Conclusion. The use of network virtual simulators in the educational process during training will increase its effectiveness not only by ensuring the possibility of practicing practical issues by all students without using real samples of radio equipment, but also by bringing them as close as possible to the conditions of real organization and provision of radio communications [3].

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ALGORITHM FOR DETECTING AND MEASURING THE COORDINATES OF A GROUND OBJECT IN DIFFICULT PHONO TARGET CONDITIONS

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Keywords: algorithm, TV, temporal and spatial filtering, phonotarget condition.

The article proposes an algorithm based on temporal and spatial filtering for detecting ground objects in complex phonotarget conditions.

Currently, the use of video surveillance systems is used all the more widely, covering many about the nature of human activity. The most significant and relevant application of video surveillance systems are security systems. The disadvantage of using such systems is that the burden of processing information falls entirely on the operator and if the operator does not cope with the video data stream, the concept of working in real time ceases to operate, and we can only talk about analyzing the situation with a certain delay, which is unacceptable for security systems.

Material and methods. In [1], an algorithm for detecting an object was proposed, while the task of detection was set as the task of testing a hypothesis about whether the object is present in the image or not.

$$\max_{\alpha,\beta} F(\alpha,\beta) > \sqrt{\frac{2N_xN_y}{S_gS_h}\ln C\sigma_\xi}. \quad (1)$$

And the algorithm of detecting an object and measuring its coordinates consists in maximizing the criterion function and comparing the maximum value with the threshold.$F(\alpha,\beta)$

However, this algorithm is derived under the assumption of the constancy of the background component. In case that the background component is a changing process, this algorithm requires modification in which it can work effectively.

Therefore, it is proposed at the initial stage to filter the observed image in time according to the formula:

$$\hat{l}(i,j,n) = \gamma\hat{l}(i,j,n-1) + (1-\gamma)l(i,j,n), i = \overline{0, N_x - 1}, j = \overline{0, N_y - 1} \quad (2)$$

where is $\hat{l}(i,j,n), \hat{l}(i,j,n-1)$ – image anti-aliased in time to $n -$ му and $n-1$ frame, respectively;

γ – smoothing coefficient (in [3] recommendations for the choice of this coefficient are proposed).

Mathematically, the expression (2) is a formal description of an exponential filter. after the filtering procedure, it is suggested the difference $d_{\text{вр}}(i,j,n)$ between the observed image and the score $\hat{l}(i,j,n-1)$ be found:

$$d_{\text{вр}}(i,j,n) = l(i,j,n) - k_{st}\hat{l}(i,j,n-1) \quad (3)$$

where is k_{st} – some coefficient that takes values of 0 or 1. At $k_{st} = 0$ difference $d_{\text{вр}}(i,j,n) = l(i,j,n)$.

Application of formulas (2) and (3) in $k_{st} = 1$ allows you to increase the contrast of the changing areas of the observed image. Such changes are most often due to the movement of the object. However, the situation is complicated by the dynamically changing background component. Therefore, the use of mules (3) at a unit coefficient $k_{st} = 1$ can lead to a deterioration in the characteristics of the selection of objects (i.e. an increase in the likelihood of false positives). To provide a compromise between the advantages and disadvantages of time processing using formulas (2) and (3), the value of the coefficient is selected to be less than one. To estimate the residual background and suppress noise k_{st}after temporal filtering, the difference $d_{\text{вр}}(i,j,n)$ it is proposed to process with a linear filter having a mask w_1 dimension $q_{11} \times q_{12}$. In parallel with this, $d_{\text{вр}}(i,j,n)$ smoothed by a filter with a mask w_2 with dimension $q_{21} \times q_{22}$, and $q_{21} > q_{11}$, $q_{22} > q_{12}$:

