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PolicyAdvisor.ai: An Intelligent Insurance Policy Recommendation System

Dr. D. Anusha[1], P. Ajay Kumar Varma[2], P. Thirumala Naveen[3], P. Dilip Chand[4], G. Kiran Bhargav[5]
[1]*Head of Department of Computer Science Engineering (AI&ML), SRK Institute of Technology , Andhra Pradesh, India*
[2, 3, 4, 5]*Department of computer science and Engineering (AI & ML), SRK Institute of Technology , Andhra Pradesh, India*

Abstract: ***PolicyAdvisor.AI uses Machine Learning and a trained Random Forest Classifier model to recommend insurance policies, by analyzing the inputs of a user such as age, salary, number of dependents, and type of insurance required, and determining the most suitable policies that match their financial Profile. It also ranks and filters policies based on estimated premium, sum assured, and coverage suitability derived from real-world policy datasets. Using a seamless integration between a React.js frontend and a Flask backend server via FastAPI, the system processes user inputs and returns the top 3 personalized policy recommendations, allowing users to quickly identify the most relevant insurance plans in an increasingly complex financial environment where they can make informed decisions more efficiently. The system eliminates the manual overhead of comparing numerous insurance policies on a massive scale by automating the recommendation and ranking process based on predictive capabilities.***

Keywords: PolicyAdvisor.AI, Insurance Policy Recommendation, Random Forest Classifier, Machine Learning, FastAPI, React.js, Ranking Algorithm, Personalized Recommendations, Intelligent Decision Support.

I. INTRODUCTION

In a modernized and rapidly evolving digital landscape, insurance selection remains one of the most critical yet overwhelming financial decisions for individuals and families. The sheer volume of available insurance policies across multiple providers makes it nearly impossible for an average user to manually compare and choose the most suitable plan. Classic insurance comparison methods rely on static web listings, agent-driven recommendations, or rule-based filters that fail to account for personal financial profiles, number of dependents, or long-term premium affordability.

In order to overcome these challenges, PolicyAdvisor.AI is presented as an AI-powered intelligent system that helps users discover the most relevant insurance policies effectively. It uses sophisticated machine learning approaches to automatically analyze user profiles and recommend the top 3 personalized policies. Instead of generic listing-based solutions, a context-aware Random Forest Classifier model is used to understand user requirements and rank policies accordingly.

Dynamics Of The System: At the centre of this system, we have a trained Random Forest Classifier model and a ranking algorithm-based policy scoring engine. It receives and processes user inputs such as age, salary, type of insurance, and number of dependents using a seamless FastAPI integration which categorizes and matches them against real-world policy datasets. It evaluates key parameters such as sum assured, estimated annual premium, and coverage suitability, calculates compatibility scores, and highlights the top 3 most relevant policies. React and Flask based, it has a scalable, modular architecture with an interactive frontend dashboard that increases recommendation accuracy.

II. RELATED WORK

1) Machine Learning–Based Insurance Recommendation Using Decision Trees**:** Existing insurance recommendation systems process user demographic inputs through supervised machine learning classifiers such as Decision Trees and Random Forest models for policy matching and classification. They pair rule-based policy classification with probabilistic scoring engines that evaluate user attributes such as age, income, and policy preferences to suggest suitable insurance plans. They effectively manage structured policy datasets through a combination of tree-based classification and ensemble learning logic.
2) Static Rule-Based Limitations in Traditional Recommendation Systems: Many conventional insurance recommendation systems depend upon predefined rules that associate demographic attributes or income brackets to fixed policy categories. They are great for basic policy filtering or narrowing down broad insurance types, but do not cope well with complex user profiles that involve multiple dependents, varying salary ranges, or mixed insurance needs. These systems do not measure policy suitability based on dynamic user context.

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3) Semi-Automated and Agent-Driven Insurance Advisory Systems**:** Some modern insurance platforms add recommendation functionality with tools such as basic eligibility filters and rudimentary premium calculators that help surface relevant policies. While these solutions allow users to explore plans more quickly, they still base themselves either on generic algorithms or manual agent inputs that limit true personalization. Automation such as category-based sorting or provider filtering provides basic organization but not deeper intelligence.

4) Scalable AI-Powered Policy Recommendation Architectures**:** FastAPI, React, and real-world policy datasets are used to handle multiple users and diverse insurance inputs efficiently. They also allow for safe data transmission and processing with secure request handling and seamless frontend-backend integration. Such systems store structured, queryable policy data for real-time recommendation analytics..

