International Science Group

ISG-KONF.COM

STUDY OF MODERN PROBLEMS OF CIVILIZATION

V SCIENTIFIC AND PRACTICAL CONFERENCE

19-23 October

Oslo, Norway

DOI 10.46299/ISG.2020.II.V

ISBN 978-1-63649-940-6

STUDY OF MODERN PROBLEMS OF CIVILIZATION

Abstracts of V International Scientific and Practical Conference

Oslo, Norway
19-23 October, 2020

Library of Congress Cataloging-in-Publication Data

UDC 01.1
The V th International scientific and practical conference «STUDY OF MODERN PROBLEMS OF CIVILIZATION» (October 19-23, 2020 Oslo, Norway 2020. 516 p.

ISBN - 978-1-63649-940-6`
DOI - 10.46299/ISG.2020.II.V

EDITORIAL BOARD

MODERN METHODS OF ANALYSIS OF THE MOVEMENT SCHEME USING VIDEO DETECTION OF VEHICLES

Tvoroshenko Iryna,
Ph.D., Associate Professor
Kharkiv National University of Radio Electronics

Dziubenko Mykyta
Master in informatics
Kharkiv National University of Radio Electronics

Many subject areas use computer vision systems to solve applied problems [1]. An urgent problem is the development of a video detection system for vehicles to establish a safe situation on highways [2].

Video surveillance systems are used to ensure order in various complexes and facilities [3, 4]. An example is solving the problem of finding abandoned luggage, identifying suspicious people, and the trajectory of their movement. Automated process control systems use methods of visual analysis of images [5-7] or video in the decision-making process [8, 9]. Graphic information tools use different approaches to effectively index images [10-12] and video data.

It is important to establish high-quality video processing. The key issues are the ratio of quality and speed of video processing, qualitative and quantitative analysis of traffic flows. Due to the increase in traffic, the issues of road junction planning are being resolved. It is important to effectively distribute traffic flows to ensure uninterrupted traffic on individual roads and highways [2].

The solution to this problem will provide automatic traffic control by improving the schedule of traffic lights based on information about the number of transport units [13-14]. Statistical information on the number of vehicles of different classes will make it possible to estimate the load on the roadway [15].

This approach will predict the service life of the road surface and further planning of repair work. Will allow making reasonable decisions [15] on the need to build back up roads and to design a road network in the city.

Qualitative analysis of road scenes will partially reveal violations of traffic rules:

– Travel under prohibitory traffic light signals;

– Section of continuous strips of marking;

– Stopping or parking of vehicles in forbidden places;

– Entry of lorries on the highway with restrictions on the permissible weight of the transport unit.

Computer vision [16-18] is a critical area in the development of applications for the analysis of traffic flows and the development of intelligent transport technologies:

– Video recorders;

– Automatic parking systems;

– Car navigation systems;

– Registration number recognition systems.

The development of visual road detectors of vehicles is an important area. Visual recognition [19] of transport provides an intuitive way of presenting information in contrast to other methods.

Video detection is a method of solving the problem of traffic analysis. Video detection determines the position of vehicles in each frame of the video data stream and builds the trajectory of the detected objects.

The construction of the trajectory involves the selection of a set of consecutive frames of data that correspond to each object under research.

The difficulty of reliable detection using computer vision methods [20] is expressed in the fact that roads are dynamic "scenes" with different backgrounds. This background is constantly changing with lighting and possible overlap of objects.

Analysis of scientific work in recent years has shown that the task of video detection of vehicles is studied by many researchers [3, 4, 13-15]. The main goal is to improve the quality of search by modifying computer vision algorithms.

In most works, the search for vehicles is performed by detecting registration plates. This object is the simplest due to the contrast of the background and characters, the limited number of characters. This approach does not allow detecting of vehicles in situations of lack of license plates or their location in non-standard parts.

Performing the classification [21] of vehicles requires access to a special database, which is not always necessary and possible. It is possible to search for simple geometric primitives: straight lines in the area of the bumper or suspension; circles bounding the wheels. Vehicle parameters are restored based on the relative position of the set of primitives and the history of their displacement in the coordinate system associated with the image.

Video detection systems are implemented in software on a streaming video processing server or integrated directly into the camera. Modern detection systems come with the equipment, and software developers are adapting existing libraries for other cameras and video processors.

The scheme of operation of detection systems by detecting and tracking objects consists of the following sequence of actions [17]:

1. Detect a frame from a video stream.

2. Pre-processing of the received frame.

3. Search for the position of the object in the image. Assess the reliability of the object in this area. Classification of objects within one considered class.

4. Maintenance of detected objects.

5. Analysis of search and maintenance results. The functionality of the results analysis unit depends on the specific task for the developer of the detection system.

Modern methods for solving the problem of **finding objects** in images can be divided into three main groups [16, 18]:

1. Methods that use features those are most characteristic of objects to describe an object. The features can be selected point features of the object.

