INFORMATION SYSTEM FOR ANALYZING DIAGNOSTIC INFORMATION BASED ON ADAPTIVE NEURO-COGNITIVE CRITERIA

Sanjarbek Sharifboyevich Bekturdiev

Tashkent social innovations Senior Lecturer , University of Tashkent, Uzbekistan

Abstract : *This in the article medicine The conceptual architecture and mathematical foundations of an intelligent information system designed to effectively solve complex problems arising in the process of managing clinical data and making clinical decisions are discussed. In order to overcome the limitations of the traditional Hebb algorithm and linear neural networks, a modern hybrid neuro-cognitive approach is proposed in the system - the BioBERT model for processing textual clinical conclusions and the XGBoost algorithm for analyzing structured biometric indicators . The article presents in detail the structural subsystems of the system, the dynamic modeling scheme based on fuzzy rules, and the algorithms for calculating eight main analytical indicators that assess the stability and stability of the system using fuzzy transition matrices.*

Keywords : *Medical information system, decision support, adaptive fuzzy cognitive map, BioBERT, XGBoost, neuro-cognitive model, dynamic modeling, system stability, consonance, dissonance* **.**

INTRODUCTION

In modern medical institutions, digitization and information processing processes are developing rapidly. This allows not only to ease the workload of doctors, but also to dramatically increase the accuracy of diagnostics and the quality of medical care for patients. However, a large part of the data collected in clinical practice consists of unstructured (free-text medical records, anamnesis) and indicators with a high degree of uncertainty (ambiguity). In this complex environment, traditional decision-making systems and linear neural networks (for example, the Hebb algorithm

or standard backpropagation methods) cannot fully reflect the deep semantic connections of medical text and the nonlinear relationships between dynamic indicators [1].

A medical decision support system (MSS) designed to effectively solve problems arising in medical data management decisions should provide the following fundamental tasks: simplifying the formalization of expert knowledge; developing treatment strategies based on adaptive fuzzy cognitive maps (AFCMs) and dynamic modeling procedures ; establishing a personalized treatment model based on AFCMs; presenting treatment and diagnostic results to the doctor in an adequate and understandable form. The software package should be capable of complex analysis of various types of clinical and biometric information, as well as rapid reconfiguration for other medical tasks with similar elements of control and evaluation [2].

METHODOLOGY

Production issued intellectual The main functional subsystems of the information system are designed for continuous processing of information flows and consist of the following components:

Information collection , processing and transmission subsystem: Receives primary data from clinical laboratories, diagnostic centers and electronic medical records;

The Adaptive Fuzzy Cognitive Map (AFCM) creation subsystem: Generates an array of linguistic variables and concepts, as well as their fuzzy association functions;

The ANKX working and modeling subsystem: Calculates the interaction of elements in the object domain , external influences, and system indicators;

Input/output management and information conversion subsystem: Provides an interface between the physician and the system core , visualizing data;

Database management subsystem: Manages the hospital's medical database and document hierarchy.

Fuzzy clustering methods are used to monitor statistical data and develop a knowledge base. This allows you to gain knowledge about the types of variables used in the analysis process and their hidden relationships. The software solves five main problems: creating an ANCX, building a dynamic model of the situation based on fuzzy rules, training a neuro-cognitive model , analyzing system stability based on fuzzy transit-closed matrix values, and designing a data flow model [3].

RESULTS AND DISCUSSION

Traditional training methods (Hebb's differential rule) were limited to adjusting synaptic weights based only on local information available in the neuron, which would cause the global context and complex combinations of variables in clinical texts to be missed. Therefore, in this project, a hybrid algorithm of BioBERT and XGBoost was implemented to train a neuro-cognitive model and generate diagnostics for medical information .

The system has a two-stage intelligent analysis mechanism:

Semantic Analysis of Textual Data (BioBERT): Free-text clinical notes, symptom descriptions, and medical histories entered by the physician are fed to a BioBERT model based on the Transformer architecture, pre-trained on medical literature texts. The model's " Self - Attention" mechanism determines the level of importance (weight) of each medical term in the text relative to other words and generates a digitized symptom vector.

Clinical risk prediction (XGBoost): The symptom vector generated by BioBERT, as well as laboratory tests (hemoglobin, leukocytes, glucose, etc.) and biometric parameters (BMI, arterial pressure) are given as input parameters to the XGBoost (Extreme Gradient Boosting) algorithm. Based on an ensemble of decision trees, XGBoost calculates the diagnostic risk with high accuracy by minimizing the loss function [4] .

