Impact Factor:					
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	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 0.126	PIF (India) = 1.940
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	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2021 **Issue:** 04 **Volume:** 96

Published: 18.04.2021 **http://T-Science.org**

QR – Issue QR – Article

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OPTIMIZATION OF THE CREDIBILITY OF INFORMATION PROCESSING BASED ON HYPER SEMANTIC DOCUMENT SEARCH

Abstract: *The problem of increasing the reliability of the information in electronic document management systems based on the search, recognition, and classification of requisites, attributes, electronic document (ED) formats, as well as mechanisms for detecting and correcting distortions is formulated. Principles and methods of reference validation credibility based on fractal processing of image characteristics and lexicological synthesis of the ED structure are proposed. Methods have been developed to optimize the training of a semantic hypernet based on the formation of rational training sets and the reduction of redundant connections between the constituent components of the ED.*

Key words: *electronic document, credibility, reference check, fractal processing, lexicological synthesis, document structure.*

Language: *English*

Citation: Djumanov, O. I., Kholmonov, S. M., & Shukurov, L. E. (2021). Optimization of the credibility of information processing based on hyper semantic document search. *ISJ Theoretical & Applied Science, 04 (96),* 161-164.

Soi: http://s-o-i.org/1.1/TAS-04-96-34 ***Doi***: crossref https://dx.doi.org/10.15863/TAS

Scopus ASCC: *1700.*

Introduction

Relevance of the topic. At present, technologies for software services for various purposes are being intensively developed to optimize the functioning of electronic document management systems (EDMS), information resource networks (IRS), monitoring systems for production and technological indicators, etc. [1].

EDMS technologies in a wide class of methods, software, and hardware are used when reading e-mail, databases, in natural language spelling control editors, machine translation, systems for synthesis, analysis, generation and translation of texts, execution of organizational and administrative documents [2-5].

Decrease in the reliability of the information in ED is conditioned to the probability of operator errors made when entering information, distortions due to errors in scanning and recognition devices, the impact of interference in communication channels, failures, and failures of electronic devices, as well as spelling errors of users.

II.Literature review

This work is devoted to the analysis of well-known works, software technologies and products, the

development of scientific and methodological foundations of the problem of increasing the reliability of ED information based on the mechanisms of using the structural and technological redundancy of data [6].

Is proposed an approach aimed at designing a four-level semantic hyper network of the EDMS, which performs functions in the following blocks [7]: the first is aimed at the performance of the functional of semantic analysis, both incoming and stored in a database (DB); the second is aimed at the formation of basic vocabulary libraries, key words of tasks, messages, comments, recommendations; third, it requires the formation of offshoots of a given thematic directions of the EDMS, saving the ED at the time of processing, the formation of thematic headings and their composition; fourth, aimed at synthesis, analysis, generation, translation of texts.

III.Analysis

The semantic hypernet performs the functions of searching for the necessary ED element, analyzing the connections between them, which is built on the basis of the synthesis of stochastic search models, as well as reflecting the functional connections of variable inputs and outputs [8].

Let s_p be the probability distribution on the set of parameter values $S = \{s_p, p \in P\}$. The choice of the p parameter is carried out in the form of a realization of a random variable with the s_p distribution. And the S strategy is represented as a vector in a finite-dimensional space [9].

In no small cases of practice, for minimizing the $\omega(S)$ function on the S set, is applied the gradient method search optimization. However, the implementation of such a method is associated with great computational character difficulties and the impossibility of obtaining an explicit analytical representation of the ω function and its derivatives [10].

To substantiate the effectiveness of the approach to optimizing the reliability of ED processing, an experimental study was carried out, and the following [11]: the adaptive optimization algorithm allows you to obtain a stable value of the strategy (point) from the set S up to the third decimal place; the probability of choosing the values of the S_{adap} parameters is estimated according to the best and worst strategy $S_{\max}$ and $S_{\min}$; the spread between the best and worst strategies, obtained by random search, turned out to be quite big enough; the target function and other indicators of the complex turned out to be sensitive to the setting of any of the selected six parameters of the models for describing transient processes with fixed values of the rest; the implementation of the random enumeration method when optimizing the functional takes an order of magnitude longer and gives worse results than the adaptive strategy based on stochastic models with partial Markov chain; the S_{adap} strategy obtained as a result of the adaptive algorithm execution turned out to be an interior point in the S set; the proposed approach to solving the optimization problem is justified, since the imitation of transient processes of the signal characteristics of the transmitted ED frames based on the Markov stochastic model becomes significantly controllable using the selected tuning parameters.