2. Methods of searching for objects by a template.

3. Methods for determining the motion of objects. Selects moving objects based on multiple images or video frames of the same scene.

There are methods based on **obtaining signs**.

Approaches to solving the problem of finding objects are to use machine learning methods [22] to build models of object classes and derivation methods to determine the position of objects in the image.

The methods in this group describe an object using feature vectors. Vectors are calculated based on the analysis of the pixel brightness function.

In the simplest case, an object is a set of pixel intensities. A vector whose number of components matches the resolution of the object. In practice, the histogram of oriented gradients and its various modifications are widely used to describe [10]. Contextual information [23-25], data on the mutual location of parts of the object [17] can be used in the construction. The object is described by a set of feature vectors, and in the process of learning a model is formed [20], which contains the most typical feature vectors.

The quality of the methods of this group depends on the selected features. How well the features divide the object classes. Currently, you can find special methods based on obtaining signs, for example, to search for people [6], vehicles [3], and pedestrians [4].

Template search methods assume that there is an image of an object (template) and a test image that is mapped to that template.

In the simplest case, the pattern can be a matrix of color intensities that are most characteristic of the object. More complex methods of this group use sets of feature vectors (descriptors) [26, 27], geometric representation of the object [28], or probabilistic models of objects, which contain information about the distributions of pixel intensities [1]. Search methods for a given pattern work effectively when searching for single objects. When there are overlaps, some features in the description disappear.

Methods for **determining areas** of motion involve a set of areas of a scene in which one or more objects are moving.

The simplest approach to solving this problem is to use the mechanism of subtracting the background from the video frame [10]. The subtraction procedure assumes that a background model is built for this video, and there may also be a mechanism to update the background model over time.

The quality of determining the position of moving areas by subtracting the background depends on the quality of the constructed background model. Background subtraction methods are divided into two groups depending on the mechanism of construction of the background image: recursive and non-recursive.

The easiest way to estimate movement on multiple images is to go through all the possible options for displacing images or fragments. To do this, you must first choose a metric to assess the degree of similarity of the fragments [19].

Methods for **tracking special points** of an object involve the presence of selected points that represent the object.

The selection of special points is performed using special detectors and descriptors [26, 27]. If the detector finds the position of a special point in the image, the descriptor constructs a vector of features characteristic of the obtained point.

The analysis of modern methods has shown that the existing methods do not allow solving the problem of estimating the intensity of traffic flows taking into account their qualitative composition in conditions when vehicles change the angle. The problem of developing methods for solving the problem of video detection of vehicles of different classes is relevant.

The research focuses on the processing of video from stationary cameras, in which vehicles change the angle and direction of movement (Fig. 1) [29]. Video can be provided from DVRs or obtained in the process of shooting a trafficked person.

Figure 1. Vehicles change the angle and direction of movement.

The purpose of this work is to improve modern methods of video detection of vehicles to ensure resistance to changes in angle or location of the camera, as well as to improve the quality of search and tracking.

The results of the work can be used:

– In systems for estimating the intensity of traffic flow;

– In video recorders in parking lots for control of loading.

The practical significance and value of the work lie in the creation of a software system for video detection of vehicles, which supports the preparation of test data, integration, and application of software implementations of the developed methods. Developments will provide classification by one frame, assessment of the quality of video detection, visualization of search, and tracking results.

References:

1. Szeliski R. (2010) *Computer Vision: Algorithms and Applications*, London, Great Britain: Springer-Verlag, 957 p.

2. Tvoroshenko I.S., and Kramarenko O.O. (2019) Software determination of the optimal route by geoinformation technologies, *Radio Electronics Computer Science Control*, 3, pp. 131-142.

3. Chen B.Y., Shi C., Zhang J., and et al. (2017) Most reliable path-finding algorithm for maximizing on-time arrival probability, *Transportmetrica B: Transport Dynamics*, 5(3), pp. 253-269.

4. Andrew V. Goldberg (2007) Point-to-Point Shortest Path Algorithms with Preprocessing, *Proceedings of 33rd Conference on Current Trends in Theory and Practice of Computer Science*, pp. 88-102.

5. Gorokhovatskyi V., Gadetska S., and Stiahlyk N. (2020) Image structural classification technologies based on statistical analysis of descriptions in the form of bit descriptor set, *In CEUR Workshop Proceedings: Computer Modeling and Intelligent Systems (CMIS-2020)*, 2608, pp. 1027-1039.

6. Gorokhovatskyi V., and Tvoroshenko I. (2020) Image Classification Based on the Kohonen Network and the Data Space Modification, *In CEUR Workshop Proceedings: Computer Modeling and Intelligent Systems (CMIS-2020)*, 2608, pp. 1013-1026.

7. Gorokhovatskyi V.O., Tvoroshenko I.S., and Peredrii O.O. (2020) Image classification method modification based on model of logic processing of bit description weights vector, *Telecommunications and Radio Engineering*, 79(1), pp. 59-69.

