Tracker trees: hierarchies to spot rare events

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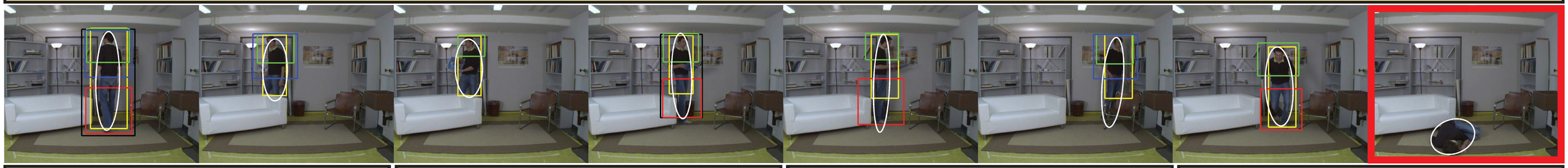
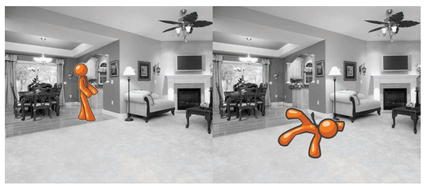
DIRAC
Detection and Identification of Rare Audiovisual Cues

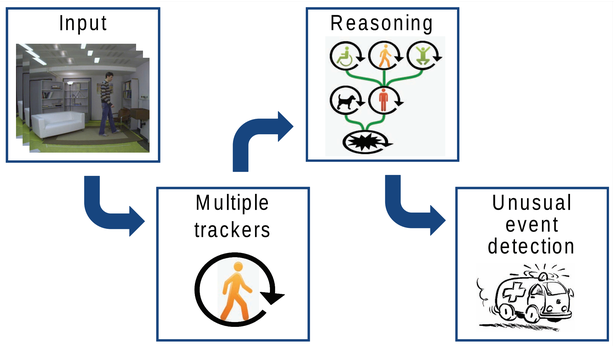


Motivation

- Autonomous living of elderly people in their homes.
- Aging society requires new solutions.
- Install cameras in peoples homes.
- Goal: Analyze the behavior of a person in the scene and report all kinds of abnormalities.

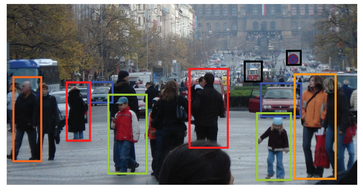


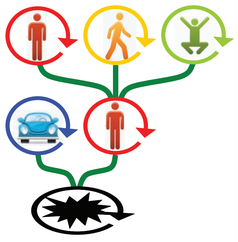
Our approach



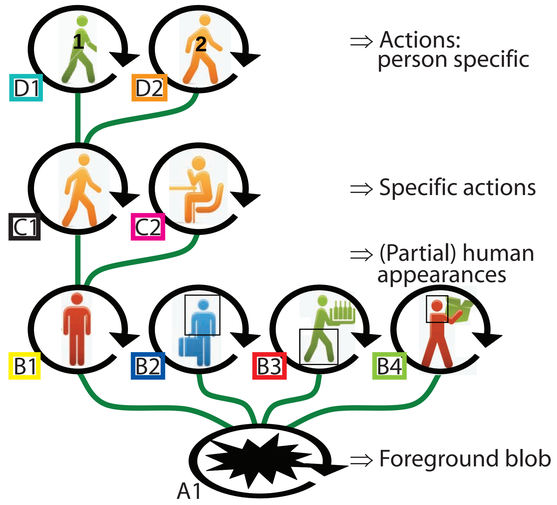
Tracker tree concept

- Arrange trackers in a tree-like structure.
- A tracker at each node.
- Get semantically more rich, from bottom to top.



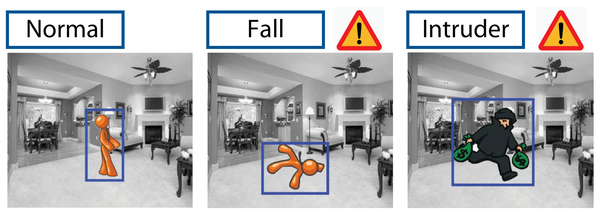


Tracker tree for elderly care



- Abnormal event detection
  - Assumpton about the 'normal' world no longer holds,
  - Anomaly: one tracker reacts, but none of its more specialised children,
  - Semantic interpretation is possible from the location of the anomaly in the tree.

