

ON MULTI-CRITERIA DECISION-MAKING METHODS IN FINANCE USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

Jurgita Černevičienė, Audrius Kabašinskas

ABSTRACT

The influence of Artificial Intelligence is growing, as is the need to make it as explainable as possible. Explainability is one of the main obstacles that AI faces today on the way to more practical implementation. In practice, companies need to use models that balance interpretability and accuracy to make more effective decisions, especially in the field of finance. The main advantages of the multi-criteria decision-making principle (MCDM) in financial decision-making are the ability to structure complex evaluation tasks that allow for well-founded financial decisions, the application of quantitative and qualitative criteria in the analysis process, the possibility of transparency of evaluation and the introduction of improved, universal and practical academic methods to the financial decision-making process. This article presents a review and classification of multi-criteria decision-making methods that help to achieve the goal of forthcoming research: to create artificial intelligence-based methods that are explainable, transparent, and interpretable for most investment decision-makers.

INTRODUCTION

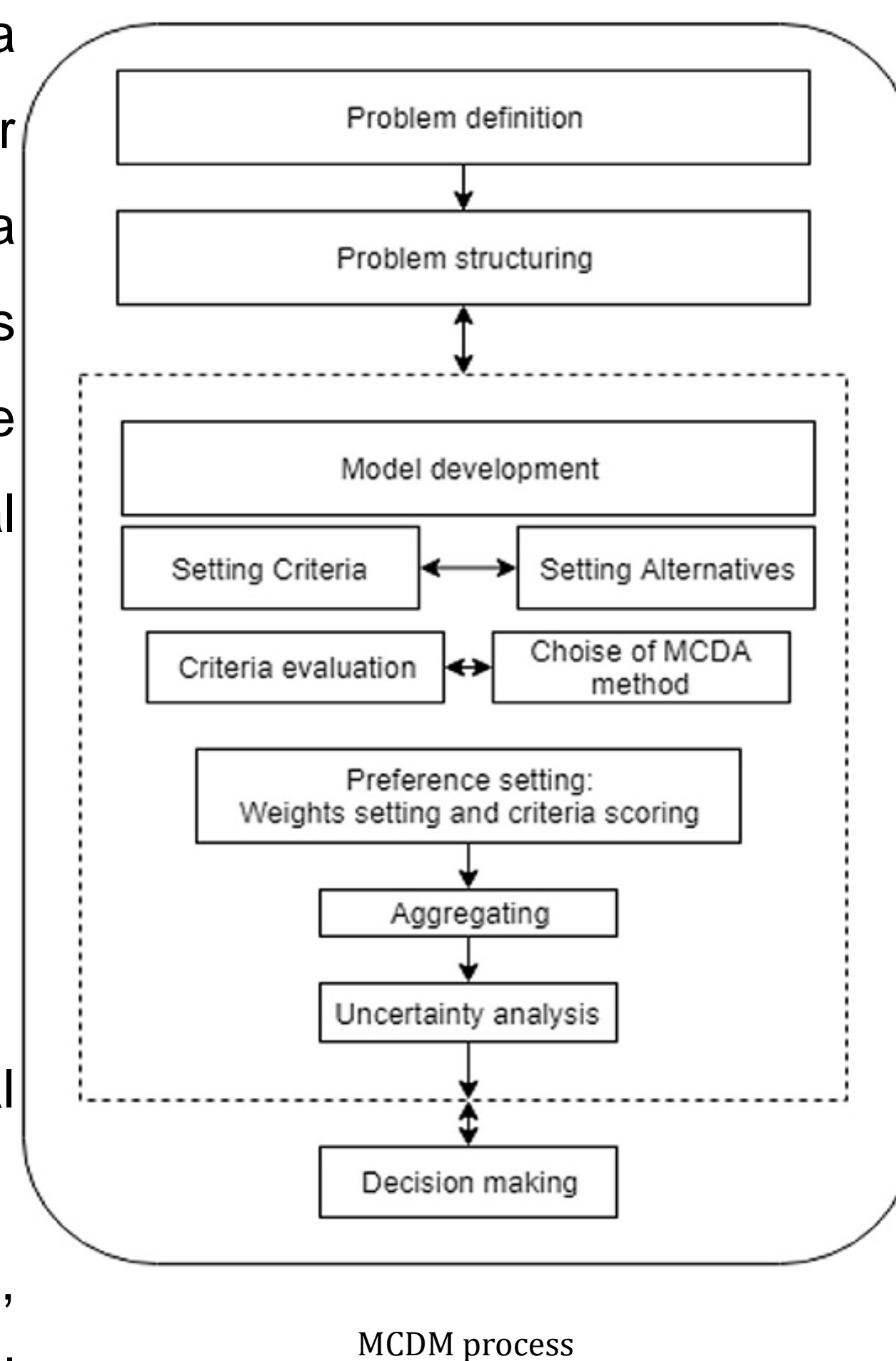
Multi-criteria methods are widely used for decision-making in a wide range of commercial and financial fields, as they can provide a variety of solutions. The financial sector is highly competitive and the wrong decision can lead to irreversible financial losses. Large digital data sets are new challenges for decision-making in finance.