$$\begin{gathered} f_1(i,j) = \sum_{m_x=-\frac{q_{11}-1}{2}}^{\frac{q_{11}-1}{2}} \sum_{m_y=-\frac{q_{12}-1}{2}}^{\frac{q_{12}-1}{2}} w_1(m_x,m_y) l(i-m_x, j-m_y), \\ f_2(i,j) = \sum_{m_x=-\frac{q_{21}-1}{2}}^{\frac{q_{21}-1}{2}} \sum_{m_y=-\frac{q_{22}-1}{2}}^{\frac{q_{22}-1}{2}} w_2(m_x,m_y) l(i-m_x, j-m_y) \\ i = \overline{0, N_x - 1}, j = \overline{0, N_y - 1} \end{gathered} \quad (4)$$

where is $f_1(i,j)$ и $f_2(i,j)$ – images obtained after filtering with masks w_1 and w_2 respectively. filter masks resemble the following.

Filter result $f_2(i,j)$ is an assessment of the background component of the observed image. subtracting filtered images results in a difference $d_{\text{пр}}(i,j) = f_1(i,j) - f_2(i,j)$.

$$w_1(m_x,m_y) = \frac{1}{q_{11}q_{12}}, \quad \begin{matrix} m_x = \overline{-\frac{q_{11}-1}{2}, \frac{q_{11}-1}{2}}, \\ m_y = \overline{-\frac{q_{12}-1}{2}, \frac{q_{12}-1}{2}}; \end{matrix}$$

$$w_2(m_x,m_y) = \begin{cases} 0, & \begin{matrix} m_x = \overline{-\frac{q_{11}-1}{2}, \frac{q_{11}-1}{2}}, \\ m_y = \overline{-\frac{q_{12}-1}{2}, \frac{q_{12}-1}{2}}, \end{matrix} \\ \frac{1}{q_{21}q_{22}-q_{11}q_{12}}, & other. \end{cases} \quad (5)$$

The decisive rule is:

$$\hat{r}(i,j) = \begin{cases} 1, \left|d_{\text{пр}}(i,j)\right| > k\sigma, \\ 0, other, \end{cases} \quad (6)$$

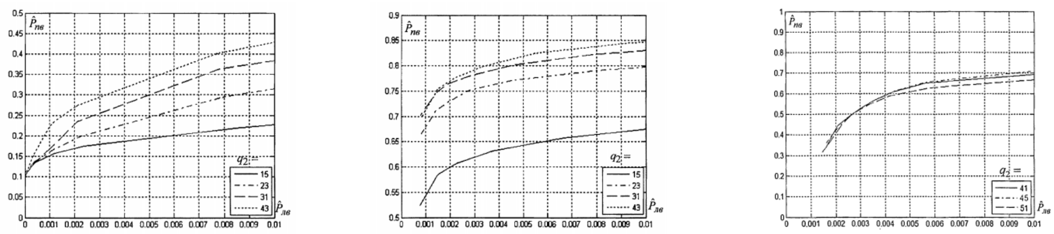
where is k – threshold coefficient; σ – SKO final noise.

Findings and their discussion. To conduct research, a number of videos were created in the TV range and containing images of a person (intruder), observed both on a homogeneous background and a contrasting background with sharp changes in brightness.

When studying the quality of the algorithm for detecting and isolating a ground object in complex phono-target conditions, the dependence of the frequency of correct isolation of the object on the frequency of false selection of the object was built, the analytical dependence of which can be determined by the formulas:

Figure 1 shows the dependency graphs $\hat{P}_{\text{пв}}$ от $\hat{P}_{\text{лв}}$, obtained for one of the plots at different given sizes of masks. The filter masks were considered square, i.e. $q_{11} = q_{12} = q_1$ and $q_{21} = q_{22} = q_2$, at odd s$k_{st} = 0$. At the same time, by coefficient q_2 a restriction was imposed $q_2 > 2q_1$.

