

THEORETICAL BASIS OF THE AUTOMATED SPEAKER RECOGNITION SYSTEM OF CRITICAL USE IDENTIFICATION

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Abstract. *Class of automated speaker recognition systems of critical use with determination of limitation is identified in thesis. Neural generalized criterion of quality evaluation of such systems taking into account the certainty of speaker recognition is formulated.*

Keywords. Automated speakers recognition systems of critical use, reliability, authenticity, neural classifier, criterion of recognition systems evaluation

Introduction

Actual classification of critical systems divides them by the reaction to the occurrence of extraordinary situations and by the branch of operating. By the reaction to the appearance of extraordinary situations critical systems are divided into critical systems, which have to continue performing of functional operations in the event of failures or impact of unexpected factors, for example a plane has to continue flying in any case, and critical systems, which necessarily have to finish functioning safely regardless of the actions of surrounding factors, for example it is necessary to slow the train to transfer it in the “safe” state.

By the branch of exploitation critical systems are divided into:

- Safety critical - automated systems failures in functioning of which can lead to death of people, essential damages of environment, for example automated control systems of chemical industry, planes, metro, atomic power station
- Mission critical - automated systems which are being created with prediction of guaranteed ending of performing operations, for example navigation systems, luggage management in airports
- Business critical – these automated systems are created to avoid significant material or reputational costs, it is usually provided by timely termination of implementation of certain operations by integrated critical system for example in systems of work with clients in banks, Internet searching systems, ERP systems, systems of work with stock transactions etc.
- Security critical – these automated systems make a loss of conference information impossible in any conditions.

Research results

There is no class of the system of critical application among the existing automated speakers recognition systems, so current problem is identification of automated speaker recognition system of critical application within a set of classes of the automated speaker recognition systems with allocation of clear limits and indicators of evaluation quality of such systems.

Methods of authenticity evaluation of recognition systems have a number of disadvantages namely stochastic authenticity evaluation making it difficult to use these methods for analysis of recognition system quality, which represent the resultant evaluation of recognition in a non-probabilistic form, quality of authenticity evaluation depends on scope and content of training base on the materials of which classifier of recognition system studied and parameters of the external environment where the system will function are not taken into account at forming conclusion concerning system authenticity.

Since it is necessary to formulate universal criteria of authenticity evaluation of automated speakers recognition systems of critical use then it is necessary to apply system approach to the process of formulating rules for determining authenticity.

To synthesize them, divide the factor space with which the system will operate into three groups:

- priority factors – sustainable over time factors that describe recognition system and characteristics of speech signals with which the system will operate,

- factors of alternatives – factors that characterize vector of alternatives analyzing it recognition system generates solutions,
- factors of use – factors values and quantity of which depend on specific conditions of recognition system use.

If the artificial neural network $f_r^{NET}(\vec{a}, \theta)$, which authors have offered to use for authenticity evaluation of the recognition system of critical use, issues on the output the value P_g - estimate of probability $P(C_1 | x)$, having set the threshold value T all recognition results with the value $P_g \geq T$ are considered to be authentic and the rest – inauthentic. Quantity of errors of the first and second kind we will determine from the ratio:

$$N_{rc}(\theta) = \sum_{i=1}^M \sum_X l((g_i = \max_k g_k) \wedge (x \in C_i) \wedge (f_r^{NET}(\vec{a}, \theta) < T)),$$

$$N_{ae}(\theta) = \sum_{i=1}^M \sum_X l((g_i \neq \max_k g_k) \wedge (g_j = \max_k g_k) \wedge (x \in C_i) \wedge (f_r^{NET}(\vec{a}, \theta) \geq T)).$$

Conclusions

So, concept of automated speakers recognition system of critical use was identified by authors, which unlike existing speakers recognition systems, allows predict the authenticity of the recognition results due to recognition of matrices with values estimates of interclass relations and interclass distances in the space of classes of speakers.

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