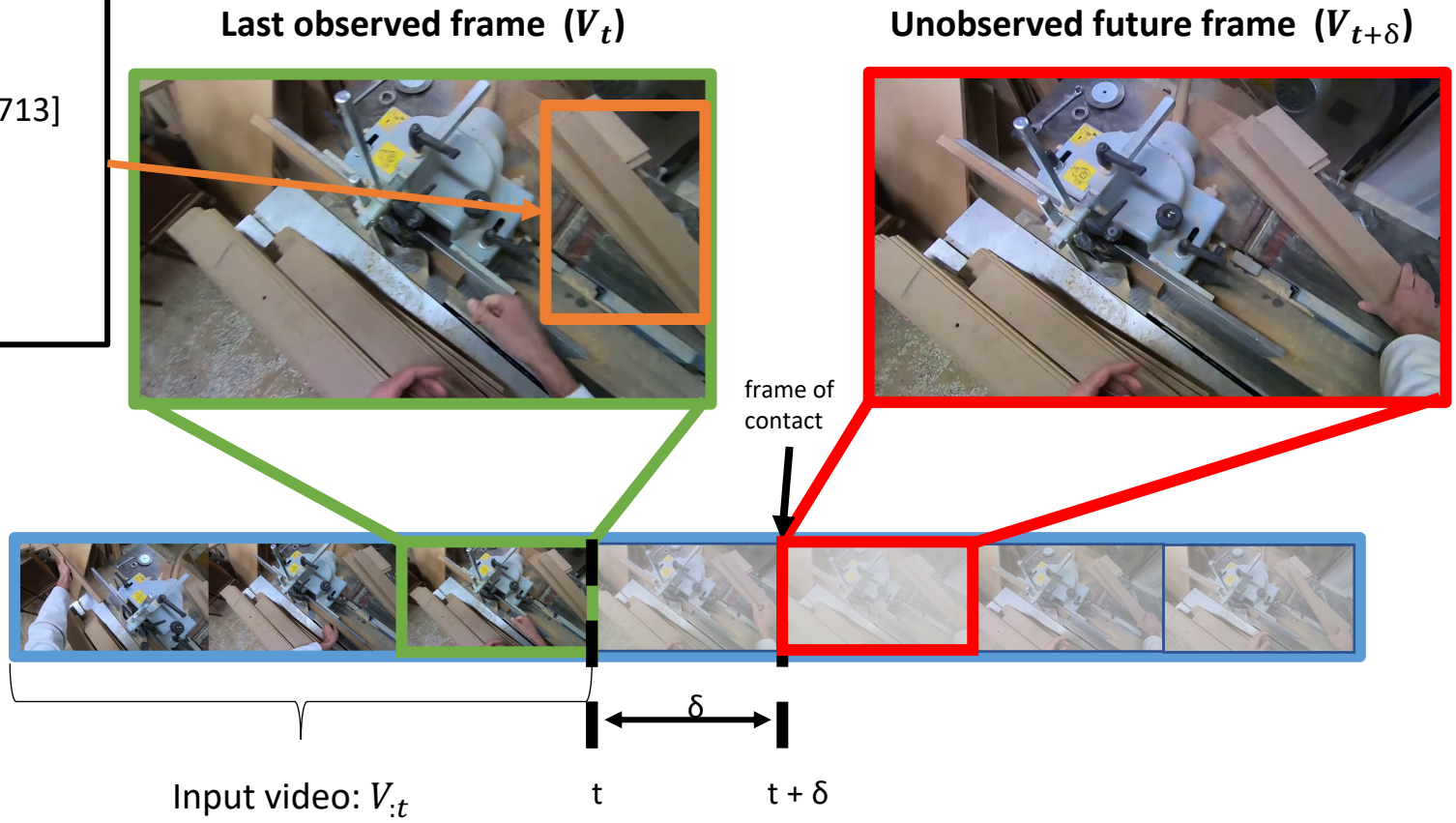

A. Furnari, G. M. Farinella, What Would You Expect? Anticipating Egocentric Actions with Rolling-Unrolling LSTMs and Modality Attention. ICCV 2019 (ORAL).

