

› **Faster finding and tracking of suspects in multiple CCTV cameras**

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The logo for TNO, consisting of the letters 'TNO' in a bold, black, sans-serif font. The logo is positioned on a horizontal line that is black on the left and right, with a blue segment in the middle. A vertical line on the left side of the slide meets the horizontal line at the blue segment.

TNO

Camera surveillance

- › **High Probability Low Impact Events:**
 - › Theft
 - › Robberies
 - › Aggression
 - › Graffiti
 - › Vandalism

- › **Questions:**
 - › Where did the individual come from?
 - › Where is the individual (going) now?

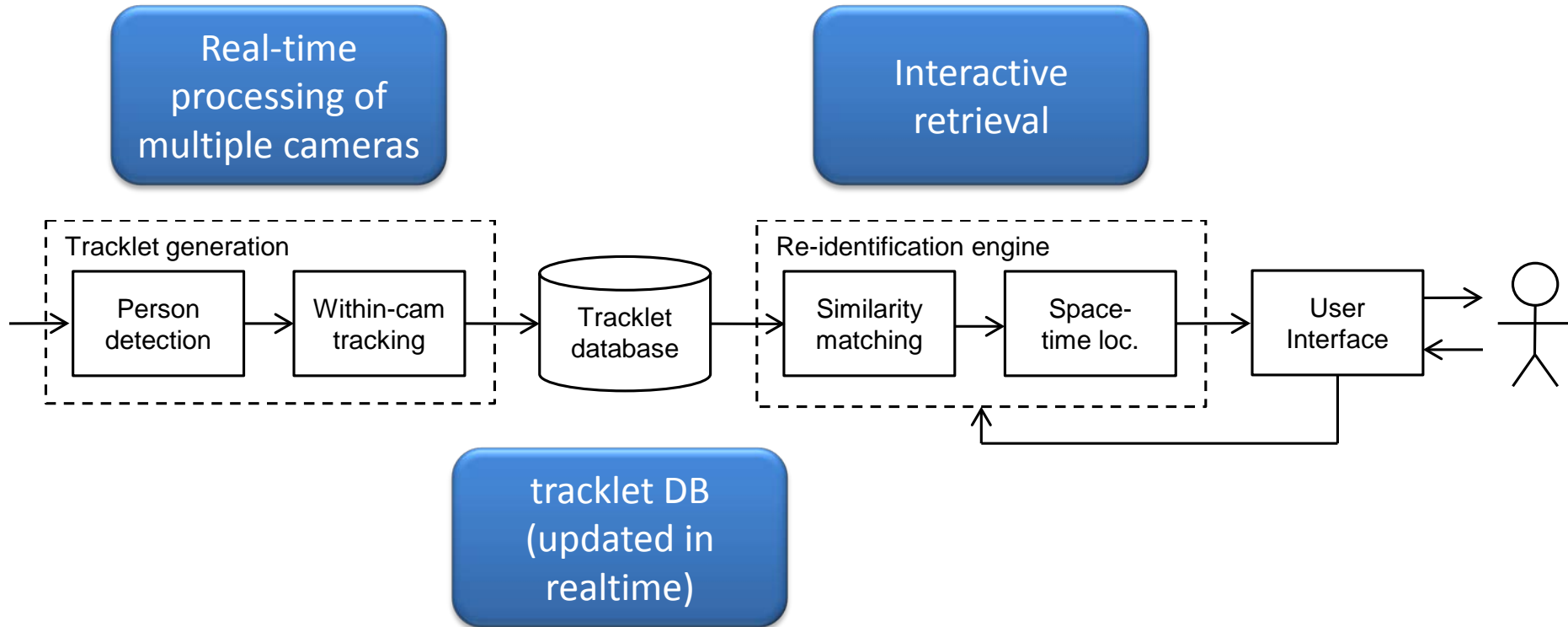


Problem definition

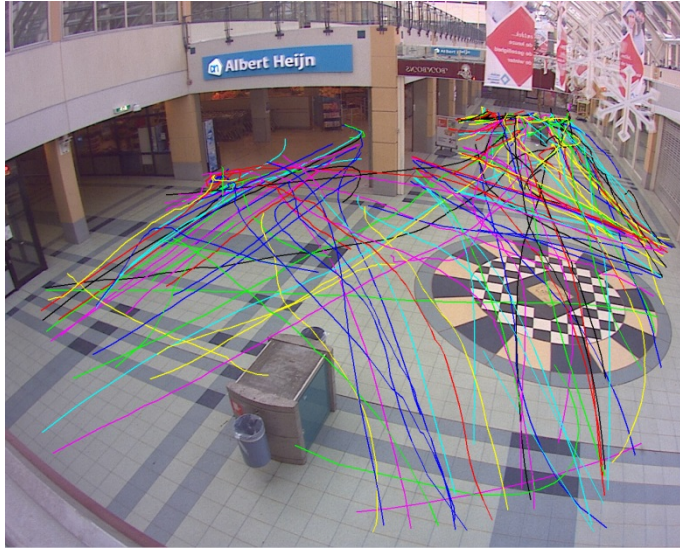
- › Manual search of suspects in multiple CCTV cameras:
 - › Search is **time consuming**
 - › Suspects are **easily missed**, especially in crowded situations



