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Automatic pipeline threat detection by aerial surveillance

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Biography:

Vijayan K Asari is a Professor in Electrical and Computer Engineering and Ohio Research Scholars Endowed Chair in Wide Area Surveillance at the University of Dayton, Dayton, Ohio, USA. He is the Director of the Center of Excellence for Computer Vision and Wide Area Surveillance Research (Vision Lab) at UD. He received his BS in Electronics and Communication Engineering from the University of Kerala (College of Engineering, Trivandrum), India in 1978, MTech and PhD degrees in Electrical Engineering from the Indian Institute of Technology, Madras in 1984 and 1994 respectively. Prior to joining UD in February 2010, he worked as Professor in Electrical and Computer Engineering at Old Dominion University, Norfolk, Virginia for 10 years. He worked at National University of Singapore during 1996-98 and led a research team for the development of a vision-guided microrobotic endoscopy system.

The pipeline industry has millions of miles of pipes buried along the length and breadth of the country. Since none of the areas through which pipelines run are to be used for other activities, it needs to be monitored so as to know whether the right-of-way of the pipeline is encroached upon at any point in time. Rapid advances made in the area of sensor technology have enabled the use of high end video acquisition systems to monitor the right-of-way of pipelines. Huge amounts of data are thus made available for analysis. However, it would be very expensive to employ analysts to scan through the data and identify threats along the right-of-way in the vast expanse of wide area imagery. This warrants the deployment of an automated mechanism that is able to detect threats and send out warnings in the event of any hint of a threat. The images captured by aerial data acquisition systems are affected by a host of factors that include light sources, camera characteristics, geometric positions and environmental conditions. UD Vision Lab is developing a multistage framework for the analysis of aerial imagery for automatic detection and identification of machinery threats along the pipeline right of way which would be capable of taking into account the constraints that come with aerial imagery such as low resolution, lower frame rate, large variations in illumination, motion blurs, etc. The visibility and features of objects may not be clear because of partial or total occlusion of light sources by buildings and trees which create a shadow. The complexity of large variations in the appearance of the object and the background in a typical image causes the performance degradation of detection algorithms. Our novel preprocessing technique improves the performance of automatic detection and identification of objects in an image captured in extremely complex lighting conditions. This step consists of a new non-linear transformation technique which is capable of simultaneous enhancement of both dark and brighter regions by preserving the main structure of illuminance-reflectance characteristics of an image.

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Page 46