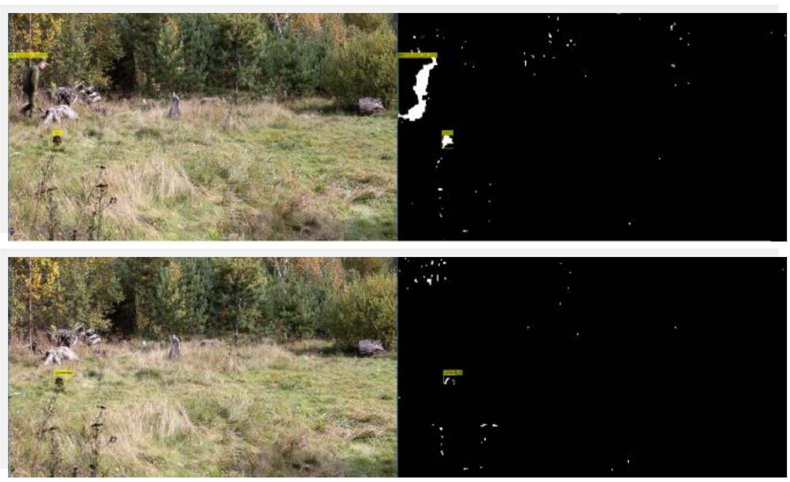
According to the results of the research, it can be concluded that the maximum value of the frequencies of the correct allocation of the ground object was obtained at the dimensions of the filters. $q_1 = 7$, $q_2 = 43$, which was0,70-0,82 at a false alarm frequency of 0.005 for the size of objects lying in the range from 10x10 to 50x50 resolution elements.



$q_1 = 1$ $q_1 = 7$ $q_1 = 23$

Figure 1 – Dependencies $\hat{P}_{\text{пв}}$ *to* $\hat{P}_{\text{лв}}$ at different set sizes of masks q_1 *and* q_2

Figure 2 shows a visual assessment of the operation of the detection and allocation algorithm tothe terrestrial object.



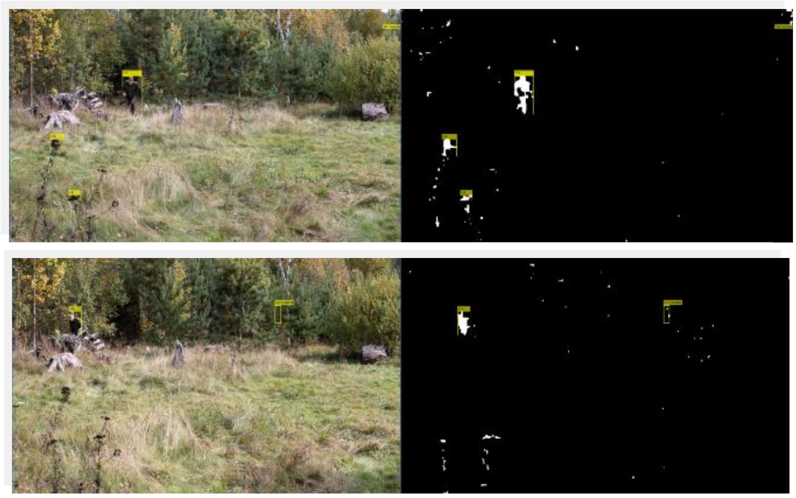


Figure 2 – Visual evaluation of the work of the developed algorithm

Conclusion. Thus, the proposed algorithm for detecting and measuring the coordinates of a ground object allows you to detect and highlight the object of observation in difficult phono-target conditions, but it is worth noting the presence of false positives caused by the flickering of the background. The elimination of false positives can be achieved in the future by subsequent recognition of the selected fragments.

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ON THE CHARACTERIZATION OF HALL-CLOSED FITTING CLASSES

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Keywords: Fitting class, Hall subgroups, Π-soluble groups, Π-closed class.

The paper considers only finite groups. In terminology and notation, we follow [1].

An actual problem in studing the structure of classes of groups is the characterisation of Fitting classes that are closed under taking Hall subgroups [2].

The purpose of the paper is the study of Hall-closed Fitting classes.

Material and methods. Methods of the study of the finite group theory are used as well as methods of the Fitting class finite group theory.

Findings and their discussion. A class of groups is a set of groups that along with each group contains an isomorphic group. The class of group $\mathfrak{F}$ is called a *Fitting class* if $\mathfrak{F}$ closed under taking normal subgroups and products of normal $\mathfrak{F}$-subgroups. A class