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Towards Curated learning - Analyzing Casemix NordDRG system Expert System using Machine Learning tools

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Introduction

The Nordic Diagnosis Related Groups (NordDRG) system is a CaseMix system developed through Nordic expert collaboration over the past four decades. NordDRG plays a crucial role in Nordic healthcare classification and reimbursement.

This study examines NordDRG from a decision-making and machine learning perspective. While traditionally regarded as a structured expert system, the decision tree framework provides new insights into its complexity, efficiency, and optimization potential. In the future, the system could be further developed using both traditional expert collaboration and machine learning.

Methods

We analysed the NordDRG logic specification, including all country variants, and projected the structure as machine learning decision tree models. We defined aggregate metrics to estimate the size and complexity of the decision tree.

We created a user interface capable of dynamically visualizing different levels of decision trees. The system was reconstructed as a decision tree with hierarchical decision paths, and key structural metrics were computed.

Results

On the DRG Logic level the decision tree contains

* Decision tree nodes ~ 58 000, Decision tree leaf nodes ~ 9000 and Average nodes per path from root to leaf node: 6.5

On primary classification level characteristics:

* Diagnosis Features ~ 100 000 and Procedure Features ~ 60 000

When the decision tree was extended to contain also primary classification level the tree extended to contain about 2 000 000 nodes. This can be interpreted that the number of cumulative decisions made during the expert collaboration work is in millions.

Discussion

Viewing NordDRG as a large-scale decision tree provides a way to analyze the outcomes of expert-driven classification system development. However, this perspective also highlights challenges, such as the complexity of maintaining and updating a rule-based model at scale. The cumulative number of decisions in the active decision tree is on the scale of millions of rules. Maintaining and updating such logic requires significant effort and a sustained level of expertise.

Our analysis demonstrates that when represented as a decision tree, NordDRG exhibits characteristics of both an expert system and a machine learning-driven classification model. The hierarchical decision structure reveals redundancies and opportunities for optimization within the system. By interpreting NordDRG as a decision tree, we gain insights into how automated decision-support models could streamline and enhance its classification process.

Conclusions

By analyzing NordDRG through a decision tree framework, we provide a novel perspective on its structure and decision-making logic. Future research should explore how machine learning and expert-based decisions can work together to maintain the decision tree logic. This hybrid machine learning approach could be termed curated learning, where human experts always retain the final verification authority over machines. Such an approach could enhance the efficiency and adaptability of CaseMix systems.

References

01 NordDRG casemix system: https://nordcase.org/

02 Decision Trees: https://en.wikipedia.org/wiki/Decision_tree 03

03 Machine Learning: https://en.wikipedia.org/wiki/Machine_learning

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