- Examples

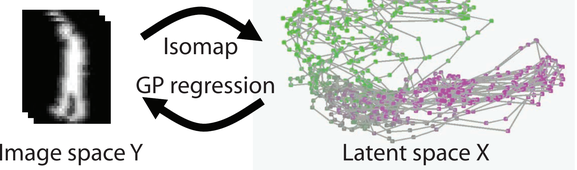


- Requirement: trackers at different levels of detail.
- Technical implementation:
  - A1: CAMshift tracker [Bradski 98],
  - B1: Person detector [Felzenszwalb 2008] (tracking-by-detection),
  - B2-4: Model tracking (training on body parts),
  - C1-2: Model tracking (training on actions),
  - D1-2: Model tracking (training on individuals).

Tracking method

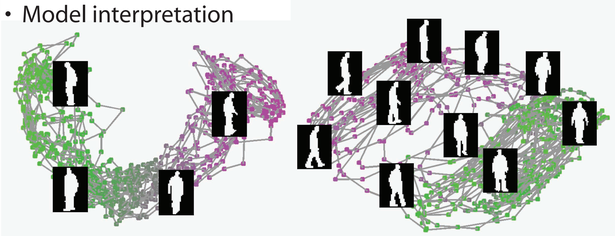
- Representation:
  - BG subtraction,
  - Down sampling,
  - Distance transform

- Learning a low dim model

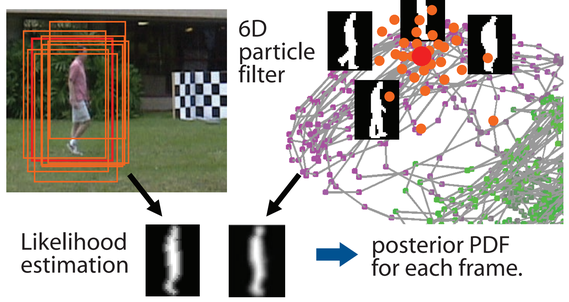


- Non-linear dimensionality reduction,
- Exploit the small number of intrinsic d.o.f.,
- One manifold encodes one human action.

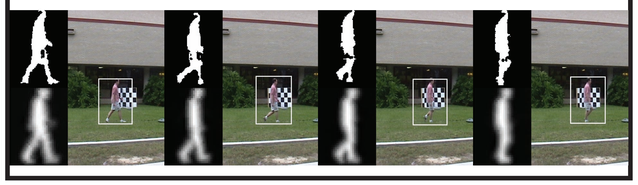
- Model interpretation



- Probabilistic tracking



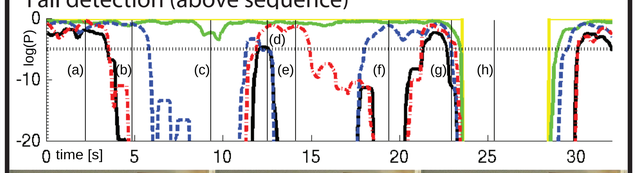
- Illustration

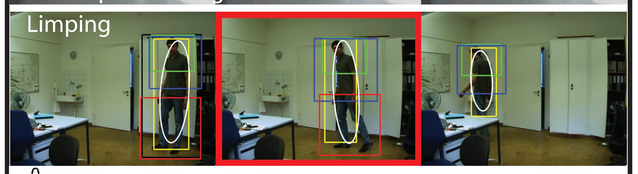


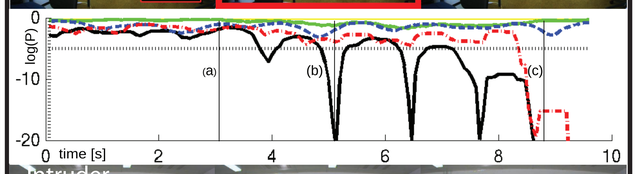
Results

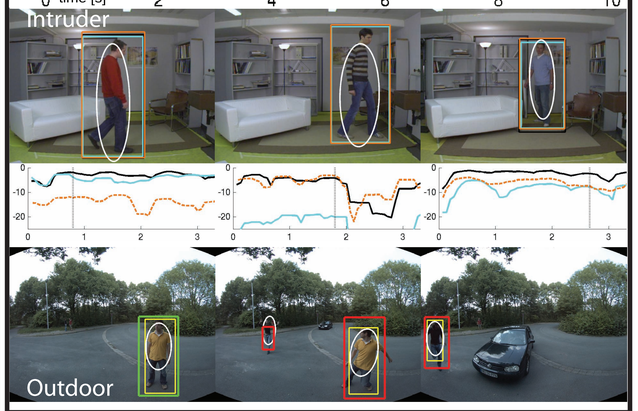
- No standard dataset is available for the evaluation of in-house rare events.
- Tests on different recordings and scenarios.
- Plot posterior probability of the independent trackers over time, infer model belonging, perform reasoning.

Fall detection (above sequence)









videos: *www.vision.ee.ethz.ch/~fnater/tracker-trees*