COMPARISON OF ALGORITHMS AND METHODS FOR SELECTING AN OBJECT IN A VIDEO STREAM

Jaumitbaeva Mexriban Karamatdin qizi[1] , Beknazarova Saida Safibullaevna[2]

[1]PhD student of Audiovisual technologies of Tashkent University of Information Technologies named by Muhammad Al- Khwarizmi, mexriban.zhaumitbaeva@gmail.com

[2]Dsc, doctor of technical science, Professor, head of Dept. Audiovisual technologies of Tashkent University of Information Technologies named by Muhammad Al- Khwarizmi, saida.beknazarova@gmail.com

https://doi.org/10.5281/zenodo.7859545

Abstract. *In this paper described method of straight line detector on the contour image. Presented set and the described problems of detecting and tracking an object in a video stream, we can single out the main criteria for comparison.*

Keywords. *method of straight, line detector, contour image.*

According to the goal set and the described problems of detecting and tracking an object in a video stream, we can single out the main criteria for comparison:

–resistance to changes in brightness;

–resistance to affine transformations.

–resistance to obscuration of the object by other objects;

–resistance to image noise;

–learning to a new geometric shape of the object;

–learnability to change the color histogram of the object.

There is still a lot of important criterion for comparing algorithms and methods for searching for an object - speed.

Table 1 shows the comparative characteristics of the considered methods and algorithms for searching for an object in a video stream, where **Y** is resistance to brightness changes, **Sc** is resistance to scaling, **Rot** – resistance to turns, **Ovl** – resistance to occlusion by other objects, **Ns** – noise resistance , **Frm** – resistance to changing the geometric shape, **G** – resistance to changing the color histogram, **Ol** – the complexity of the training stage (if the stage is present), **Of** – the complexity of the detection stage, n– the number of points in the image on which the search is performed, w– the size of the window of the Gaussian function, s– the number of octaves, $x$is the number of points in the neighborhood for orientation calculation, k is the number of projectively distorted images.

The considered methods can be classified into four groups: deterministic, probabilistic, neural network and combined methods (see Figure 1).

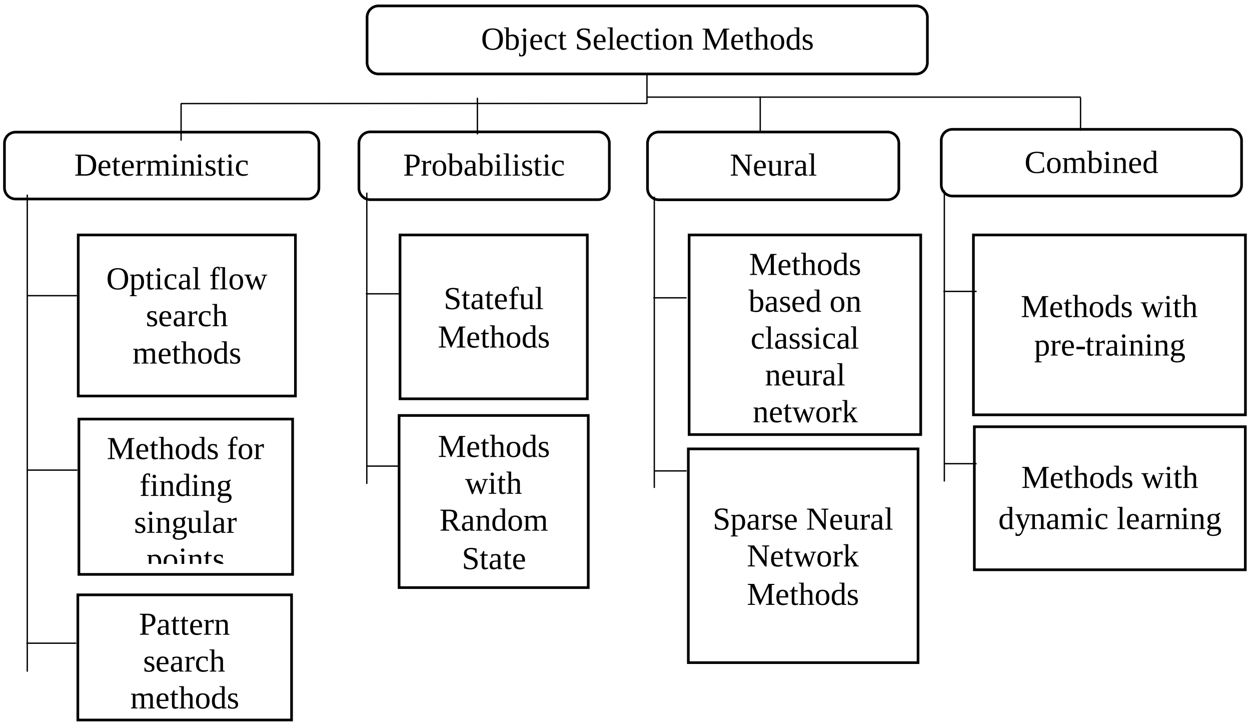

Figure 1 - Classification of methods for selecting an object in a video stream

Table 1 does not list pattern matching methods, since these methods do not search for a specific object, but are only designed to search for certain primitives, therefore, pattern matching methods do not participate in comparison with other methods.