8. Daradkeh Y.I., and Tvoroshenko I. (2020) Technologies for Making Reliable Decisions on a Variety of Effective Factors using Fuzzy Logic, *International Journal of Advanced Computer Science and Applications*, 11(5), pp. 43-50.

9. Yousef Ibrahim Daradkeh, and Iryna Tvoroshenko (2020) Application of an Improved Formal Model of the Hybrid Development of Ontologies in Complex Information Systems, *Applied Sciences*, 10(19). p. 6777.

10. Gorokhovatskyi V.A. (2018) Image classification methods in the space of descriptions in the form of a set of the key point descriptors, *Telecommunications and Radio Engineering*, 77(9), pp. 787-797.

11. Gorokhovatskyi V.O., Gadetska S.V., and Stiahlyk N.I. (2019) Study of statistical properties of the block representation model for a set of key image descriptors, *Radio Electronics Computer Science Control*, 2, pp. 100-107.

12. Gorokhovatsky V.A. (2016) Efficient Estimation of Visual Object Relevance during Recognition through their Vector Descriptions, *Telecommunications and Radio Engineering*, 75(14), pp. 1271-1283.

13. Sun Y., Yu X., Bie R., and et al. (2017) Discovering time-dependent shortest path on traffic graph for drivers towards green driving, *Journal of Network and Computer Applications*, 83, pp. 204-212.

14. Liang Shen, Hu Shao, Long Zhang, and et al. (2017) The Global Optimal Algorithm of Reliable Path Finding Problem Based on Backtracking Method, *Mathematical Problems in Engineering*, 2017, pp. 1-10.

15. Abdulkareem I., Ammar A. Shubber, and Sabah A. (2018) Multi-criteria decision making to select the best monorail route, *Global Journal of Engineering Science and Research Management*, pp. 16-32.

16. Peters J.F. (2017) *Foundations of computer vision: Computational Geometry, Visual Image Structures and Object Shape Detection*, Cham, Switzerland: Springer International Publisher, 417 p.

17. Sonka M., Hlavac V., and Boyle R. (2014) *Image Processing, Analysis, and Machine Vision*, Atlanta, USA: Thomson-Engineering, 920 p.

18. Duda R.O., Hart P.E., and Stork D.G. (2000) *Pattern classification*, Hoboken, USA: John Wiley & Sons, 738 p.

19. Gorokhovatskyi V.O., Tvoroshenko I.S., and Vlasenko N.V. (2020) Using fuzzy clustering in structural methods of image classification, *Telecommunications and Radio Engineering*, 79(9), pp. 781-791.

20. Kobylin O., Gorokhovatskyi V., Tvoroshenko I., and Peredrii O. (2020) The application of non-parametric statistics methods in image classifiers based on structural description components, *Telecommunications and Radio Engineering*, 79(10), pp. 855-863.

21. Tvoroshenko I.S., and Gorokhovatsky V.O. (2019) Intelligent classification of biophysical system states using fuzzy interval logic, *Telecommunications and Radio Engineering*, 78(14), pp. 1303-1315.

22. Flah P. (2015) *Machine learning. The science and art of building algorithms that extract knowledge from data*, Moscow, Russia: DMK Press, 400 p., (in Russian).

23. M. Ayaz Ahmad, Irina Tvoroshenko, Jalal Hasan Baker, and Vyacheslav Lyashenko (2019) Modeling the Structure of Intellectual Means of Decision-Making Using a System-Oriented NFO Approach, *International Journal of Emerging Trends in Engineering Research*, 7(11), pp. 460-465.

24. Nong Ye. (2013) *Data Mining: Theories, Algorithms, and Examples*, Florida, USA: CRC Press, 349 p.

25. Tvoroshenko Irina, Ahmad M. Ayaz, Mustafa Syed Khalid, Lyashenko Vyacheslav, and Alharbi Adel R. (2020) Modification of Models Intensive Development Ontologies by Fuzzy Logic, *International Journal of Emerging Trends in Engineering Research*, 8(3), pp. 939-944.

26. Leutenegger S., Chli M., and Siegwart R. (2011) BRISK: Binary Robust Invariant Scalable Keypoints, *Proceedings of 2011 IEEE International Conference on Computer Vision (ICCV)*, pp. 2548-2555.

27. Rublee E., Rabaud V., Konolige K., and Bradski G. (2011) ORB: an efficient alternative to SIFT or SURF, *Proceedings of 2011 IEEE International Conference on Computer Vision (ICCV)*, pp. 2564-2571.

28. Ahmad M. Ayaz, Tvoroshenko Irina, Baker Jalal Hasan, and Lyashenko Vyacheslav (2019) Computational Complexity of the Accessory Function Setting Mechanism in Fuzzy Intellectual Systems, *International Journal of Advanced Trends in Computer Science and Engineering*, 8(5), pp. 2370-2377.

29. Kustikova V.D. (2013) Comparison of some video detection algorithms vehicle, *Bulletin of the Nizhny Novgorod State University Lobachevsky N.I.*, 4(1), pp. 231-242.