Spatial Cognition from Egocentric Video: Out of Sight, Not Out of Mind

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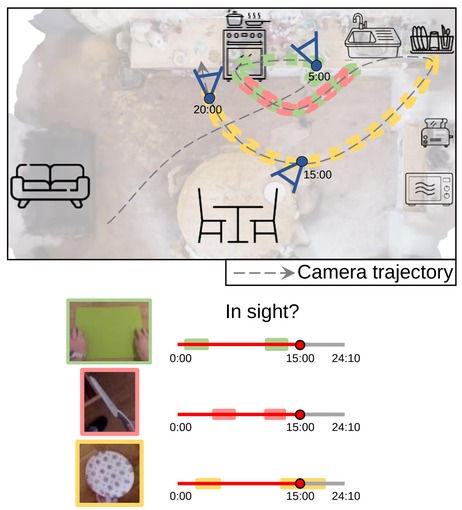
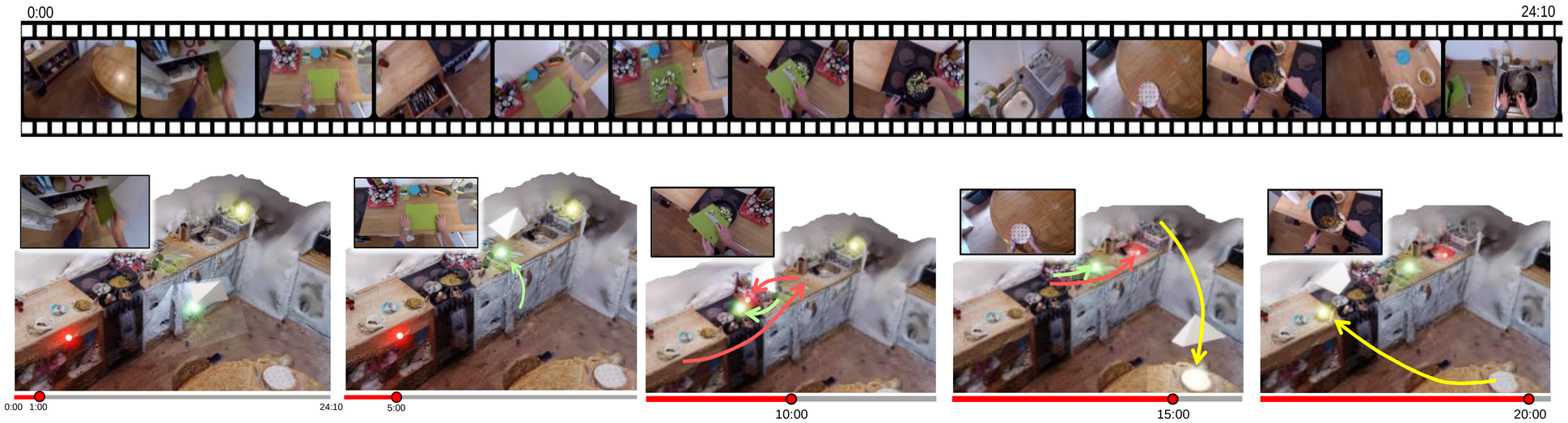
Motivation

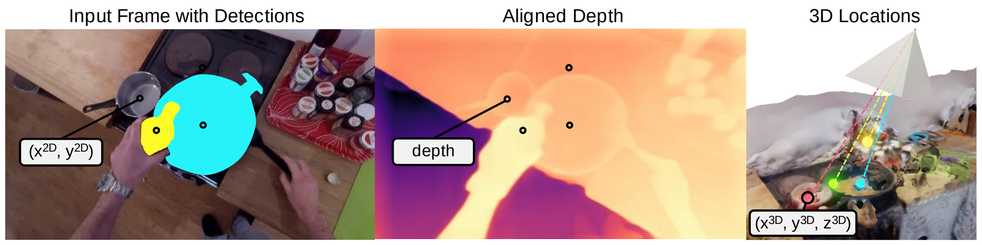
- The ability to "*know what is where*" is an integral part of *spatial cognition*. It allows humans to build a mental map of the environment and dynamic objects.
- We introduce the task **Out of Sight, Not Out of Mind (OSNOM)** – maintaining the knowledge of where *all objects* are, even when absent from the egocentric video.
- We propose an effective approach that tracks objects in the world coordinate frame: **Lift, Match & Keep (LMK)**.





