DETECTING ANOMALIES FROM VIDEO-SEQUENCES: A NOVEL DESCRIPTOR

GIULIA ORRÙ, DAVIDE GHIANI, MAURA PINTOR, GIAN LUCA MARCIALIS, FABIO ROLI
Department Of Electrical And Electronic Engineering, University Of Cagliari, Italy
CROWD ANALYSIS
A NOVEL DESCRIPTOR FOR ANOMALOUS EVENTS DETECTION IN HIGH-DENSITY CROWDS

- based on the hypothesis that anomalous events happen when multiple group formation events and group breaking-up events suddenly appear in the scenario

- inspired by the concept of one-dimensional local binary pattern

LOW LEVEL FEATURES: GROUP COUNTS

We compare 4 methods for counting the groups:

- Manual counting as ground truth (MC)
- Clustering of optical flow (COF)
- OpenCV Cascade detector (CD)
- Blob detector (BD) [our implementation]

HIGH LEVEL FEATURES: TRINARY CODES
EXPERIMENTAL PROTOCOL

- Motion Emotion data set: 31 video sequences of around 44000 frames in total.
- The videos contain both normal and abnormal behavior, labeled frame-by-frame as 5 classes (panic, fight, congestion, obstacle and neutral).

Metrics:
\[
\text{precision} = \frac{TP}{TP + FP} \quad F1_{\text{score}} = 2 \times \frac{\text{precision} \times \text{recall}}{\text{precision} + \text{recall}} \quad \text{recall} = \frac{TP}{TP + FN}
\]

Descriptor parameters have been set using a grid search, which maximize the F1score:
- in a supervised way ➔ F1score maximised on all videos
- with a Leave-one-out cross validation ➔ F1score maximised on N-1 videos and test on the video left out
EXPERIMENTAL PROTOCOL

- Experiment 1: set of videos recorded by the camera in frontal position with respect to the scene.
- Experiment 2: set of videos recorded by the camera in lateral position with respect to the scene.

Frontal view, slope $\leq 5^\circ$

Lateral view, slope $> 5^\circ$
Different position of the camera leads to very different performances: better performance on lateral videos.

<table>
<thead>
<tr>
<th></th>
<th>Supervised</th>
<th></th>
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<th>Leave-one-out</th>
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<tbody>
<tr>
<td></td>
<td>Precision</td>
<td>Recall</td>
<td>F1</td>
<td>Precision</td>
<td>Recall</td>
<td>F1</td>
</tr>
<tr>
<td>MC</td>
<td>88.89%</td>
<td>94.12%</td>
<td>91.43%</td>
<td>79.31%</td>
<td>71.87%</td>
<td>75.41%</td>
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<tr>
<td>COF</td>
<td>71.11%</td>
<td>88.89%</td>
<td>79.01%</td>
<td>52.50%</td>
<td>60.00%</td>
<td>56.00%</td>
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<tr>
<td>CD</td>
<td>75.00%</td>
<td>91.67%</td>
<td>82.50%</td>
<td>73.17%</td>
<td>83.33%</td>
<td>77.92%</td>
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<tr>
<td>BD</td>
<td>70.45%</td>
<td>86.11%</td>
<td>77.50%</td>
<td>56.52%</td>
<td>74.29%</td>
<td>64.20%</td>
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</tbody>
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ANALYSIS OF INDIVIDUAL CASES: STRUCTURED CROWD
ANALYSIS OF INDIVIDUAL CASES: UNSTRUCTURED CROWD

Frame 0
Frame 6
Frame 12
Frame 18
Frame 24
Frame 30
Frame 36
Frame 42
Frame 48
Frame 54
Frame 60
Frame 66

VIDEO 023

ALGORITHM ground_truth

ALGORITHM of_clusters

ALGORITHM bb_detect_multi_scale

ALGORITHM blob_detection
CONCLUSIONS

WHITE BOX DESCRIPTOR

CONTROL OF STRUCTURED CROWDS

PIPELINE WITHOUT DELAY
THANKS FOR THE ATTENTION!

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giulia.orru@unica.it