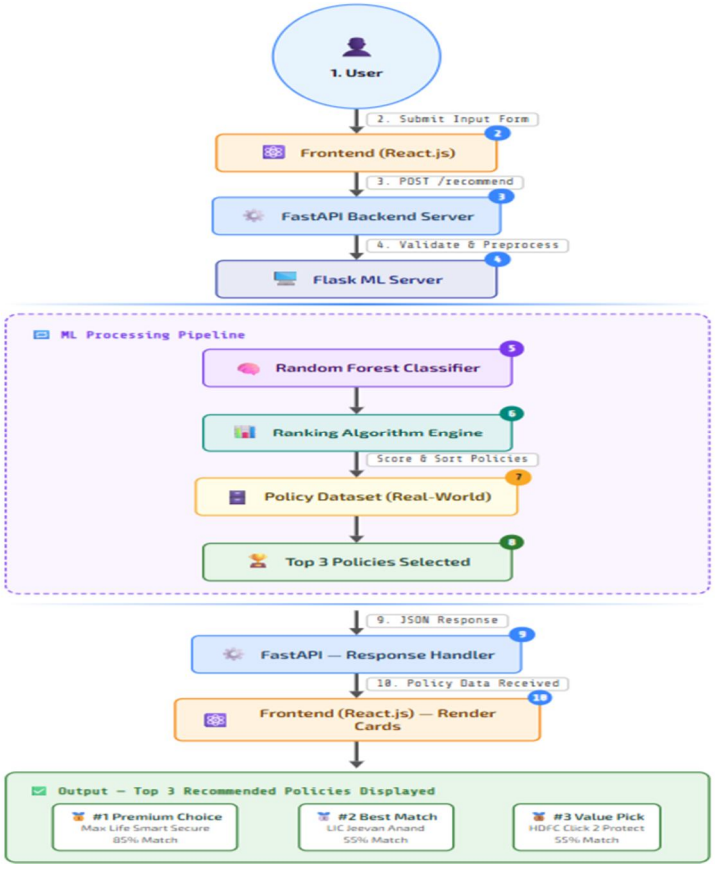
III. PROBLEM STATEMENT

Choosing the right insurance policy has become a challenging task for individuals due to the increasing number of policy options, complex terms and conditions, and lack of financial awareness. Most users are unable to accurately assess their insurance needs based on factors such as age, income, dependents, health condition, financial goals, and risk profile. Existing insurance platforms mainly promote policies rather than providing personalized, unbiased recommendations, which often leads to wrong policy selection, overpayment of premiums, or insufficient coverage.

IV. WORKFLOW

The following flowchart helps us visualize the PolicyAdvisor.AI workflow starting with user input collection using the React web frontend and backend API. Once the user submits their details such as name, age, salary, type of insurance, and number of dependents, the system securely transmits the data to the Flask backend server via FastAPI. It provides a smooth and responsive data exchange between the frontend and backend, synchronized with the application environment without any interruption.

It then handles every incoming user request through the ML engine for profile analysis and preprocessing, and passes the processed data through the Random Forest Classifier to predict and rank the most suitable insurance policies. The ranked policy results are scored using a ranking algorithm that evaluates key parameters such as sum assured, estimated annual premium, and coverage compatibility. The top 3 recommended policies are then sent back to the React frontend.