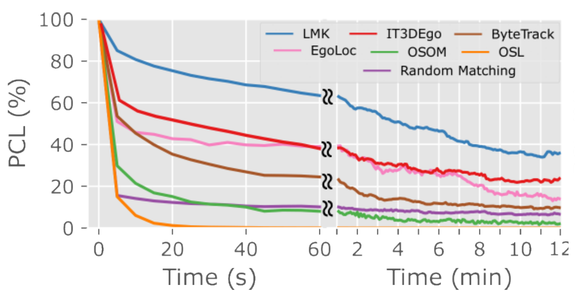
Method (LMK): Lift

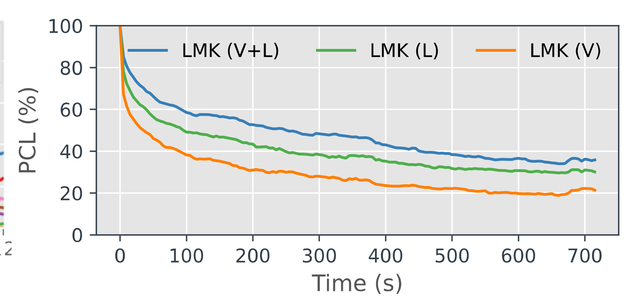
- We lift 2D object detections (masks) to 3D using centroid of object masks and estimated mono depth in camera coordinate frame.
- We align the depth map to scene geometry so as to map these to world coordinate frames.



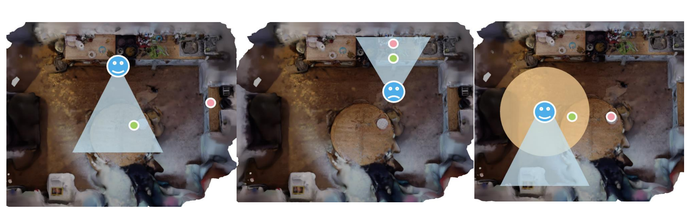
Lift, Match & Keep (LMK) Results

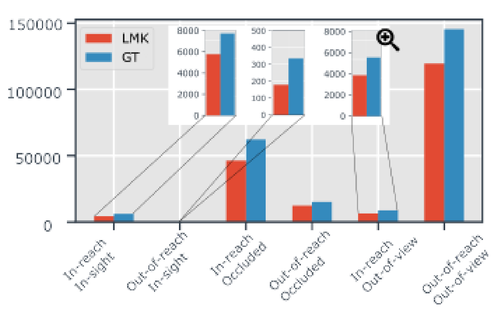
- We benchmark OSNOM on 100 videos from EPIC-KITCHENS, using the camera estimates from EPIC Fields [1].
- We introduce a new metric: *Percentage of Correct Locations* (**PCL**).





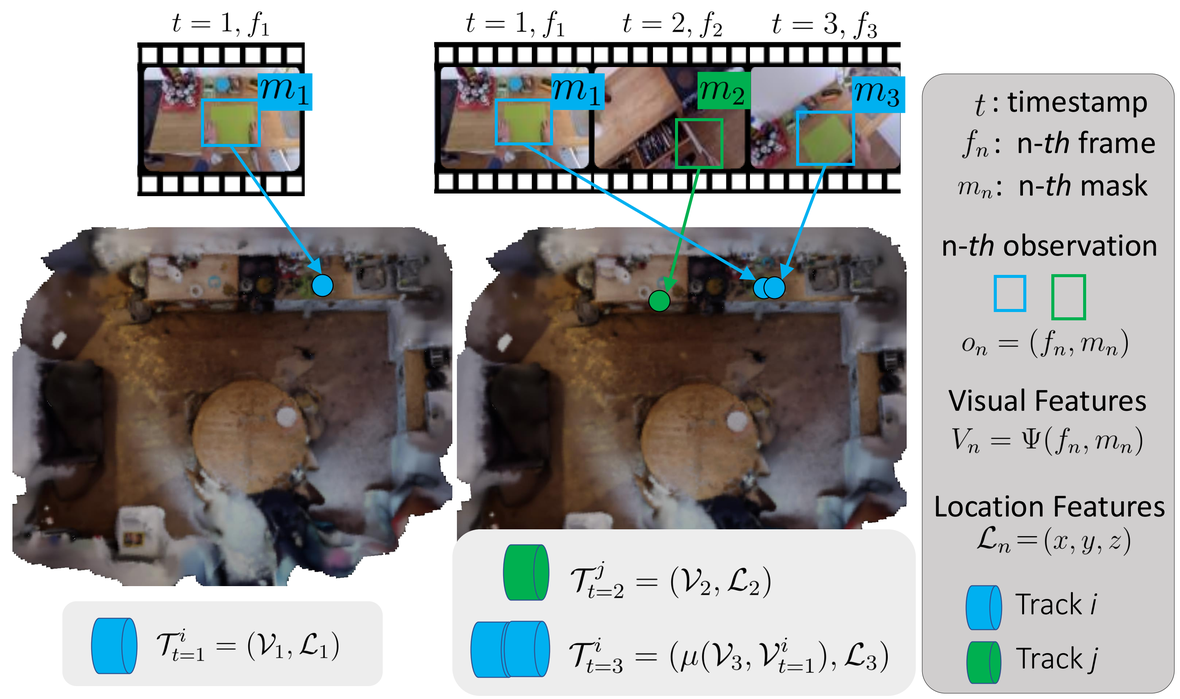
- After we Lift, Match and Keep (LMK) we can reason about object *visibility* and *positioning:* in-view *vs* out-of-view, in-sight *vs* out-of-sight (occluded) in-reach *vs* out-of-reach.





Method (LMK): Match & Keep

- Objects are *tracked* in 3D by *matching* visual and location features.



Qualitative Results