APPLICATION OF ONTOLOGICAL ENGINEERING METHODS IN OPTIMIZATION OF COMPLEX ML MODELS AND AI APPLICATIONS

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In today's world, artificial intelligence (AI) and machine learning (ML) play a key role in many areas of human activity. However, the complexity and insufficient definition of the relevant models can create problems of their efficiency, interpretability and management when implementing technologies based on AI and ML. That is why it is important to use ontological engineering methods to improve these models. Ontological engineering is an approach that makes it possible to represent knowledge and dependencies between them in special information structures, so-called ontologies. Ontologies define concepts, relationships, and rules that describe a domain or problem area. At the same time, these information structures, in comparison with others, have extended functionality, which brings the manipulation of ontologies closer to the human thinking process.

One of the benefits of using ontology engineering is to improve the interpretability of ML models. By formalizing knowledge in an ontology, it is possible to obtain clearer and more comprehensible results. This helps experts and users understand the principles behind the model and trust its solutions. In addition, the application of ontological engineering allows to define and control model parameters [1]. By using ontologies, it is possible to define and configure model parameters, which facilitates the process of their adjustment to the specifics of a specific application task. This allows for a more flexible approach to working with ML models and faster achievement of the desired results.

Another important aspect is the automation of the learning process of models with the help of ontologies. The ontological approach allows you to automatically find and integrate a large amount of data that is necessary for training models. This
contributes to the improvement of the quality of learning and operation of models, and also reduces the time and effort required for data preparation and processing [2].

In the field of AI applications, the ontological approach plays an important role in the integration and exchange of knowledge between systems. With the help of ontologies, it is possible to standardize knowledge formats and ensure interaction between different artificial intelligence systems. This contributes to the exchange of information, the improvement of cooperation between specialists in the process and the construction of complex AI systems.

However, the use of ontological engineering methods in the construction and optimization of complex ML models and AI applications creates a number of applied problems. For example, the complexity of building and maintaining ontologies can be a challenge for researchers and practitioners [3]. Also, the need to host large volumes of data for the effective operation of ontological models can be a limitation in certain situations. In addition, integration with existing systems and infrastructure may require additional adaptation efforts.

The general prospects for the use of ontological engineering methods in the process of developing complex ML models and AI applications are:

1. Improving the efficiency and accuracy of ML models: the application of ontological engineering allows taking into account additional knowledge and relationships between data, which helps to improve the quality of results and reduce model errors.

2. Ensuring Interpretability and Trust: Using ontologies allows you to create understandable models with clear rules and explanations. This makes the results of ML models more interpretable and trustworthy for experts and users.

3. Flexibility and extensibility: With the help of an ontological approach, ML models can be easily extended and modified, adding new concepts and relations without the need to rebuild the entire model. This provides greater flexibility and adaptability of the system as a whole.

4. Automation and efficient management: the use of ontologies allows the automation of model training and optimization processes, which reduces the effort and time required to develop and implement complex ML systems.

5. Integration and collaboration: the ontological approach allows to standardize knowledge formats and ensure interaction between different artificial intelligence systems. This facilitates information sharing and collaboration between different researchers and development groups.

In conclusion, the application of ontology engineering methods in the optimization of complex ML models and AI applications has great potential for improving the efficiency, interpretability and control of such systems. The use of ontologies helps to understand and explain the working principles of models, improves the quality of results and provides flexibility in working with models. Automation of training and optimization processes, as well as integration with existing infrastructure, contribute to faster development and implementation of complex AI systems.

However, the use of ontological engineering methods also requires solving a number of science-intensive tasks and some challenges. The need to build and
maintain ontologies may require additional effort and expertise. Providing a sufficient amount of data for the effective operation of models is usually quite a difficult task in practice. Also, integration with existing systems and interaction with them may require additional research and development of methodological and software tools.

Based on the conducted research and analysis, it can be concluded that the application of ontological engineering methods in the optimization of complex ML models and AI applications is a relevant and promising field [4]. Further research and development of methodologies, tools and technologies in this area could lead to significant improvements in the application of artificial intelligence and machine learning to a wide range of practical tasks.

References: