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INTEGRATION OF EXPERT SYSTEMS AND MACHINE LEARNING ALGORITHMS IN THE CREATION OF A KNOWLEDGE BASE FOR DECISION-MAKING SYSTEMS IN PRIMARY CARE

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Annotation: This article discusses the mutual integration of expert systems and machine learning algorithms in the formation of a knowledge base in order to improve the effectiveness of clinical decision-making systems (CDSS) in primary care. While traditional expert systems in medical decision-making are useful in formalizing knowledge and making rule-based recommendations, the large-scale, complex, and dynamic information emerging in modern medical practice shows the limitations of this approach. For this reason, systems used in conjunction with machine learning algorithms significantly increase medical decision accuracy, flexibility, and real-time analysis capability. The article covers the structuring of the knowledge base, algorithmic analysis, experimental results based on real clinical cases, and the benefits of this approach on a scientific basis.

Keywords:primary care, clinical decision-making system, knowledge base, expert system, machine learning, artificial intelligence, Medical Informatics.

The effectiveness of the health system depends primarily on making quick, clear and scientifically based decisions in primary care. Complications in medicine, multifaceted expression of symptoms, correlations of diseases, the presence of patient information in different forms complicate clinical decision-making. Therefore, Clinical Decision Support Systems (CDSS) are increasingly prominent in modern medicine.

Expert systems have been used in the early stages to support multiple decisions in medicine, which primarily operate in the form of “if-then” rules based on knowledge gained from experts. However, these systems in many cases cannot respond to the complexity and variability of real clinical cases. For this reason, the integration of machine learning algorithms is becoming important in the way of improving the efficiency of modern CDSS.

This article reveals exactly the scientific and methodological foundations of this integration: how the knowledge base is formed, what is the role of machine learning models and what practical results their harmony leads to.

Style (Methodology). The study is carried out through the following stages:

1. Build a knowledge base.

- The knowledge gained from experts is analyzed and the rules of if-then are formed on the basis of symptom-disease dependence.
- The semantic relationship between medical concepts is modeled through an ontological approach.

2. Selection and training of ML algorithms. The following machine learning algorithms are used:

- Random Forest: creating a diagnostic forecast based on symptoms;
- Naive Bayes: decision making based on symptoms and probability;
- Support Vector Machine (SVM): clinical classification issues.

3. Architecture.

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- Expert system and ML models are integrated using the module developed on the basis of RESTful API.
- As a data warehouse, SQLite and NoSQL (MongoDB) solutions are compared.

4. Testing and analysis.

- A system is tested based on a simulated 500 patient profile and their symptoms.
- Accuracy, sensitivity (sensitivity), specificity (specificity) are evaluated.

As a result of experiments and tests, the following are determined:

• Integration of knowledge base and ML models shows 89% accuracy. This is a significant achievement compared to 72% accuracy only on the basis of the expert system.

• Random Forest model achieves correct diagnosis at 92% accuracy.

• SVM algorithm shows high sensitivity (87%) in diagnostic classification.

• The integrated system can provide clinical recommendation within 2-3 seconds for each patient in real-time working condition.

These results prove that the CDSS system can be an effective tool in health care.

As indicated in the article, only an expert approach is not enough for the effective functioning of the knowledge base in the field of medical informatics. The reasons for this are as follows:

• Expert systems are based solely on traditional knowledge;

• They do not have the ability to automatically study changing or new states.

ML algorithms, on the other hand, are convenient tools for drawing new conclusions through large amounts of medical data, detecting errors and finding trends that have not been seen before.

Expert systems provide structural accuracy, while ML provides flexibility and statistically based inference. Their integration, on the other hand, creates a strong decision-making system. In the future, these systems can be further developed through medical NLP, genomic data, federal machine learning.

In summary, the knowledge base in CDSS systems is an important component, and integration of expert systems and machine learning algorithms is necessary to improve its efficiency. This approach increases diagnostic accuracy in primary care, provides a quick recommendation, guarantees the quality of medical decisions. These systems are an important foundation in the digitization of health services and occupy a special place in the strategy of our republic's transition to digital medicine.

Literature used:

1. Shortliffe, E.H., & Cimino, J.J. (2014). Biomedical Informatics. Springer.
2. Sutton, R.T., et al. (2020). “An overview of clinical decision support systems: benefits, risks, and strategies for success”. NPJ Digital Medicine.
3. Kononenko, I. (2001). “Machine learning for medical diagnosis”. Artificial Intelligence in Medicine.
4. Patel, V.L., & Shortliffe, E.H. (2009). “Medical informatics and decision-support systems”. Yearbook of Medical Informatics.
5. Obermeyer, Z., & Emanuel, E.J. (2016). “Big data, machine learning, and clinical medicine”. NEJM.