IV.Discussion

The implemented complex for increasing the reliability of ED information is performed by launching 10 software modules c_i, $i = 1,...,10$. To test them, 2 conditional f_1 and f_2 task packages were formed.

Evaluations of the complex efficiency are determined by the values of the following indicators in the EDMS [12]:

capacity: $c_1.v = 100$, $c_2.v = ... = c_5.v = 50$, $c_6.v = ... = c_{10}.v = 10$;

performance: $c_1 = 10$, $c_2 = c_3 = 5$, $c_4 = c_5 = 2$, $c_6 = ... = c_{10} = 1$;

$c_i.H_0$ - distribution of ED processing time without errors exponential with a parameter of 0.01;

$c_1.H_1$ – distribution of ED transmission time with information distorted exponential with parameter 0.5;

$c_i.P_{01}$ – distribution of time for detecting and correcting distortions in information;

$f_1.D_{in}$ – the distribution of the time interval between DE, respectively, without information distortions is exponential with a parameter of 0.7, and $f_2.D_{in}$ and with errors in information is exponential with a parameter of 0.3;

$f_1.D_{1t}$ and $f_2.D_{1t}$ – the distribution of the execution time of the ED task package is uniform on the segment;

$f_1.D_{key}$ – distribution of time for tasks from the f_1 package with the task of checking the reliability of the ED, which is evenly distributed

$f_2.D_{key}$ – distribution of time for tasks from the f_2 package, which is unknown in advance and the task of information reliability control is absent;

$f_1.D_{len}$ and $f_2.D_{len}$ – the distribution of the length of the tasks execution is uniform on the segment $[10^4, 2\cdot10^4]$;

$f_1.D_{prep}$ and $f_2.D_{prep}$ – the distribution of time for preparing a task for launch has a fixed value of 0.01;

D_{send} – the distribution of the packet transmission time is uniform over the segment $[10^{-3}, 2\cdot10^{-3}]$.

As a result of experimental calculations, the optimal values of the parameters were obtained for setting the following parameters of the complex:

$g = (p.j).f$ on the basis of which a packet of length $p.l$ is formed;

$\tilde{z}$ - the sum of $p.l$ independent positive random terms with the mean $g \cdot \mu = 1{,}5 \cdot 10^{-3}$ and the variance $g.\sigma = 10^{-4}$.

z - random variable with normal distribution, approximating the distribution of $\tilde{z}$;

$p.t_{exec} = \max(0, z)$;

t_ε - constant and equal to 10^{-7};

$C_1 = 20$, $C_2 = 2$, $C_3 = 10^{-3}$, $C_4 = 10$ – coefficients of the objective function;

$p_{break} \in \{0{,}5;0{,}6;0{,}7;0.8;0{,}9;1\}$ – start interruption threshold;

$r_{run} \in R_{\max rs}, R_{\min rs}, R_{\max crs}, R_{\min csr}$ – preference rating for setting the parameters of the complex;

$R_{\max rs}$ $(R_{\min rs})$ - the greatest (least) rating;

$n_{run} \in \{0,....4\}$ – the number of simultaneously launched modules;

$k^1_{check} \in \{0,...,4\}$ – control time for checking the results of the complex execution;

$\Delta t_{dec} \in \{0{,}1;0{,}2;...;1\}$ – the interval between successive decisions adoptions on the reliability of ED information.

V.Conclusion

Thus, the methodological foundations of the implementation of the software-algorithmic complex for ensuring the integrity, safekeeping and increasing the credibility of the transmission and processing of ED information on the basis of the semantic hypernet have been developed.

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