UBnormal: New Benchmark for Supervised Open-Set Video Anomaly Detection – Supplementary

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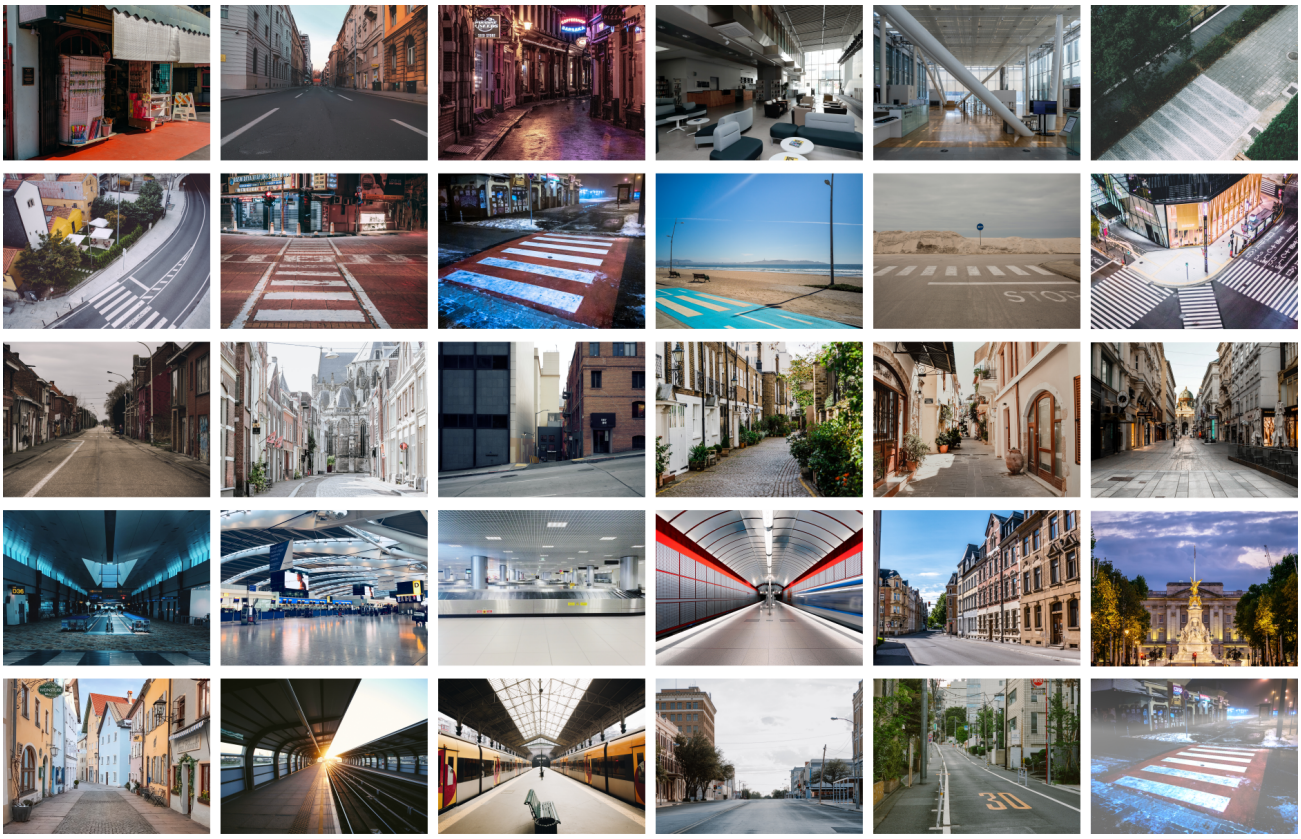

Figure 1. The 29 backgrounds used to generate the virtual scenes in UBnormal. One of the scenes is repeated (in the bottom-right corner) to show the fog effect. Best viewed in color.

1. Discussion

In Figure 1, we present the 29 scenes of our data set. We have 22 outdoor scenes and 7 indoor scenes. There are various illumination conditions, corresponding to different weather conditions (*e.g.* sunny, cloudy, foggy) and different day times (*e.g.* day, sunset, night). The last image (at the bottom right) illustrates one of the existing scenes with the fog effect.

We present the animated characters from the UBnormal data set in Figure 2. There are 19 unique characters, but in order to increase the variety of the data set, we augment the characters by changing the color of their hair and clothes.

In Figure 3, we show the 5 object categories (excluding people) from UBnormal. We variate the colors of objects to increase diversity, as for the animated characters.

In Figure 4, we illustrate an example for each abnormal action category from the UBnormal benchmark. There

Figure 2. Various characters animating the scenes in the UBnormal benchmark. There are 19 unique characters that serve as seeds for generating people with different hair color and clothes. Best viewed in color.