Many financial multi-criteria decision-making tasks are performed using artificial intelligence methods because such methods frequently outperform traditional methods. Artificial intelligence is increasingly applied in the financial industry. Typically machine learning algorithms may provide better prediction results but operate with a low degree of explainability. Explainability is one of the main obstacles to more widespread implementation of AI in financial decision-making. The development of hybrid multi-criteria decision-making/artificial intelligence (MCDM + AI) techniques could address to some degree the explainability problem of artificial intelligence.

MULTI-CRITERIA DECISION MAKING (MCDM)

The application of computational methods involving a number of criteria and a ranking of preferences for evaluating and selecting the best option from among a number of alternatives, given a desired outcome, is known as **multi-criteria decision making (MCDM)**. The **main advantages** that MCDM models offer in financial decision-making:

- ☐ Systematization of complex evaluation problems,
- ☐ Completeness of the evaluation process achieved by introducing both quantitative and qualitative evaluation criteria,
- ☐ Valuation transparency in support of financial decisions,
- ☐ The possibility of implementing flexible, complex, realistic scientific methods in making financial decisions.



ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions.”

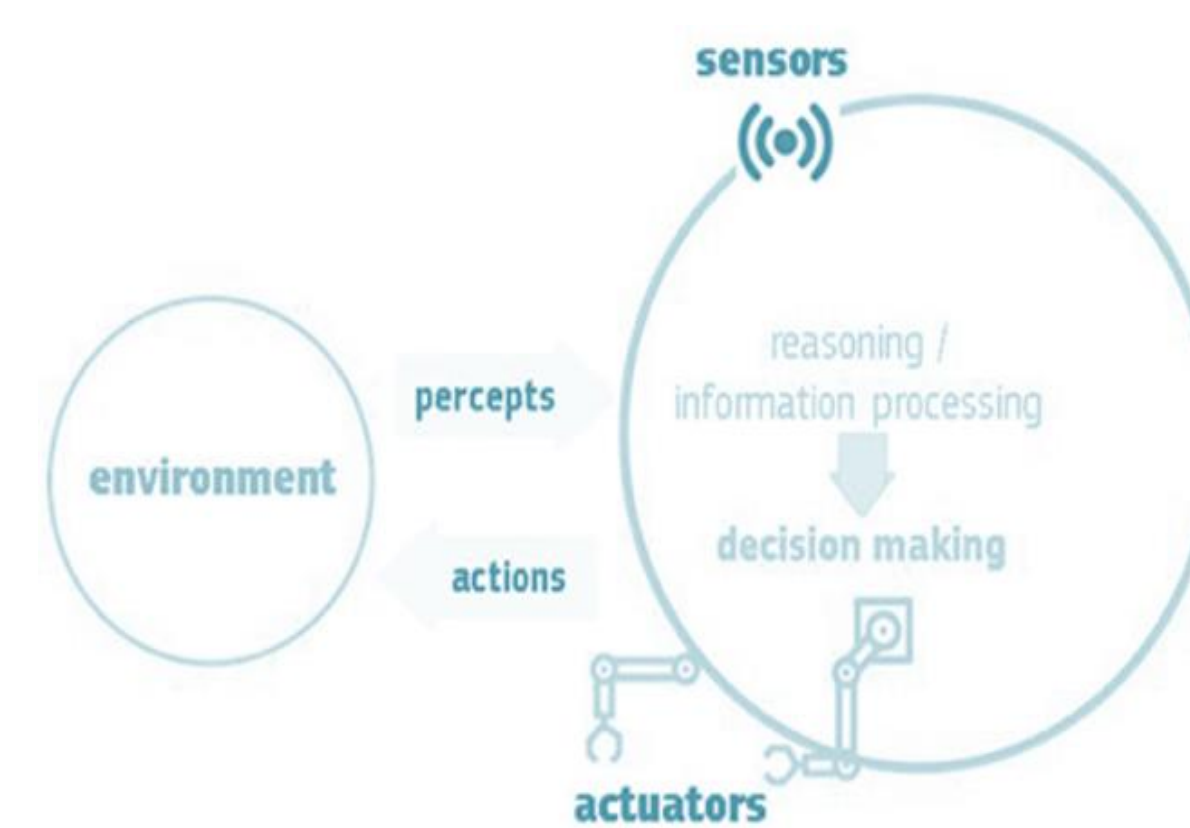
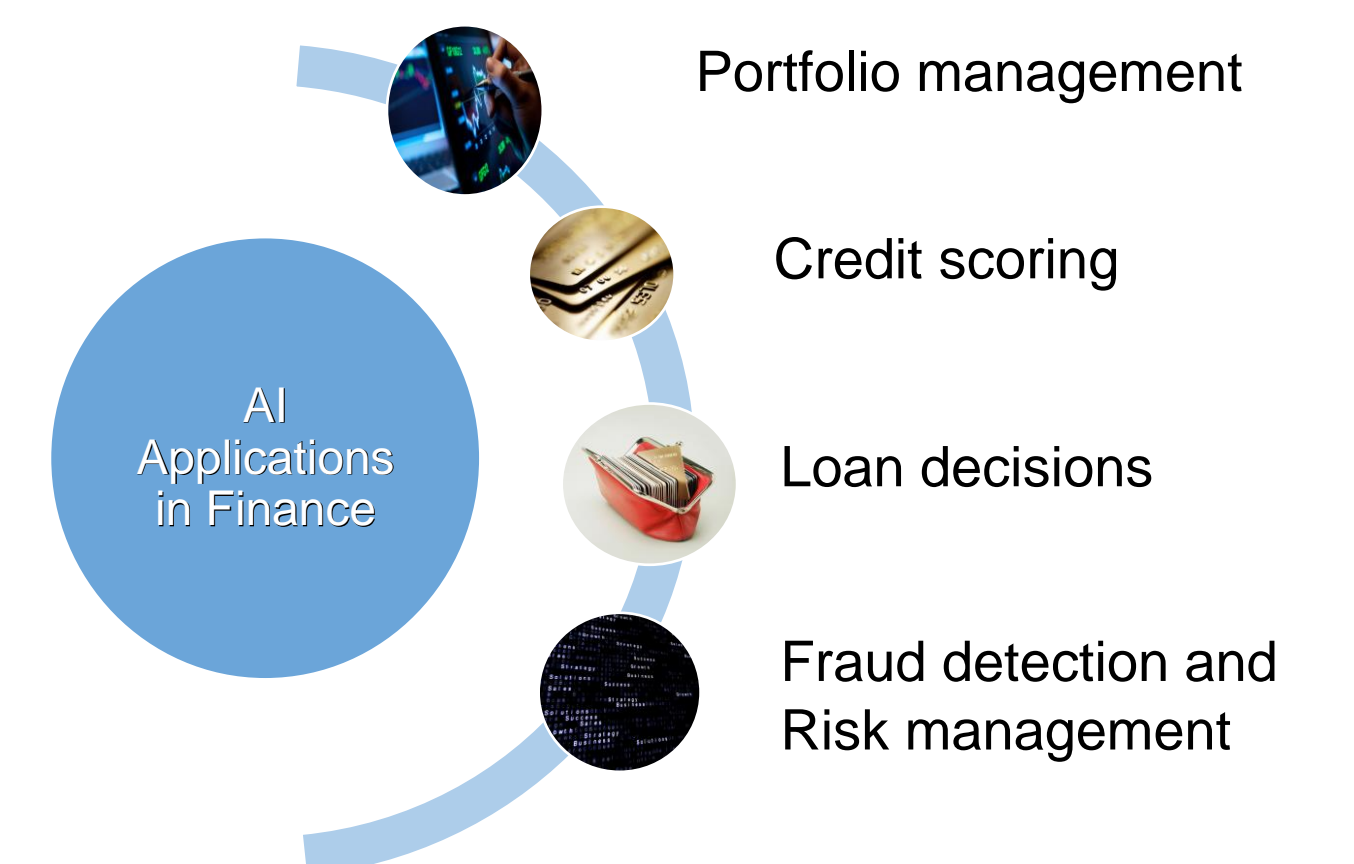


Illustration of how an AI system performs (European Commission, 2021)



AI applications in Finance

EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI)

Three questions are important for any **XAI** strategy

What constitutes a good explanation?

