Efficient Safety and Security in Crowded Environments

CENTAUR
Crowded ENvironments moniToring for Activity Understanding and Recognition

Scientists in Charge: Prof. Brémond (Inria), Prof. Cavallaro (QMUL), Prof. Fua (EPFL), Prof. Pajdla (Neovision), Dr. Libal (Honeywell, Project Coordinator)

Motivation
- Surveillance systems with hundreds of cameras overload operators.
- Automatic tracking of individuals is limited to non-crowded scenes.

Tracking & Re-identification

Tracking
Algorithm to automatically follow individuals by their appearance and motion using:
- Dynamic Background Subtraction\(^1\),
- Probabilistic Occupancy Map\(^2\),
- k-Shortest Paths\(^3\).

FOV = camera field of view.

Does the same person appear in the blue and red zone tracks?

Re-identification
Appearance-based track signatures are compared to facilitate detection of an individual’s reappearance. This enables individuals to be tracked across non-overlapping FOVs.

Crowd Understanding

- Crowds are highly dynamic, constantly changing in size, density, velocity and direction.
- Crowd analysis cannot be performed with standard tracking algorithms.
- CENTAUR solution highly successful in detecting violence from camera footage.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Accuracy</th>
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<tbody>
<tr>
<td>Histograms of Oriented Gradients and Optical Flow (Laptev et al., CVPR'08)</td>
<td>56.52%</td>
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<tr>
<td>Histograms of Oriented Gradients (Laptev et al., CVPR'08)</td>
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<td>Histograms of Optical Flow (Laptev et al., CVPR'08)</td>
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<tr>
<td>Local Trinary Patterns (Yeffet and Wolf, ICCV 2009)</td>
<td>71.53%</td>
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<tr>
<td>Violent Flows (Hassner et al., SISM, CVPR'12)</td>
<td>81.3%</td>
</tr>
<tr>
<td>Our Approach</td>
<td>93.53%</td>
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Non-violent Scenes

Violent Scenes

Ethics & Privacy, an Opportunity?
The CENTAUR project is being conducted against a backdrop of intense debate about the right balance between privacy and security in the Information Age. Our objective is to boost the security operator’s situational awareness and to achieve this, absolute identification is simply not required. Furthermore, video analytics actually provide an opportunity to harness procedures such as automated anonymisation or cancellable biometrics.

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