COGNITO: Activity Monitoring and Recovery

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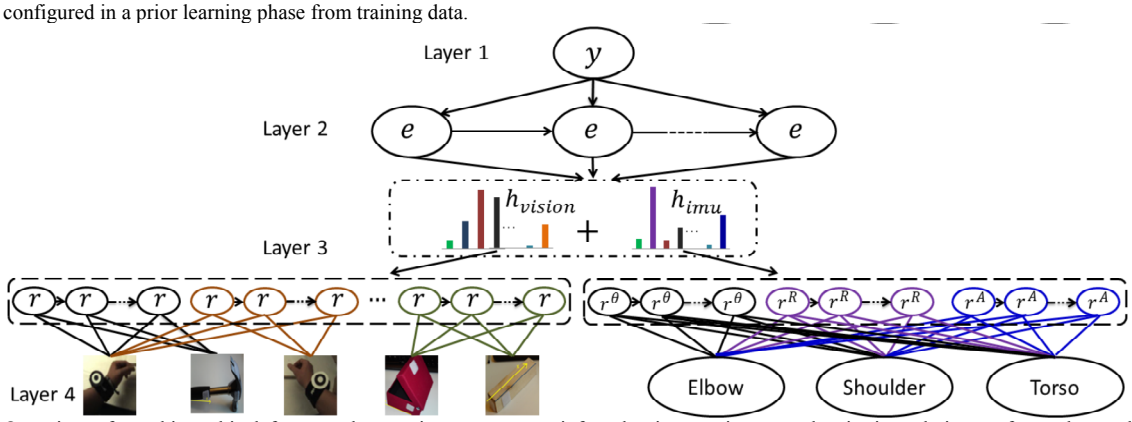
The goal of this work is to recognize egocentric atomic events in real-time. The atomic events are characterised in terms of binary relationships (*bag-of-relations*) between parts of the body and manipulated objects. The key contribution is to summarise, within a histogram, the relationships that hold over fixed time interval. This histogram is then classfied into one of a number of atomic events. The relationships encode both the types of body parts and objects involved (e.g. wrist, hammer) together with a quantised representation of their distance apart and the normalised rate of change in this distance. The quantisation and classifier are both configured in a prior learning phase from training data.



Overview of our hierarchical framework: atomic events *e* are inferred using spatiotemporal pairwise relations *r* from observed objects and wrists, and relations between body parts (*elbow-shoulder* and *shoulder-torso*) using inertia sensors (IMU). Activities *y* are represented as a set of temporally-consistent *e*.

Motivation

Most of the existing approaches for activity recognition are designed to perform after-the-fact classification of activities after fully observing videos of single activity. Moreover, such systems usually expect that the same number of people or objects are observed over the entire activity whilst in realistic scenarios often people and objects enter/leave the scene while activity is going on.

There are three main objectives of the proposed activity recognition system: 1) to recognise the current event from a short observation period (typically two seconds); 2) to anticipate the most probable event that follows on from the current event; 3) to recognise activity deviations.

Publications

A. Behera, D. C. Hogg and A. G. Cohn, Egocentric Activity Monitoring and Recovery (ACCV 2012). pdf

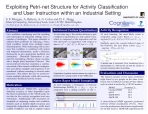

poster

Demos: labeling and packaging bottles and hammering nails and driving screws

A. Behera, A. G. Cohn, D. C. Hogg. Workflow Activity Monitoring using the Dynamics of Pair-wise Qualitative Spatial Relations. International Conference on MultiMedia Modeling (MMM 2012) (Oral). pdf

Demos: driving screws and hammering nails

S. F. Worgan, A. Behera, A. G. Cohn, D. C. Hogg. Exploiting petri-net structure for activity classification and user instruction within an industrial setting. International Conference on Multimodal Interaction (ICMI 2011). pdf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Datasets

In order to test our hierarchical framework, we have obtained two datasets using an egocentric setup. These datasets consist of non-periodic manipulative tasks in an industrial context. All the sequences were captured with on-body sensors consisting IMUs, a backpack-mounted RGB-D camera for top-view and a chestmounted fisheye camera for front-view of the workbench.

The first dataset is the scenario of *hammering nails and driving screws*. In this dataset, subjects are asked to hammer 3 nails and drive 3 screws using prescribed tools.

The second dataset is a *labelling and packaging bottles* scenario. In this dataset, participants asked to attach labels to two bottles, then package them in the correct positions within a box. This requires opening the box, placing the bottles, closing the box, and then writing on the box as completed using a marker pen.

Hammering three nails and driving three screws

Snapshots from the dataset. The first two images of are from the top view (RGB-D) and the last two are from the chest-view fisheye camera.

The dataset consists of videos from both views, object tracklets (3D positions), upperbody model (IMU) and ground-truth. The top view video sequences (~0.7 GB) and front view sequences (~0.6 GB) are available. Object and wrist tracklets, and IMU data (upperbody model) and activity labels are available here (~80MB).

Labelling and packaging bottles

Snapshots from the dataset. The first two images of are from the top view (RGB-D) and the last two are from the chest-view fisheye camera.

The dataset consists of videos from both views, object tracklets (3D positions), upperbody model (IMU) and ground-truth. The top view video sequences and the activity labels are available here (~1.7 GB). Objects and wrist tracklets, and IMU data (upperbody model) can be found here (~100MB).

Acknowledgement

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