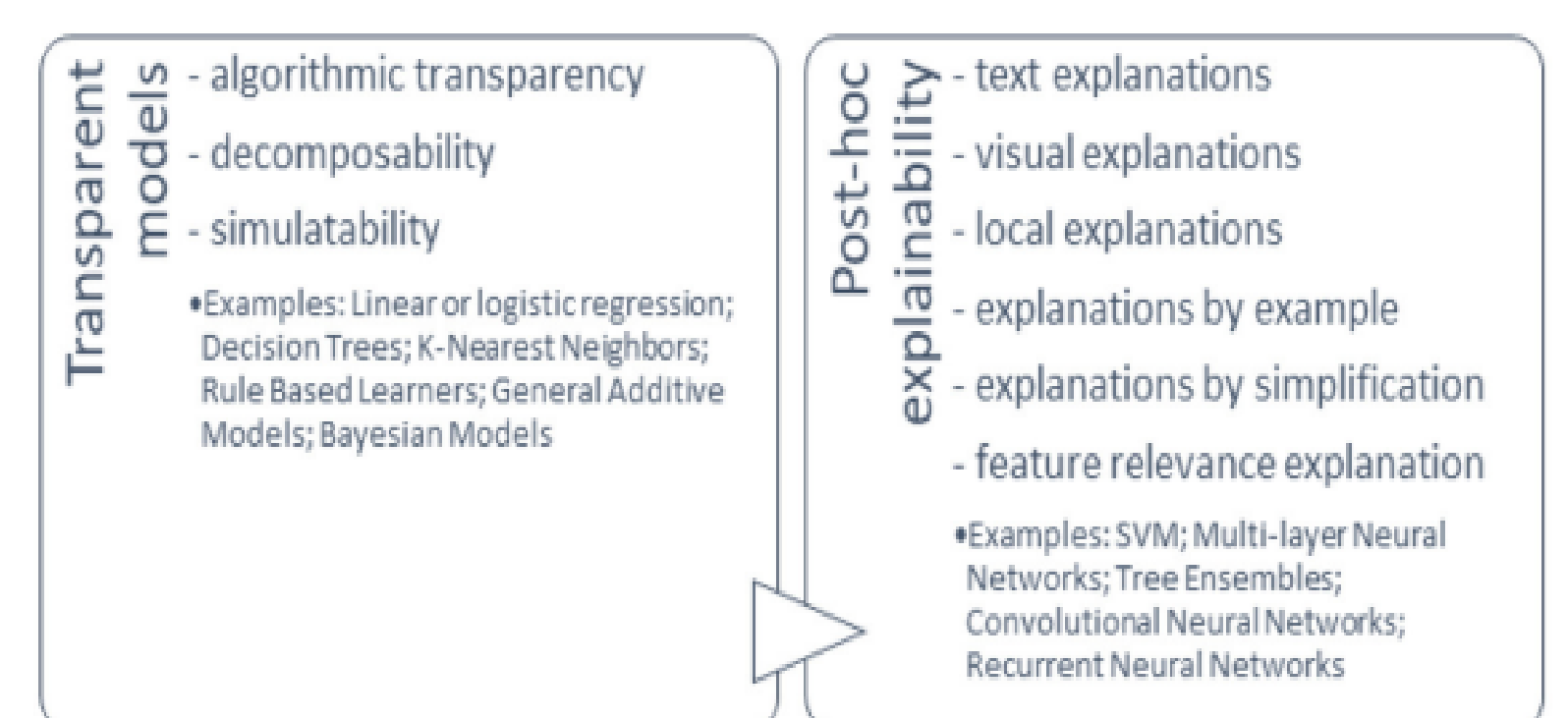
Who is the explanation for?

How will the explanation be provided?

The concept of **explainable AI (XAI)** proposes the creation of a set of machine learning methods that *Create* more understandable models while maintaining a high level of training efficiency (for example, predictive accuracy); *allow* people to understand, properly trust and *control* a new generation of AI partners.



XAI goals



Classification of model explainability

DISCUSSION



The main advantage of AI is its ability to process big data at speeds and accuracies beyond the reach of humans or traditional methods, to learn from data and its own mistakes, and to improve and solve multi-criteria problems. However, the rapid increase in the performance of complex AI-based systems has turned them into "black box" models, raising questions about how decisions are made and how to explain them. Therefore, the use of AI in the financial field is still challenging. The rapid adoption of investment decisions should meet the requirements of accountability, transparency, ethics and trustworthiness.

Compared to AI methods, MCDMs are transparent decision making tools. As MCDM and AI methods are usually used to solve multi-criteria problems on a comparative basis (to see which method yields better results), the development of hybrid multi-criteria decision-making (MCDM+AI) could be consistent with the principles of XAI development. A promising area of future research in the field of finance is the development of MCDM models that use AI methods to improve the reliability and accuracy of models for solving financial problems that can be applied in practise.