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REGIONS APPLICATIONS SYSTEMS RECOGNITION

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Abstract. Robots' sense of touch . Many robotics tasks, in particular automatic assembly of products, require direct physical contact between the object and the robot's gripping unit. Since the presence of such contact is a necessary condition for the successful solution of the problem, the problem arises the desire to use it simultaneously for recognizing the object with which the robot interacts, to evaluate its parameters: geometric dimensions, orientation in space, degree of surface roughness .

Key words: Robots', General, Remote sensing in geophysics, Seismology, Electrocardiography

Introduction. To date, significantly fewer devices and methods have been developed for artificial touch than for artificial vision. However, the speed of information processing in tactile sensors can be even higher than in optical ones. This is due to the fact that in the first case, a significantly smaller number of signal samples are processed than when processing video signals. Tactile sensors can solve various problems: determining the state of a surface, recognizing the shape of contours and studying other characteristics of an object by "feeling" it with a sensitive element. The advantages of tactile sensors are their mechanical flexibility, low cost, ease of use, as well as the linear dependence of electrical resistance from deformation, and therefore, from local load. Areas of application of tactile sensors include industrial robotics, remote control, including on devices designed to operate in adverse environments.

Research methods. *Remote sensing in geophysics.* This refers to observations of the Earth's surface and other planets - these are various satellites, reusable ships, orbital stations and and much more. Each of these systems produces huge flows of information. Since the number of consumers of this information is rapidly increasing, it seems necessary to perform automatic classification of observations in a

minimum time consistent with the urgency of the requests. The ideal solution is considered to be real-time image processing and delivery of results to users.

Seismology. Seismic waves can be observed and recorded at any point on the earth's surface. Seismographs are used for this purpose - devices that have an extremely high sensitivity to mechanical vibrations of the earth. Automatic decoding of these records is of great interest for understanding the phenomena occurring in the thickness of the earth's crust. To describe seismic waves, a grammar was developed, implemented on a deterministic finite automaton. Given that the signal segments have the same duration, among the possible interferences, one should take into account only mistakes substitutions. Each of these additional rules can be taken with a certain weight, depending on the error.

The solution is to weight permutations between two words according to the distance separating these classes in the chosen feature space. In this case, the recognition operation turns out to be identical to the operation of finding an optimal path in a tree graph, since such a representation can be associated with any finite-state grammar. states. The experiments were carried out on an array that included 321 implementation. From them 50 were used V quality



educational samples And as a basis for developing the grammar. Depending on the number of classes, the overall results showed two values: the percentage of correct recognition and the time it takes to complete it. With the number of classes around 10 the execution time increases sharply. If we take into account the resulting at the same time, the percentage of correct recognition is quite high, then it turns out that the intuitive choice of precisely this number of classes is quite justified. The results can be improved somewhat by using the length of the segment as an additional feature. In addition, it is of interest to consider the combination of this procedure with a system of expert assessments.

Electrocardiography is one of the methods for studying the work of the heart, based on recording the difference in electrical potentials that arise during cardiac activity. Schematically, the heart can be represented as an electrical dipole of variable length, depending on the heart rhythm. The shape of the electrical signal, changing over time, and its amplitude depend on the point of removal. A typical oscillogram of an ECG signal is shown in Fig. 1.1.

The letters PQRST, proposed by V. Einthoven, allow for a convenient description of individual features of this continuous curve. The periodic ECG signal has a relatively simple structure, so a procedure based on a grammatical description was proposed for its automatic recognition.

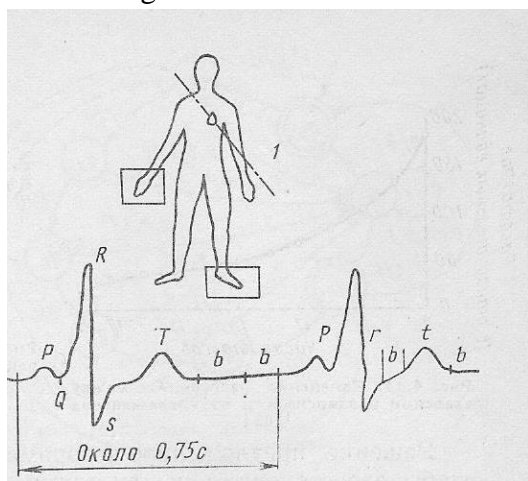


Fig. 1.1. Typical electrocardiogram, where 1 is the electrical axis of the heart.

