

Research Plan

Title: Machine Learning and Data Mining Approaches in Recommendation Systems with Explainable AI

1. Background

Recommendation systems have become a core component of modern intelligent applications, influencing decision-making in domains such as e-commerce, education, healthcare, and smart cities. While traditional machine learning and data mining techniques have achieved high predictive accuracy, they often operate as black-box models, limiting transparency, trust, and user acceptance.

Explainable Artificial Intelligence (XAI) addresses this limitation by providing interpretable insights into model behavior and decision processes. Integrating XAI into recommendation systems is crucial for improving reliability, fairness, and user trust, especially in high-stakes or socially impactful applications. This research is motivated by the need to design flexible, accurate, and explainable recommendation systems that balance performance with interpretability.

2. Research Problem

Most state-of-the-art recommendation systems prioritize accuracy over interpretability. As a result, users and stakeholders lack understanding of why specific recommendations are made. This opacity raises concerns regarding bias, fairness, and accountability. The main research problem is how to effectively integrate Explainable AI techniques into machine learning and data mining-based recommendation systems without significantly degrading their performance.

3. Research Objectives

The primary objectives of this research are:

- To study and analyze existing machine learning and data mining techniques used in recommendation systems.
- To investigate current Explainable AI (XAI) methods and their applicability to recommendation models.
- To design recommendation system architectures that incorporate explainability at different stages (data, model, and output levels).
- To evaluate the trade-off between accuracy, interpretability, and flexibility in explainable recommendation systems.
- To propose a flexible framework that allows the use of multiple XAI techniques across different recommendation scenarios.

4. Research Questions

- How can XAI techniques be effectively integrated into machine learning-based recommendation systems?
- Which XAI methods are most suitable for different types of recommendation algorithms (collaborative filtering, content-based, hybrid)?
- How does explainability impact user trust, system transparency, and decision quality?
- What is the trade-off between model performance and interpretability in explainable recommendation systems?

5. Methodology

The research will follow a structured methodology:

1. **Literature Review:** Comprehensive review of recommendation systems, machine learning models, data mining techniques, and Explainable AI methods.
2. **Model Development:** Design and implementation of recommendation models using machine learning and data mining approaches.
3. **Integration of XAI:** Application of XAI techniques such as feature importance, rule-based explanations, model-agnostic explainers, and visualization methods.
4. **Experimental Evaluation:** Performance evaluation using standard datasets and metrics (accuracy, precision, recall, interpretability metrics).
5. **Comparative Analysis:** Comparison between explainable and non-explainable models.

6. Expected Contributions

- A systematic analysis of XAI methods applied to recommendation systems.
- A flexible and explainable recommendation system framework.
- Empirical results demonstrating the impact of explainability on system performance and transparency.
- Practical guidelines for designing trustworthy and interpretable recommendation systems.

7. Expected Outcomes and Impact

This research aims to contribute to the development of transparent, trustworthy, and user-centered AI systems. The outcomes are expected to be valuable for both academic research and real-world applications, particularly in domains where accountability and interpretability are critical.

8. Conclusion

By combining machine learning, data mining, and Explainable AI, this research seeks to advance the field of recommendation systems beyond accuracy-focused models toward intelligent systems that are both effective and understandable.

Date: **22/05/2026**

Surname And Name: **Aouaidjia Mouna**

Signature:

A handwritten signature in blue ink, consisting of a stylized 'M' followed by a horizontal line and a small loop.