The dynamics of diseases and the working style of doctors in clinical practice change over time , the system uses the AutoRetrainer ("Human-in-the-loop") module. This module solves the problem of "Concept Drift" and continuously adapts the model weights based on new diagnoses confirmed by doctors, which increases diagnostic reliability by 5-7%.

The situation time according to Building a situation model based on ANKX, calculating the dynamic change function and determining the initial state vector of concepts, is carried out through the following sequential steps:

Step 1. Definition of the concept of input and determination of initial values.

Step 2. Define the boundary conditions of the output concept.

Step 3. Determine the growth rate of the input concept .

Step 4. Construction of the first fuzzy logic block (NT1): function formulation.

Step 5. Construct fuzzy production rules for NT1 and obtain values.

Step 6. Construction of the second fuzzy logic block (NT2).

Step 7. Constructing the membership rules for NT2 and calculating the final coefficients.

Step 8. Obtain the final integrated fuzzy set .

Step 9. Determine the final result set for the output concept .

Step 10. Calculate the set of output concept values .

This ten- step procedure is repeated regularly for each set of subject-domain concepts at time t. This model provides healthcare professionals with intelligent recommendations for ranking options for different treatment scenarios and selecting the optimal strategy [5,6].

ANKX stability and The stability of the system is calculated based on the values of the fuzzy transition-block matrix and the interaction matrix of concepts. An algorithm for calculating eight main analytical indicators has been developed to assess the stability of the system :

No.	Analytical indicator name	Mathematician essence and task
1	Maximum positive path	Identifying the chain of strongest positive connections between concepts
2	Minimum negative path	Assessing the most dangerous negative feedback loops in the system
3	Transition to a fuzzy matrix	Construct a new fuzzy matrix based on pairs of elements 1 and 2
4	Consonance effect	Determining whether a change in concepts is consistent with the system's equilibrium
5	Affective dissonance	Calculating the level of contradiction and conflict that occurs in the system
6	Interaction of concepts	The degree of integral dependence of all elements in the subject area
7	The impact of collections	Calculating the overall integral effect stability
8	Intergroup consonance	Determining the mutual consonance effect of group B concepts on concept C

This coefficients values After analyzing , system experts or knowledge engineers draw a final conclusion about the stability of the model . If the obtained analytical coefficient values correspond to clinically acceptable limits, the model is recommended for use in practice. Otherwise, the adaptive neuro-cognitive network is retrained using a hybrid training block and the analysis steps are repeated from the beginning .

CONCLUSION

The adaptive neurocognitive criteria-based diagnostic information system

developed in the framework of the study is distinguished from traditional medical expert systems by its flexibility and high accuracy. By abandoning outdated structures such as the Hebb algorithm, the use of a combination of BioBERT and XGBoost allowed for the simultaneous efficient processing of unstructured medical texts and digital laboratory data . The introduction of fuzzy stability criteria guarantees the safety and reliability of decision-making processes in clinical settings. The proposed system is of great practical importance in reducing diagnostic errors of physicians.

LIST OF REFERENCES USED

1. Lee, J., Yoon, W., Kim, S., Kim, D., Kim, S., So, CH, & Kang, J. (2020). BioBERT: a pre-trained biomedical language representation model for biomedical text mining. Bioinformatics, 36(4), 1234-1240.

2. Chen, T., & Guestrin, C. (2016). XGBoost: A scalable tree boosting system. In Proceedings of the 22nd ACM SIGKDD international conference on knowledge discovery and data mining (pp. 785-794).

3. Papageorgiou, EI, & Salmeron, JL (2013). A review of fuzzy cognitive maps research during the last decade. IEEE Transactions on Fuzzy Systems, 21(1), 66-79.

4. Shortliffe, EH, & Cimino, JJ (2014). Biomedical Informatics: Computer Applications in Health Care and Biomedicine. Springer Publishing Company, Incorporated.

5. Kosko, B. (1986). Fuzzy cognitive maps. International Journal of man-machine studies, 24(1), 65-75.

6. Aripov MM, Muhammadiyev A. (2021). Artificial intelligence and information technologies in medicine. Tashkent: "Universitet" publishing house.