

Artificial Intelligence PBL Report

ON

PRODUCT RECOMMENDATION EXPERT SYSTEM

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INTRODUCTION

Artificial Intelligence (AI) is a branch of computer science that enables machines to perform reasoning and decision-making similar to human intelligence. One of the earliest and most fundamental AI applications is the Expert System, which simulates the decision-making ability of a human expert in a specific domain.

This project, titled “Product Recommendation Expert System”, is designed to provide personalized product suggestions to users based on logical reasoning. The system interacts with the user, accepts inputs such as category (e.g., smartphone or laptop), budget (low, medium, high), and desired feature (e.g., 5g, bluetooth, gaming), and then infers the best-matching products using Prolog’s logical rules. The entire system operates on a knowledge base containing predefined facts of 200 electronic products. The inference engine uses pattern matching and logical querying to filter the relevant recommendations.

This project aims to demonstrate how Prolog can be used for AI reasoning in decision support systems where structured logical knowledge is more important than probabilistic models.

OBJECTIVES

The primary objectives of this project are:

- To design and implement a Prolog-based expert system that recommends suitable electronic products based on user requirements.
- To demonstrate rule-based AI reasoning without the use of statistical or neural network-based learning.
- To develop a knowledge base of 200 electronic products, each represented by Prolog facts that store attributes such as category, price level, features, and ratings.
- To implement an inference mechanism that uses rules to match user preferences and suggest relevant products.
- To provide a user-friendly interactive interface for collecting inputs and displaying recommendations.
- To showcase AI principles such as knowledge representation, inference, and logical deduction through a real-world application scenario.

PROBLEM STATEMENT

Online shopping platforms like Amazon and Flipkart list thousands of products under each category. Customers often face confusion when trying to choose a product that matches their specific requirements and budget.

While large-scale e-commerce systems use data-driven algorithms (machine learning, collaborative filtering), smaller or offline systems lack the resources to train such models. In such cases, a knowledge-based system can efficiently provide recommendations using logical rules.

The main challenges are:

- The need for accurate product filtering based on multiple parameters (category, price, features).
- Absence of intelligent decision systems in small-scale or offline platforms.
- Difficulty in understanding complex machine learning models for educational use.

This expert system addresses these issues by creating a transparent, rule-based AI that can reason logically about product attributes and recommend items that satisfy user-defined criteria.

SYSTEM DESIGN AND ARCHITECTURE

5.1 Architecture Overview

The system consists of three main components:

1. Knowledge Base:
 - Contains all product-related facts in the format:
 - product(ID, Category, Brand, PriceLevel, [Features], Rating).
 - Each product entry specifies key attributes for logical matching.
2. Inference Engine:
 - The logical core of the system.
 - Uses Prolog's built-in search and pattern-matching mechanisms to find facts that satisfy user input conditions.
 - Uses the findall/3 and member/2 predicates to gather recommendations dynamically.
3. User Interface:
 - A simple console-based interface that prompts the user for category, price, and desired feature.
 - Results are displayed in a readable format showing brand, features, and ratings.

5.2 Flow of Operation

1. The user runs the system using ?- start.
2. The program displays available categories and price levels.
3. The user inputs the desired parameters.
4. The inference engine searches the knowledge base for matches.
5. Matching results are displayed as recommendations.

IMPLEMENTATION DETAILS

6.1 Language Used: Prolog (SWI-Prolog version 8.4.2)

6.2 Development Environment:

- Visual Studio Code with SWI-Prolog extension
- Can also run on Google Colab or SWISH online Prolog IDE

6.3 Dataset:

200 products categorized into 5 groups:

- Smartphones
- Laptops
- Televisions
- Camera
- Headphones

Each entry includes brand, price level (low/medium/high), features, and rating (1–5 scale).

