Developing an Algorithm for Tracking Vehicles in High Resolution Satellite Image and Aerial Photographs

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***Abstract*— Roads and vehicles contribute an important part in the urbanization and society. Very high resolution satellite image and aerial photograph allow the automated traffic pattern analysis in an area at a given time at a given point. To track the vehicles in satellite image, an algorithm for faster output and better efficiency can be developed. There are algorithms already available for tracking roads and vehicles separately like Median filter, Color-box segmentation and Morphological processing algorithms for roads tracking, Bayesian Background Transformation, Gradient vectors, Blob extraction, Vision based algorithms for vehicles tracking. Many research have been done on aerial images, videos for motion detection of vehicles for traffic monitoring. A few research have been done on high resolution satellite images for traffic monitoring, traffic pattern analysis. The aim of this paper is to track the vehicles in high resolution satellite image and aerial photograph at a given time.**

Keywords*— Tracking of vehicles, High resolution satellite image, Aerial photograph, Traffic monitoring.

I. INTRODUCTION

To track vehicles in high resolution satellite image and aerial photograph, a new algorithm can be developed for efficient traffic analysis. This will reduce the time in tracking vehicles which are on roads. By tracking vehicles which are on roads many long-term objectives in urbanization can be achieved. The focus of this paper is to develop a new algorithm for offline traffic pattern analysis which will be based on mainly three algorithms which are Median filter algorithm, Blob extraction algorithm and Vision based algorithm. Counting of vehicles can be used for traffic pattern analysis by identifying congestion points. It can be used for road-network maintenance in urbanization.

Median Filter algorithm: The algorithm removes noise from the image. It gives a filtered image and preserves edges in the image. This enhances the image and removes the unwanted pixels from the image.

Color Segmentation algorithm: Color segmentation segments the image based upon various color regions in the image. The objective of color segmentation is to extract meaningful output from the input to process the image effectively.

Blob extraction algorithm: Blob extraction algorithm extracts the blob from the images like vehicles from the image. This works on the principle of connected component analysis. The extracted blobs gives the vehicles from the images.

Vision based algorithm: Vision based algorithm detect the vehicles from the images and helps in forming bounding box around vehicles which counts the no. of vehicles.

II. STUDY AREA AND MATERIALS USED

Materials required: MATLAB 7.12.0, Paint software and ArcGIS software are being required to process the aerial photographs and high resolution satellite images.

Study Area: Aerial photographs of Phoenix city, Arizona (30 cm resolution) and high resolution satellite image of Berlin, Germany (0.5 m resolution) has been taken as study area in which roads with vehicles are present. Other features like parking plots, settlements, vegetation etc. are present in the images.

Fig 1. Aerial photograph 1, Phoenix city (Arizona) (30 cm resolution)

Fig 2. Aerial photograph 2, Phoenix city (Arizona), (30 cm resolution)

Fig 3. High resolution satellite image, Berlin city (Germany), (0.5 m resolution)

III. METHODOLOGY

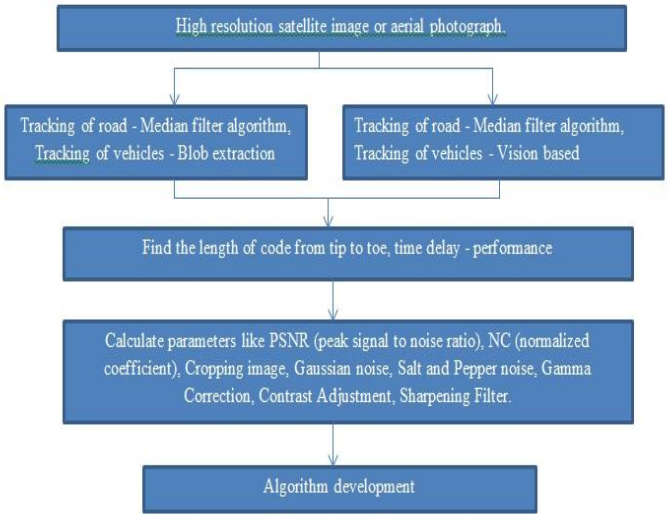

Fig 4. Methodology for algorithm development

IV. RESULTS

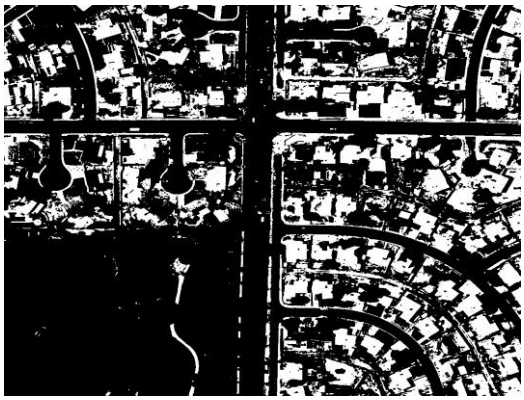

Fig 5. Output of road extraction using median filter on aerial photograph, Phoenix city, Arizona.

