Region-based Appearance and Flow Characteristics for Anomaly Detection in Infrared Surveillance Imagery

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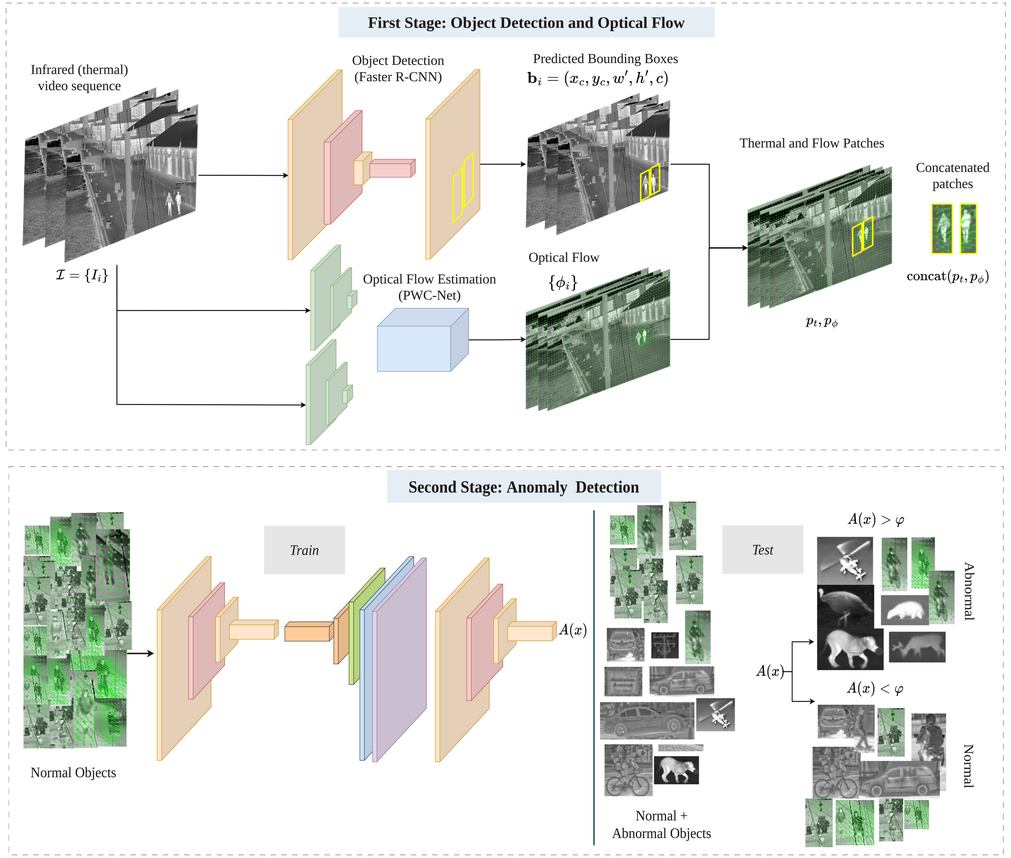
Motivation

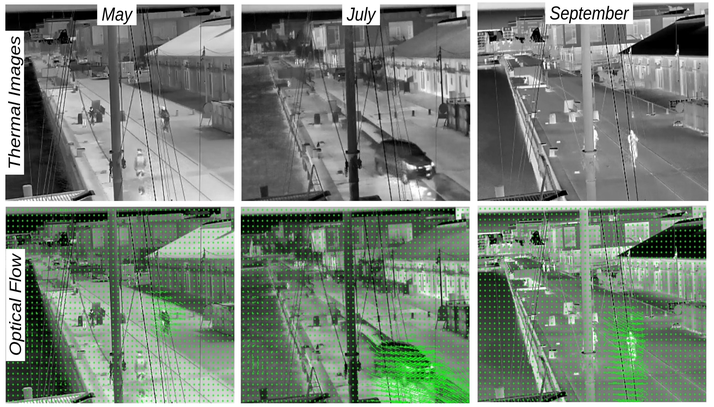
-Varying environmental conditions affects normality distribution in a scene[1]
-The dual use of both visual **appearance**[2] and motion characteristic[3] (**optical flow**) to facilitate object-wise anomaly detection in context.