This description ECG is being compiled from four symbols - p, r, b, t ,

each of which corresponds to a specific section of the curve in Fig. 1.6. Symbol p corresponds to the P wave ; r – RS transition; b – relative to the flat part separating the extremes of S and T (about 0.1 s); t – wave T . If we take the wave P as the starting point , then in such notations a normal ECG can be described by sequences of symbols: $prbtb, prbtbb, prbtbbb$, etc.

Syntactic descriptions of this kind can be obtained using the grammar G :

$$G = \{ V_t, V_n, P, S \}, V_t = \{ p, r, t, b \}, V_n = \{ S, A, B, C, D, E, H \},$$

$$P = \{ S \rightarrow pA, A \rightarrow rB, B \rightarrow bc, C \rightarrow tD, D \rightarrow b, D \rightarrow bE, E \rightarrow b, E \rightarrow bH, E \rightarrow pA, H \rightarrow b, H \rightarrow bS, H \rightarrow pA \}.$$

Results.The language generated by this grammar can be mapped to a finite state machine, the diagram of which is shown in Fig. 1.7. In order to detect an abnormal ECG and distinguish it from a normal one, the output “0” is used if the ECG under study corresponds to the “normal” standard, and the output “1” is used if the ECG under study corresponds to the “normal” standard. otherwise. This output in Fig. 1.2 is connected to the transition lines. This type of recognition machine is very primitive: it is capable of detecting only gross deviations from the norm. In reality, the analysis of an abnormal ECG is a serious task that is performed by qualified specialists.

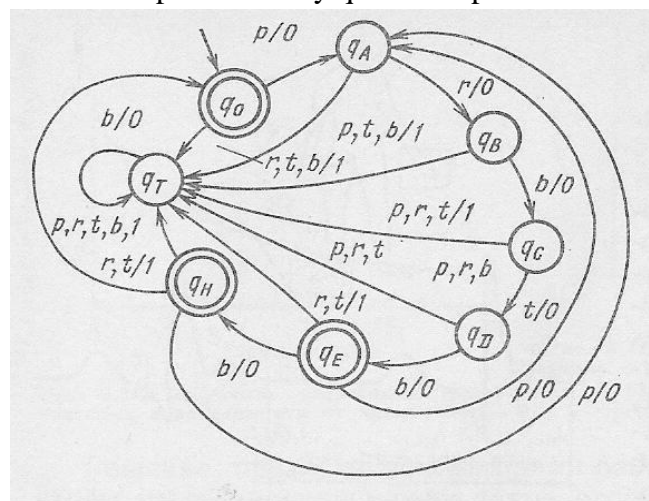


Fig. 1.2. Scheme machine gun For recognition electrocardiograms



Industrial application. Automatic control of parts during their manufacturing process is a task for which various information processing tools are used and developed. However, the introduction of devices that automatically measure the dimensions, surface condition, and other characteristics of objects during the manufacturing process is often associated with considerable difficulties. One of the main tasks that arise during automatic control is the task of training the recognition device.

Conclusion. In the process of manufacturing parts or units, the variety of possible defects can be so great that compiling a training set for the machine that includes all variants of situations subject to control is often an impossible task. Therefore, it is necessary either to create a training set based on a limited set of typical defects that require identification, or to introduce an automatic learning procedure, which seems a priori incompatible with many industrial applications. However, the need for such systems is becoming increasingly more acute in those areas where one has to deal with repeatedly repeated operations or where high speed of execution is required.

The tasks of assembling units and mechanisms are also gradually being transferred to robots. In most cases, the elements to be assembled must be fed and oriented in a strictly defined manner. The correctness of this is checked automatically using various sensors, most often optical ones.

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