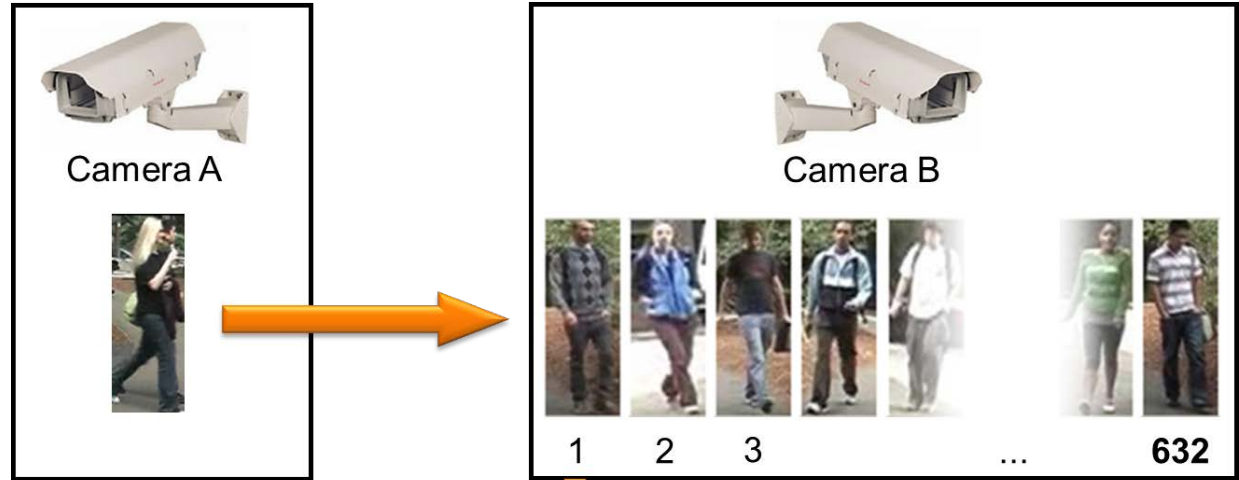
TNO System



Real-time track generation



Interactive re-identification



› **Re-identification:**

- › Retrieve similar candidates
- › Patent



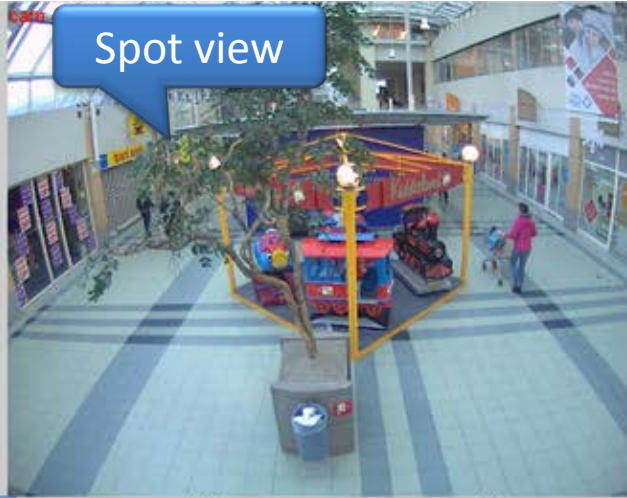
Note: Applicable to
CCTV resolution

Detect many candidates...