Architecture Overview

A two-stage approach that incorporates object-wise[2] and anomaly[4] detection tasks.



Datasets[1]



Optical flow *is extracted from each object region and combined with* ***appearance*** *to give a 3-channel tensor representation for each object.*

Results

Mean anomaly score using appearance only **(IR)** and appearance with optical flow **(IR+Flow)** with threshold at ***0.5.***

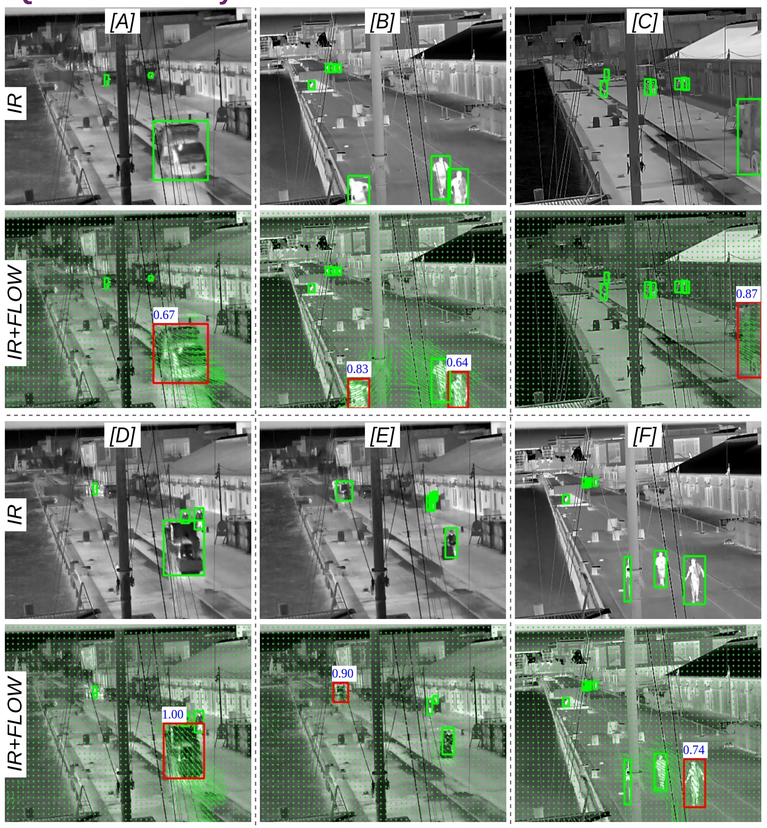
Anomaly Detection Module					
	DFKDE	FastFlow	GANomaly	RD	STFPM
IR	0.901	0.634	0.691	0.859	0.566
IR+Flow	0.895	0.669	0.924	0.709	0.607

Conclusions

- Combination of infrared (thermal) object appearance and short-term motion characteristics (optic flow), result in a notable improvement in anomalous object detection performance in varying environmental condition.

- Future work includes the use of temporal scene analysis to expand this use of anomalous behaviour detection within infrared (thermal) surveillance imagery.

Qualitative Analysis



Most genuine anomalous objects appear to generate associated anomalous flow patterns across the entire object surface.

References

[1] Van Adriyanov Nikolov, Mark Philip Philipsen, Jinsong Liu, Jacob Velling Dueholm, Anders Skaarup Johansen, Kamal Nasrollahi, and Thomas B Moeslund. NeurIPS 2021.
[2] Shaoqing Ren, Kaiming He, Ross Girshick, and Jian Sun. NeurIPS, 2015.
[3] Deqing Sun, Xiaodong Yang, Ming-Yu Liu, and Jan Kautz. CVPR, 2018.
[4] Samet Akcay, Dick Ameln, Ashwin Vaidya, Barath Lakshmanan, Nilesh Ahuja, and Utku Genc. Anomalib: A deep learning library for anomaly detection, 2022