Fig 6. Output of color segmentation for roads extraction on aerial photograph, Phoenix city, Arizona.

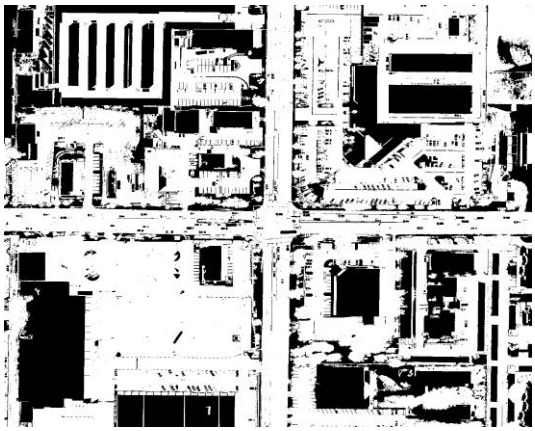

Fig 7. Output of vehicle extraction using blob extraction on aerial photograph 2 of Phoenix city, Arizona.

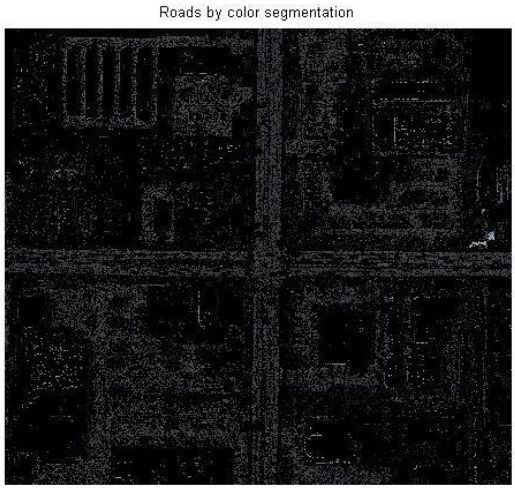

Fig 8. Output of color segmentation for roads extraction on aerial photograph 2, Phoenix city, Arizona.

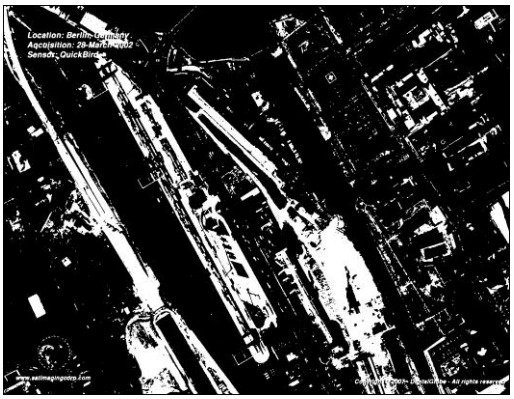

Fig 9. Output of road extraction using median filter on satellite image of Berlin, Germany.

Fig 10. Output of color segmentation for roads extraction on aerial photograph 2, Phoenix city, Arizona.

Fig 10. Output of color segmentation for roads extraction on aerial photograph 2, Phoenix city, Arizona.

V. CONCLUSION

Roads are being identified in the satellite image and aerial photographs, vehicles are being detected using blob extraction algorithm. Bounding box needs to be plotted around vehicles to count them. Algorithm can be improved by improving the color segmentation to detect roads part only or gradient vectors can be applied for extracting the roads by finding the projection map and lat-long of the area.

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REFERENCES

[1] Jia-Hua, CHEN Guo-Liang, SHAN Jiu-Long (2004). How to Measure Scalability of SMP Cluster[J]. Journal of Software.;15(7):977-986

[2] Finn A., Kushmerick N. , and Smyth B. (2001). Fact or fiction: Content classification for digital libraries. DELOS Workshop.

[3] Xianwen Liao, Donglin Cao, Songbo Tan, Yue Liu, Guodong Ding, Xueqi Cheng (2006). Combining Language Model with Sentiment Analysis for Opinion Retrieval of blog-Post[C]. TREC, :211-213.

[4] Ozaki T. , Gotoh T., Toriu T. and Yoshida M. (1986) "Automatic visual inspection system for industrial printing", *Proc. SPIE Cambridge Symp. Advances in Intelligent Robotics Systems*, pp.730 - 733.

[5] Zhao T. and Nevatia R. "Car detection in low resolution aerial images", *Proc. IEEE Int. Conf. Comput. Vis.*, vol. 1, pp.710 -717 2001.

[6] Herbert M. (2000), "Active and Passive Range Sensing for Robotics," Proc. IEEE int'l Conf. Robotics and Automation, Vol. 1 pp. 102-110.

[7] Park S., Kim T., Kang S. and Heon K. (2003), "A Novel Signal Processing Technique for Vehicle Detection Radar," 2003 IEEE MTT-S Int'l microwave Symp. Digest, pp. 607-610, 2003