6.4 Key Predicates:

```
recommend(Category, Budget, Feature, RecommendedList) :-
    findall([Brand, FeatureList, Rating],
           (product(_, Category, Brand, Budget, FeatureList, Rating),
            member(Feature, FeatureList)),
           RecommendedList).
```

6.5 User Interaction:

```
start :-
    write('==== PRODUCT RECOMMENDATION SYSTEM ===='), nl,
    write('Available Categories: smartphone, laptop, tv, camera, headphones'), nl,
    write('Price Levels: low, medium, high'), nl, nl,
    write('Enter category: '), read(Category),
    write('Enter price level: '), read(Price),
    write('Enter desired feature: '), read(Feature),
    recommend(Category, Price, Feature, List),
    nl, write('== RECOMMENDED PRODUCTS =='), nl,
    display_recommendations(List).
```

OUTPUTS

```
3 ?- start.
==== PRODUCT RECOMMENDATION SYSTEM ====
Available Categories: smartphone, laptop, tv, camera, headphones
Price Levels: low, medium, high

Enter category: laptop.
Enter price level: |: high.
Enter desired feature: |: gaming.

== RECOMMENDED PRODUCTS ==
Brand: msi | Features: [i9,32gb_ram,ssd,gaming] | Rating: 4.7
Brand: asus | Features: [i9,32gb_ram,ssd,gaming] | Rating: 4.7
Brand: msi | Features: [i9,32gb_ram,ssd,gaming] | Rating: 4.8
âš i, No matching products found!
true.
```

```

2 ?- start.
===== PRODUCT RECOMMENDATION SYSTEM =====
Available Categories: smartphone, laptop, tv, camera, headphones
Price Levels: low, medium, high

Enter category: smartphone.
Enter price level: |: medium.
Enter desired feature: |: android.

==== RECOMMENDED PRODUCTS ===
Brand: xiaomi | Features: [android,5g,128gb,amoled] | Rating: 4.4
Brand: oppo | Features: [android,4g,128gb,lcd] | Rating: 4.3
Brand: vivo | Features: [android,5g,128gb,amoled] | Rating: 4.4
Brand: iqoo | Features: [android,5g,128gb,performance] | Rating: 4.4
Brand: honor | Features: [android,5g,128gb,camera] | Rating: 4.3
Brand: huawei | Features: [android,5g,128gb,camera] | Rating: 4.4
Brand: oneplus | Features: [android,5g,128gb,fast_charge] | Rating: 4.5
Brand: oppo | Features: [android,5g,128gb,camera] | Rating: 4.3
Brand: vivo | Features: [android,5g,128gb,stylish] | Rating: 4.4
Brand: iqoo | Features: [android,5g,128gb,gaming] | Rating: 4.4
Brand: huawei | Features: [android,5g,128gb,sleek] | Rating: 4.4
Brand: lenovo | Features: [android,5g,128gb,battery] | Rating: 4.2
âš i, No matching products found!
true.

```

APPLICATIONS

- E-commerce Platforms: Offline or embedded product filtering systems.
- Retail Store Kiosks: Suggest products based on customer needs.
- Educational Demonstrations: Teaching AI reasoning and logic programming.
- Decision Support Systems: Knowledge-driven business assistants.
- Prototype Recommenders: Quick, lightweight systems without machine learning.

FUTURE SCOPE

- Integration with Graphical User Interface (GUI) for better interaction.
- Conversion into a web-based Prolog expert system using Python or Node.js as frontend.
- Addition of dynamic product databases using file I/O or API integration.
- Hybrid system combining rule-based reasoning with machine learning for adaptive learning.
- Voice-based recommendation using speech-to-text and Prolog query interpretation.

CONCLUSION

The Product Recommendation Expert System successfully demonstrates the power of logical reasoning in AI.

By utilizing Prolog's knowledge representation and inference, it provides meaningful product recommendations without relying on complex data models.

This project serves as a proof of concept for rule-based recommendation systems, emphasizing the clarity, simplicity, and interpretability of symbolic AI.

It highlights how expert systems continue to play a vital role in domains requiring transparency and reasoning capability.

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