A. Furnari, G. M. Farinella. Rolling-Unrolling LSTMs for Action Anticipation from First-Person Video. TPAMI 2020. http://iplab.dmi.unict.it/rulstm

# Short-Term Object Interaction Anticipation

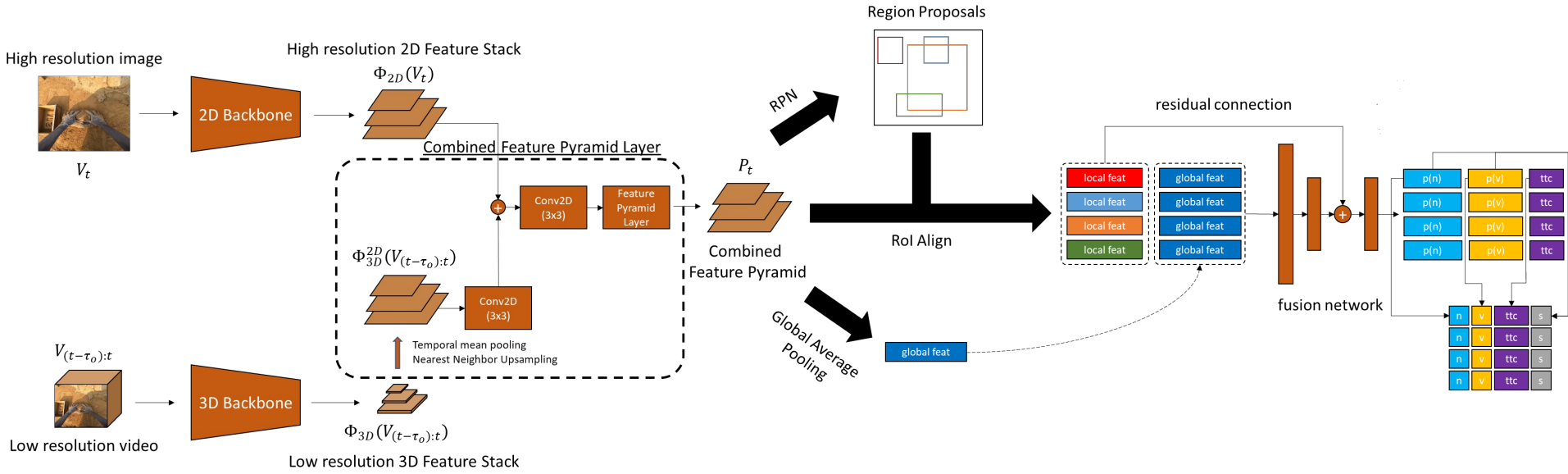
**prediction**

bbox = [1391,101,531,713]
noun = *wooden block*
verb = *take*
ttc = 0.75s
score = 0.83



# StillFast Networks

An end-to-end approach for predicting next-active-objects based on an 2D-3D backbone taking as input a high resolution image and a video clip.




Francesco Ragusa, Giovanni Maria Farinella, Antonino Furnari (2023). StillFast: An End-to-End Approach for Short-Term Object Interaction Anticipation. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops.

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# Official Baseline of the Short-Term Object Interaction Challenge

| Rank | Participant team | Noun (↑) | Noun_Verb (↑) | Noun_TTC (↑) | Overall (↑) | Last submission at | Meta Attributes |
|---|---|---|---|---|---|---|---|
| 1 | PAVIS (GAIT_v2) | 25.67 | 13.60 | 9.02 | 5.16 | 31 days ago | View |
| 2 | Host_47324_Team (V2 StilFast Baseline) B | 25.06 | 13.29 | 9.14 | 5.12 | 2 months ago | View |
| 3 | Host_47324_Team (V2 Faster RCNN + SlowFast Base) B | 26.15 | 9.45 | 8.69 | 3.61 | 2 months ago | View |
| 4 | FPV_UNICT (StillFast) | 19.51 | 9.95 | 6.45 | 3.49 | 8 months ago | View |
| 5 | Red Panda (fusion-1) | 24.60 | 9.19 | 7.64 | 3.40 | 8 months ago | View |
| 6 | Host_47324_Team (Faster RCNN + SlowFast Baselin) B | 20.45 | 6.78 | 6.17 | 2.45 | 1 year ago | View |

Francesco Ragusa, Giovanni Maria Farinella, Antonino Furnari (2023). StillFast: An End-to-End Approach for Short-Term Object Interaction Anticipation. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops.

# AI in Workplaces

**Microsoft HoloLens/HoloLens 2**

**Magic Leap One**

**Meta Project Aria**


- We are starting to have wearable devices which can be used in workplaces;
- Our research team is building AIs able to understand the user's goal and assist them;
- A lot of interest from AI big players (Meta, Microsoft, Google) and Industries;
- Vision is paramount!

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**Thank you for your attention**

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