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Integrated Decision Intelligence Approach to Catalyse the Valorisation of Knowledge Assets

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Abstract

IDI is a new direction aimed at improving decision-making efficiency by using advanced methods and technologies (including artificial intelligence, machine learning and data analysis). Developing digital support for IDI would bridge the gap between traditional methodologies based on knowledge, skills and expert experience, and the capabilities offered by data-driven analysis. In this paper, we present how the IDI approach can be used for previously created knowledge assets in the medical diagnostics domain to catalyse their valorisation as a source of reasoning.

Keywords: decision-making process, decision intelligence, knowledge-based decision, data-driven decision, integrated approach

1 Introduction

Integrated Decision Intelligence (IDI) is an approach to the decision-making process that leverages the collective power of human knowledge and empirical data to boost innovation, optimize processes, and navigate the complexity of a rapidly evolving landscape. The general scope of the proposed concept is the development of methods and algorithms for the acquisition, storage, pre-processing and inference of professional knowledge and data from various domains, as well as visualization and explanation of the generated conclusions. All these represent components of the knowledge engineering methodology aimed at decision support and adjusted to the new approach based on both professional knowledge and skills, as well as data/precedents, describing the perspectives of the problem domain.

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IDI methods allow identifying regularities, trends and interconnections in complex data sets that may not be evident through traditional analytical approaches. IDI facilitates the integration of expertise and data from different scientific disciplines. This interdisciplinary combination gives us the possibility to approach problems comprehensively, facilitating the emergence of new ideas and discoveries at the intersection of different domains.

Given the explosive growth of IDI technologies and the sheer volume of accumulated data, it is expected that the demand for IDI applications will grow rapidly.

IDI has significant commercial potential in a variety of fields, including public health, medical diagnostics, and treatment planning.

2 IDI Benefits and Risks

Integration of statistical methods, computational models, and knowledge specific to a concrete scientific domain improves the analysis of complex data, enabling more accurate predictions and correct conclusions. Continuous feedback loops in IDI systems assist researchers in learning from the results of decision-making, improving models and strategies. Also, IDI helps to optimize the allocation of resources by identifying areas that need more attention.

Medical diagnostics was selected as the primary area of development of the proposed approach.

Conducting a comprehensive review of the existing literature [1-3] showed that IDI offers many benefits, but there also exist risks associated with its implementation. Let us mention the most important of them and possible mitigation ways.

1) Inaccurate or unreliable data can lead to inaccurate results during the decision-making process. The solution here would be to establish standards for data management, authentication, data curation procedures and regular audits.

2) Lack of standardization of data formats and decision-making models may hinder their interoperability. To mitigate this risk, the data integration platforms should follow the recognized standards.

3) Unauthorized access or data leakage may compromise confidential information. Robust security protocols should be implemented, including encryption, access control, and regular security audits.

4) The excessive complexity of a system can lead to confusion (misunderstanding) or dependency on technologies without critical evaluation of them. The solution here would be a user-friendly interface and a clear presentation of the results.

3 Revision of knowledge assets based on IDI

As part of the re-inventory of professional knowledge resources, data sources, and available software relevant to the selected domain, a comprehensive revision of existing knowledge assets is carried out. There were analyzed expert knowledge bases (extensive ones) in the field of ultrasonographic diagnostics of the hepato-pancreato-biliary area [4] (129 nodes for liver, 149 – for pancreas, 115 – for kidney, 114 – for spleen); the core of knowledge bases restricted by some principles: limited by the examination time, examined area, purpose, and conditions of investigation, etc. (30 nodes for hemorrhagic shock, 63 – for EFAST); scoring systems developed for differentiated diagnosis of liver cirrhosis [5]; triage based on vital signs for patients in multiple casualty disasters [6] (7 vital signs as basic characteristics, 4 triage categories).

Subsequently, knowledge (facts and decision rules) were identified. They formed a set of knowledge gaps that can be addressed by analyzing by data collections, which are dependent on real-time changes (short or medium) and which would be good to manage both by classical expert knowledge engineering methods and by data-driven approaches (based on data analysis).

Working sessions with experts in the field of medical diagnostics were organized in order to evaluate the perspective of the IDI approach and the accessibility of data and knowledge sources, possible problems and risks were discussed.

As a result, several sub-domains with good potential for research and implementation of IDI solutions were determined. Subsequently, they were ordered by potential and possible risks (high potential and

minimal risk): 1) differentiated diagnosis of liver diseases; 2) scoring systems used under specific conditions (time constraints, incomplete data, limited technical connections, etc.); 3) new decentralized technologies aiming at attracting new independent sources of diagnostic data. For the first two, there were created curated data sets – ready for analysis. Later, validation sessions are planned to be organized.

4 Conclusion

After study of both the literature and the opinion of experts in the domain of medical diagnostics, a drastic decrease in the development of new scoring systems, as a tool for assessment and evaluation, was revealed. Even worse is that the use of old scores in practice has also decreased [7]. The main reason is that the new ones are based either on professional expert knowledge or data analysis, while the old ones are based on expert or theoretical knowledge and do not have continuous support in access to real up-to-date data. On the other hand, the detected problem from the above-formulated description is a good test for the IDI approach as a proposed solution.

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