Map



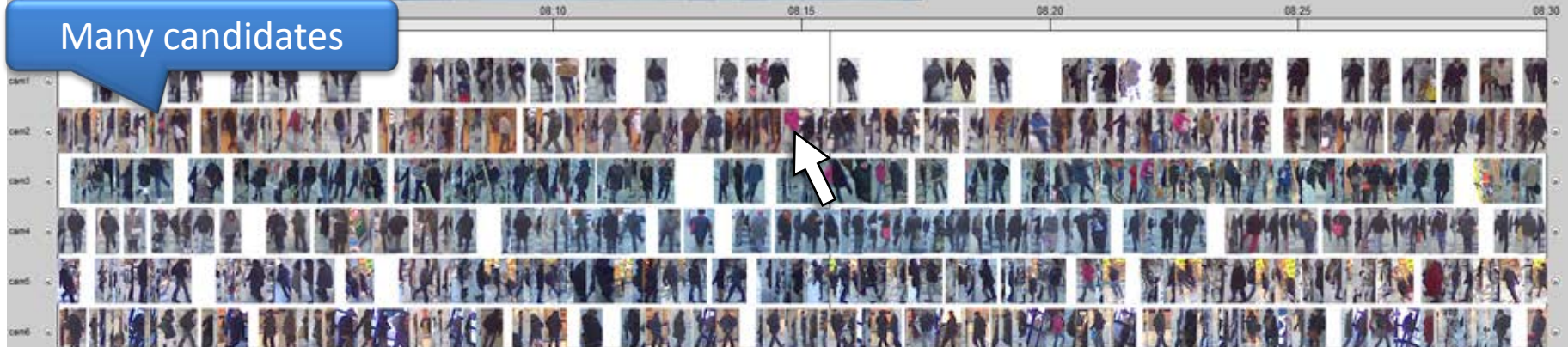
Spot view



Other cameras



Many candidates

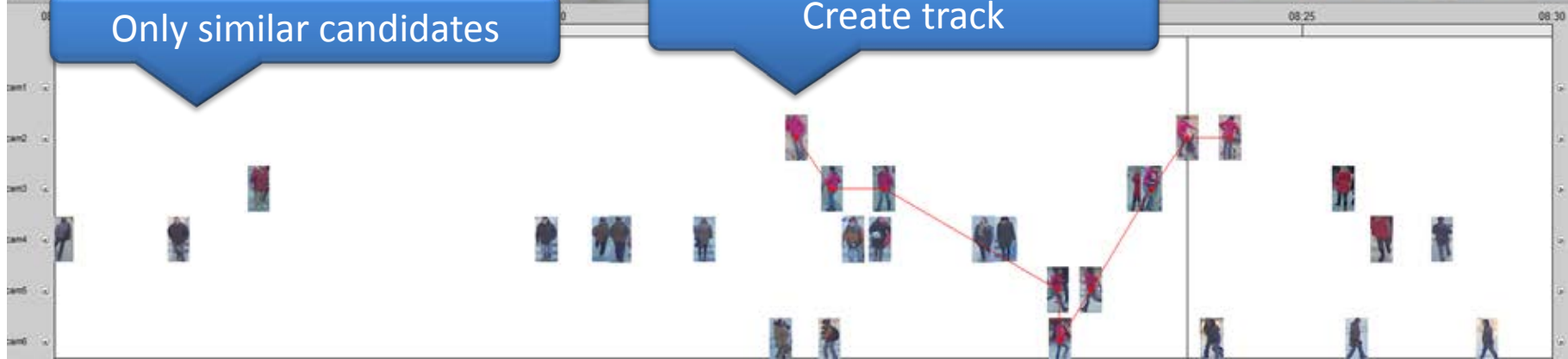


...show only similar candidates



Only similar candidates

Create track



Benefits

- › The TNO method is up to **five** times faster than without support
- › Less people are missed
 - › Especially in larger area's or large timespans
 - › (see our demo)

Live demonstrated at railway station

- › Live demonstration
 - › Test railway track and station with 50 volunteers
 - › Heterogeneous light/weather
 - › Natural clothing

- › Scenario:
 - › Left luggage
 - › Who left the luggage?
 - › Where did suspect go to?



Moving forward ...

- › We are looking for:
 - › For partners to help in putting our technology on the market

- › What we bring to the table:
 - › State of the art video analytics expertise
 - › Our patented re recognition algorithm

- › Recent references for tracking and re-identification:
 - › Marck et al., “Finding suspects in multiple cameras...”, 2014.
 - › Bouma et al., “WPSS: Watching people security services”, 2013.
 - › Bouma et al., “Real-time tracking and fast retrieval of persons...”, 2013.
 - › Hu et al., “Tracking individuals in surveillance video of a high-density crowd”, 2012.
 - › Bouma et al., “Re-identification of persons in multi-camera surveillance...”, 2012.

- › Related projects:

- › WPSS
- › PROTECTRAIL



Track record & contributions

- › Real-time tracking [Bouma, 2013]
- › **Re-identification over multiple CCTV cameras** [Bouma, 2013]
- › Fusion of multiple detections
 - › Behavioral profiling by combining multiple subtle suspicious observations [2013]
- › Action recognition and behavior analysis
 - › (DARPA): Human action and behavior recognition [Bouma, 2013][Burghouts, 2014]
- › Threat detection
 - › (EDA: ARENA): Truck on parking lot [Burghouts, 2014]
 - › (Passive sensors): Pickpockets in shopping mall [Bouma, 2014]

Next

People flow measurement

Multitel