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DYNAMIC OBSTACLE AVOIDANCE FOR MOBILE ROBOTS

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The article analyzes an algorithm for detecting dynamic obstacles, which is based on a histogram of oriented gradients and a support vector machine. The algorithm can be applied in various autonomous mobile robots.

Keywords: autonomous mobile robots, obstacle avoidance, histogram of oriented gradients, support vector machine.

Currently, robotic systems are rightly considered as the base for automation of industry, medicine, military industry, space exploration and other spheres of human activity. Their joint work allows achieving various goals and solving a wide range of technological problems.

A mobile robot is a type of robotic system based on an autonomous control system, which is provided by various sensors and computer algorithms.

For successful navigation, the robot must have a map; determine the route; control the parameters of the movement to change its position; track its location; receive information about the environment and process it [1].

The environment can include static and dynamic obstacles. Obstacle detection of the second type is more difficult and was chosen for this research. Robots function in the same environment as humans. Therefore, algorithms have been developed for detecting dynamic obstacles, which are people.

Technical vision is a technology for using images of the real world, processing them and using data to solve applied problems without human intervention.

The implementation of vision systems depends on their field of application, hardware platform and performance requirements. Typical functions can be distinguished as follows:

1. Acquisition of images. Digital images can be obtained from sensors: cameras, distance sensors, radars, ultrasonic cameras, etc.
2. Preliminary processing. Examples of such processing are scaling, increasing contrast, noise removal, etc.
3. Detection / segmentation. Determination of the most important points and fragments of the image for further processing.
4. High-level processing. This stage allows you to determine that a given image meets certain conditions, to assess the characteristic parameters and to classify the object in the image.

The main task that arises in the process of object detection is the comparison of the image received from the camera with the reference sample stored in the database. Its main solution is to establish a correspondence

between the interest points of the images. Descriptors are responsible for the process of describing interest points [2].

The histogram of oriented gradients (HOG) is a feature descriptor. The process of implementing the method includes four stages: gradient computation, orientation binning, generating descriptor blocks and block normalization, and classification of descriptors (object recognition) [3].

Support vector machine (SVM) can be used to classify descriptors. It is a set of algorithms for solving classification problems that are based on supervised learning. Its main meaning is that some function $f(X)$ is formed, which allows you to transform a set of examples X into a set of solutions Y [4].

On the basis of the described HOG and SVM algorithms, a subsystem for detecting people in digital images in the MatLAB software environment has been created (Figure 1).

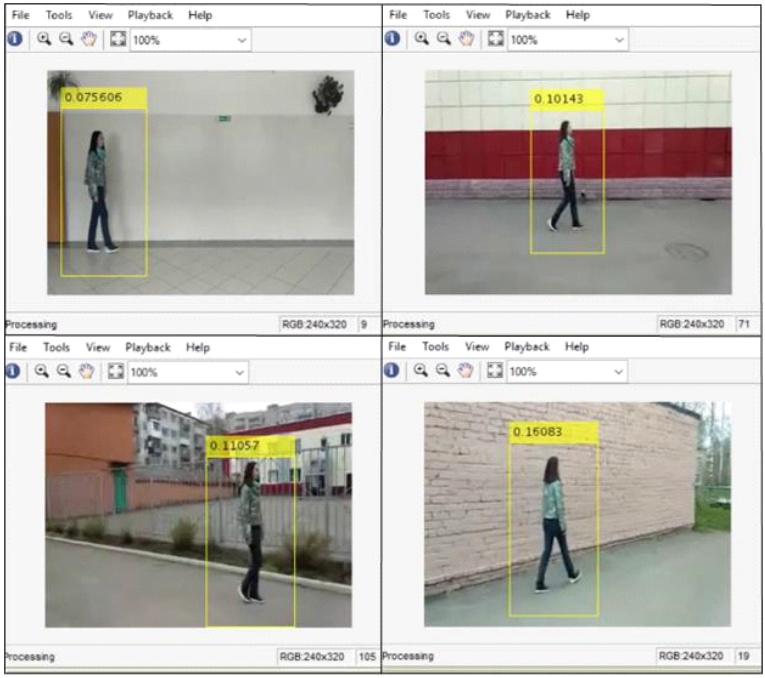

Fig. 1. Human detection in MatLAB

In the modern world, robots exist with humans in the same environment. Human is the main dynamic obstacle that must be identified to avoid colli-

sions and solve a number of other problems. The algorithm is invariant to the background and the speed of human movement.

This algorithm, which includes a set of HOG descriptors and the support vector method, allows not only recognizing objects on a static image but also extracting them from the video data stream. The algorithm is optimal for recognizing people by means of an autonomous mobile object; it can also be used for recognizing other moving and static objects.

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