Pattern Mining and Explainable AI (XAI)

Shakeer Samanthapudi

March 31, 2025

What is Pattern Mining?

- Process of discovering meaningful patterns in data.
- Used in market basket analysis, fraud detection, bioinformatics.
- Example: Finding frequent itemsets in transactions (e.g., "Milk" and "Bread" are often bought together).

Types of Pattern Mining

- **Frequent Pattern Mining** - Identifies frequently occurring patterns (e.g., FP-Growth, Apriori).
- **Sequential Pattern Mining** - Finds patterns in ordered data (e.g., web clickstream analysis).
- **Graph-Based Pattern Mining** - Discovers patterns in graph structures (e.g., social networks).
- **Contrast Pattern Mining** - Identifies patterns that differentiate two classes.

Key Terms in Pattern Mining

- **Support**: How often a pattern appears in the dataset.
- **Confidence**: How often the rule holds true.
- **Lift**: Measures the strength of an association rule.
- **Closed Patterns**: Patterns that are not a subset of another frequent pattern.

What is Explainable AI (XAI)?

- AI systems that provide understandable and interpretable results.
- Helps users trust and validate model predictions.
- Techniques: SHAP, LIME, Decision Rules, Feature Attribution.

Why XAI in Pattern Mining?

- Patterns can be complex and difficult to interpret.
- Helps in validating discovered patterns (e.g., false correlations).
- Provides human-readable explanations for association rules.
- Example: Using SHAP to explain why certain items are frequently bought together.

Example: XAI in Market Basket Analysis

- Suppose a supermarket applies pattern mining to find that "Milk" and "Bread" are frequently bought together.
- XAI techniques can help explain why this occurs:
  - SHAP values show which items contribute to this pattern.
  - LIME highlights the influence of seasonal trends.

Conclusion

- Pattern mining uncovers valuable insights from data.
- XAI makes pattern mining more transparent and interpretable.
- Combining both leads to better decision-making in various domains.