Statistics	Training	Validation	Test	Total
#anomalies	195	76	389	660
#abnormal frames	25,227	13,938	49,850	89,015
#normal frames	90,860	14,237	42,790	147,887
#abnormal minutes	14.02	7.74	27.69	49.45
#normal minutes	50.48	7.91	23.77	82.16
#videos	268	64	211	543
#abnormal regions	38,048	21,321	82,738	142,107
#unique objects	1,443	351	1,114	2,908
avg. objects / frame	4.58	4.53	4.24	4.44

Table 1. Detailed statistics for the UBnormal data set. Our videos are generated at 30 FPS.

are 20 anomaly types related to objects (*e.g.* people, cars) and two non-object anomaly types (fire, smoke). The figure shows the diversity of our anomalies.

2. Statistics

In Table 1, we report several statistics about the UBnormal data set. The number of videos in the data set is 543, with 268 videos for training, 64 for validation and the remaining 211 for testing. There are a total of 660 anomalies divided into 195, 76 and 389 for training, validation and test, respectively. The total number of abnormal frames is 89,015, with the largest fraction of 49,850 frames belonging to the test set. There are 142,107 abnormal regions in the data set, which accounts for an average of 1.60 abnormal regions per abnormal frame. The average number of objects per frame is 4.44. The overall length of our data set is 132 minutes.

Figure 3. Various objects animating the scenes in the UBnormal benchmark. There are 5 object categories besides people. To increase variation, we apply different colors to the objects. Best viewed in color.

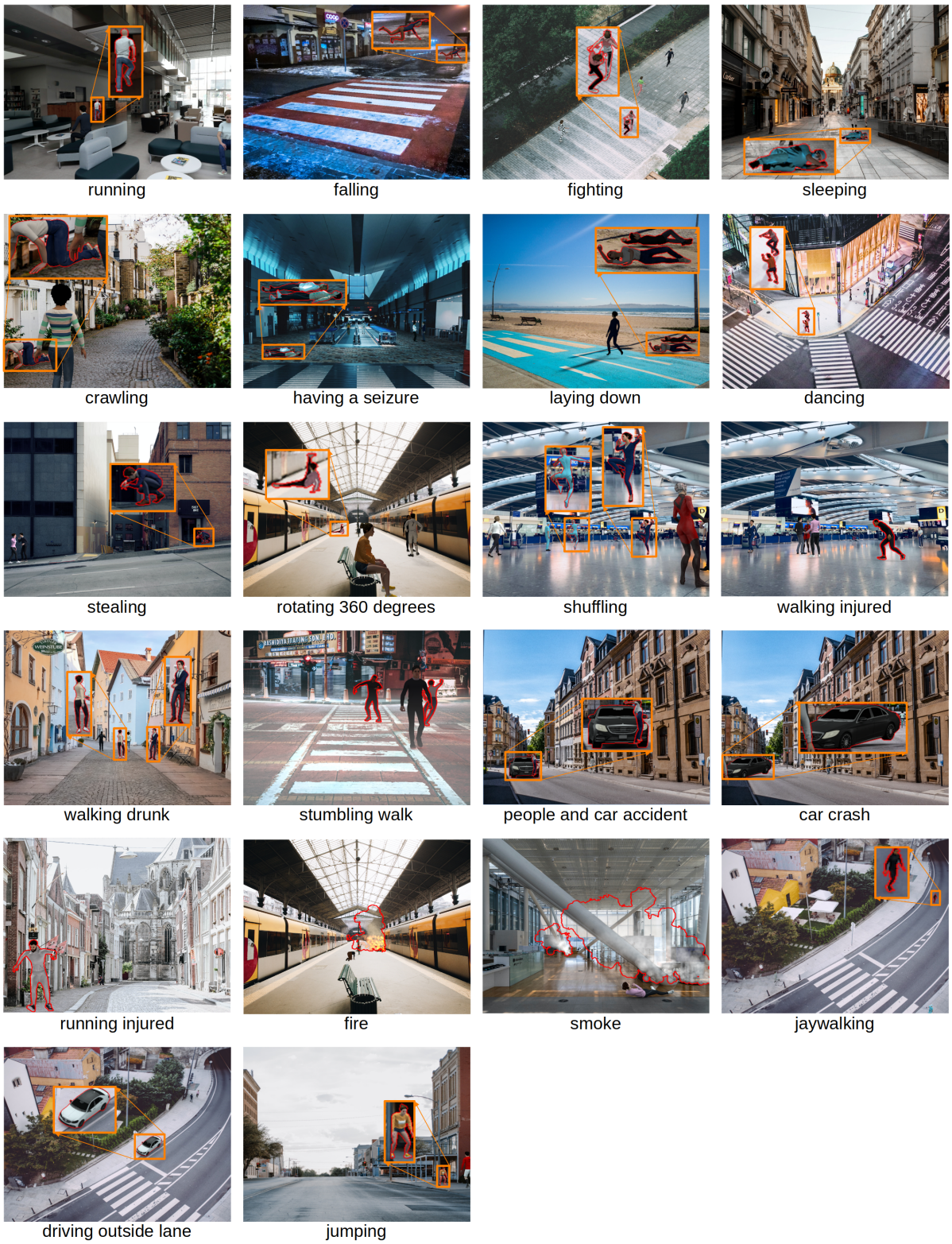

Figure 4. The abnormal action categories from UBnormal. The abnormal objects are emphasized through a red contour. To improve readability, we apply a magnifying effect to smaller objects. Best viewed in color.