

Learning Regularity in Skeleton Trajectories for Anomaly Detection in Videos - Supplementary Material

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1. Introduction

In this supplementary document we include videos containing extended examples of the illustrations shown in Figures 4 and 5 in the main paper, the source code to reproduce the reported results and the details about the construction of the HR-ShanghaiTech and HR-Avenue datasets.

2. Animated Visualization of MPED-RNN Results

We provide a set of videos with this supplementary material to further illustrate the “open-box” interpretation of MPED-RNN given in Figures 4 and 5 of the main paper, and also compare these qualitative results with related works. For each camera in the ShanghaiTech dataset, we selected one test video and generated the respective videos extending what is shown in Figures 4 and 5 of the main paper. These videos are inside the visualization folder and can be visualized in two ways:

1. By opening the index.html file in your web browser. We recommend using the Chrome web browser.
2. By opening the videos directly from the visualization/videos folder. All videos are in .mp4 format and were encoded using the H.264 codec.

If you choose option 2, the videos related to Figure 4 compare the anomaly score maps of MPED-RNN (top-right) against the score maps of Conv-AE [1] (bottom-left) and Liu *et al.* [2] (bottom-right), and the videos related to Figure 5 compare the predicted features of MPED-RNN by splitting them into global + local (left), global (center) and local (right). To enable an easy visualization of the predicted features in Figure 5, we selected a single trajectory with a strong anomaly score.

3. Source Code

We include in this supplementary material the source code and the MPED-RNN pre-trained models to reproduce the results reported in this paper. The code is written in Python and has been tested on Ubuntu 16 and 18 versions. More details on how to run it can be found in the README.md file inside the code/tbad_supp directory.

4. HR-ShanghaiTech and HR-Avenue datasets

The ShanghaiTech dataset contains non-human anomalies in 6 out of its 107 test videos. These 6 videos are: 01_0130, 01_0135, 01_0136, 06_0144, 06_0145 and 12_0152. HR-ShanghaiTech was assembled by removing those videos from the ShanghaiTech dataset.

As for the HR-Avenue dataset, since the original Avenue dataset only contains 21 videos, we ignored segments of the videos where the anomalies were not detectable by the pose detector we employed or where the anomaly was non-human. The segments ignored were:

- Video 01: frames 75 to 120, 390 to 436, 864 to 910 and 931 to 1000.
- Video 02: frames 272 to 319 and 723 to 763.
- Video 03: frames 293 to 340.
- Video 06: frames 561 to 624 and 814 to 1006.
- Video 16: frames 728 to 739.

References

- [1] Mahmudul Hasan, Jonghyun Choi, Jan Neumann, Amit K Roy-Chowdhury, and Larry S Davis. Learning temporal regularity in video sequences. In *IEEE Conference on Computer Vision and Pattern Recognition*, pages 733–742, 2016. 2

- [2] Wen Liu, Weixin Luo, Dongze Lian, and Shenghua Gao. Future frame prediction for anomaly detection – a new baseline. In *IEEE Conference on Computer Vision and Pattern Recognition*, 2018. 2