Thus, all the considered methods are, to some extent, resistant to noise in the image and to overlapping of the object by other objects. Of the deterministic methods, the most stable method to the considered criteria is the ASIFT method, however, it has a large computational complexity. Of the deterministic methods, it is worth noting the SURF methods, Harris Laplace, which takes into account the scaling of the object image, applied in conjunction with the illumination descriptor, have less computational complexity than the ASIFT method, but they are not completely resistant to affine transformations. Probabilistic methods must be used in cases where it is necessary to achieve stability according to any one criterion. You can apply several filters that are resistant to changes in different properties of the object, but then the complexity of the detection stage increases geometrically. Methods that are resistant to most of the considered

Table 1 - Comparison of methods and algorithms for searching for an object in a video stream (+ - the problem is solved completely, +/- - the problem is solved partially, - - the problem is not solved)

Search method / algorithm		Comparison criteria								
		Y	**Sc**	**Rot**	**Ovl**	**Ns**	**Fr m**	**G**	**Ol**	**Of**
Lucas–Kanade method (classical)		-	-	+/-	+/-	+/-	-	-	*0*	n
Shi -Tomasi –Kanade		-	+	+	+/-	+/-	-	-	*0*	n
Gin- Favaro – Soatto		+	-	+/-	+/-	+/-	-	+/-	*0*	n
Harris-Laplace method (classical)	Scaling Descriptor	-	+	-	-+/-	+/-	+/-	-	*0*	n^2
	Turn handle	-	-	+/-	+/-	+/-	+/-	-	*0*	n^2

	Illumination Descriptor	+	-	-	+/-	+/-	+/-	-	0	n^2
The Harris-Laplace method, taking into account the scaling of the object	Scaling Descriptor	-	+	-	+/-	+/-	+/-	-	0	n^2
	Turn handle	-	+	+/-	+/-	+/-	+/-	-	0	n^2
	Illumination Descriptor	+	+	-	+/-	+/-	+/-	-	0	n^2

Continuation of table 2

Search method / algorithm		Comparison criteria								
		Y	**Sc**	**Rot**	**Ovl**	**Ns**	**Frm**	**G**	**Ol**	**Of**
SIFT		+/-	+	+/-	+/-	+/-	+/-	-	0	$(sw^2 + x^2)n$
SURF		+/-	+	+/-	+/-	+/-	+/-	-	0	sn
ASIFT		+/-	+	+	+/-	+/-	+/-	-	0	$k(sw^2 + x^2)n$
Kalman filter	Accounting for changes in brightness	+	-	-	-+/-	+/-	-	-	0	n^2
	Accounting for color changes	-	-	-	+/-	+/-	-	+	0	n^2
	scaling-aware	-	+	-	+/-	+/-	+/-	-	0	n^2
	Taking into account the rotations of the object	-	-	+/-	+/-	+/-	+/-	-	0	n^2
Particle filter	Accounting for changes in brightness	+	-	-	+/-	+/-	-	-	0	n^2
	Accounting for color changes	-	-	-	+/-	+/-	-	+	0	n^2
	scaling-aware	-	+	-	+/-	+/-	+/-	-	0	n^2
	Taking into account the rotations of the object	-	-	+/-	+/-	+/-	+/-	-	0	n^2

Continuation of table 2

Search method / algorithm	Comparison criteria							
	Y	**Sc**	**Rot**	**Ovl**	**Ns**	**Frm**	**G**	**Ol**	**Of**
Methods based on classical neural networks	+/-	+/-	+/-	+/-	+/-	-	+/-	$n^3 \div n^5$	n^2
Methods Based on Sparse Neural Networks	+/-	+/-	+/-	+/-	+/-	-	+/-	$n^3 \div n^5$	$n \log n$
Viola-Jones Method	+/-	+	+/-	+/-	+/-	+/-	+	$n^5 \div n^7$	n
TLD	+/-	+	+/-	+/-	+/-	+/-	+/-	0	n^2

Criteria are neural network and combined methods, but methods based on classical and sparse neural networks and the Viola-Jones method have a long learning process, much more difficult than the detection stage [1].

Based on the analytical review, the following conclusions can be drawn:

1. At present, noise-resistant algorithms (and methods) for searching for an object in a video stream, suitable for practical use, have not been implemented.

2. Methods based on the search for the key points of the object, most of all satisfy the requirements of practice. Algorithms based on these methods are invariant to projective transformations, resistant to noise, brightness change, and are characterized by lower computational costs compared to alternative ones.

3. An analysis of the conditions for using object search methods shows that these methods must meet the following requirements:

–invariance to projective transformations of the object image;

–the computational complexity should be as low as possible to apply real-time problem solving.

REFERENCES

1. Anstedt, T. Video analytics: Myths and reality [Text] / T. Anstedt, I. Keller, H. Lutz. – M.: Sequrity Focus, 2012 – 176 p. – 1500 copies – ISBN 978-5- 9901176-5-5.
2. Alpatov, B. A. Methods of automatic detection and tracking of objects. Image processing and control [Text] / B. A. Alpatov, P. V. Babayan, O. E. Balashov, A. I. Stepashkin, – M.: Radio Engineering, 2008, - 176 p. – ISBN 978-5-88070-201-5.
3. Tracking (computer graphics) [Electronic resource]: Material from Wikipedia – free encyclopedia / Wikipedia authors // Wikipedia, free encyclopedia,. – San Francisco: Wikimedia Foundation, 2014. – Access mode: http://ru.wikipedia.org /?oldid=67077116.