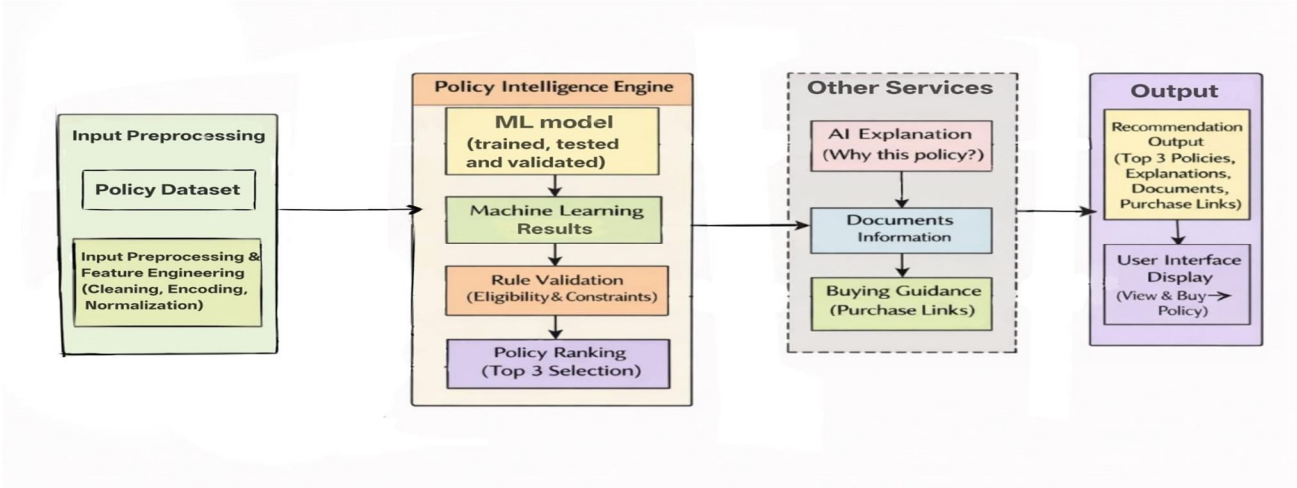
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V. PROPOSED SYSTEM

The proposed system automates the traditional human-based insurance advisory process using an AI-driven approach. User requirements are analyzed along with historical training data to generate accurate recommendations. An Explainable AI (XAI) layer is integrated to enhance transparency. The XAI module explains the reasons behind each policy recommendation. These explanations are based on factors such as age, income, financial goals, dependents, and risk profile. Coverage range and policy benefits are also considered. Additionally, a Buying Excellence Guidance module assists users during policy selection. It provides the required documents and verified purchase links for secure policy acquisition

VI. SYSTEM ARCHITECTURE

The PolicyAdvisor system architecture is designed as a modular, AI-driven recommendation system. It consists of a frontend layer (React UI) that collects user inputs such as age, income, and financial goals. These inputs are sent to a backend server (Flask/FastAPI), which handles request processing and validation. The backend integrates with an AI/ML engine that uses rule-based logic, weighted scoring, or machine learning models to recommend suitable insurance policies



VII. MODULE DESCRIPTION

A. *User Module*

Provides a login-less web interface for users to enter insurance requirements and view recommendations, AI explanations, required documents, and purchase links.

B. *System Modules*

1) User Input Interface Module: Collects user requirements such as job role, income, insurance type, coverage, dependents, and health condition.
2) Input Validation & Preprocessing Module: Validates, cleans, encodes, and formats user input data for machine learning analysis.
3) Rule Validation Module: Applies business and eligibility rules to refine and validate ML-generated recommendations.
4) Policy Ranking Module: Scores and ranks policies based on relevance and selects the top three recommendations
5) AI Explanation Module: Generates human-readable explanations describing why each policy is recommended.
6) Documents Information & Policy Purchase Link Module: Presents required documents for purchasing each recommended policy and Provides official insurer links for direct policy purchase.
7) Result Display Module: Presents top three policies, explanations, documents, and buy links on a single interface

VIII. DATASET DISCRIPTION

The PolicyAdvisor.AI system uses multiple structured datasets to deliver intelligent insurance recommendations. The Policies Dataset contains detailed information about various insurance plans, which is used to train the machine learning model. The Documents Requirement Dataset specifies the necessary documents for each policy, helping users understand eligibility and requirements. The Policy Buying Links Dataset provides direct links to official insurer websites for easy policy purchase. Additionally, the Explanation Templates Dataset supports generating understandable reasons behind recommendations. Together, these datasets enable accurate, transparent, and user-friendly decision-making within the system.

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IX. ALOGORITHM USED

PolicyAdvisor.AI uses a hybrid algorithmic approach combining machine learning, rule-based filtering, and ranking techniques. By integrating user profile data with policy datasets, the system intelligently filters, predicts, and ranks the most suitable insurance policies. This approach ensures accurate recommendations, improved decision-making, and efficient processing of user requirements.

1) Random Forest Classifier (Machine Learning Model): Random Forest is an ensemble learning algorithm used for predicting the most suitable policy category. It builds multiple decision trees and combines their outputs to improve accuracy and reduce overfitting. The model learns complex, non-linear relationships between user attributes such as salary, job role, dependents, and health condition with policy features.

2) Rule-Based Filtering Algorithm: This algorithm applies predefined logical conditions to eliminate ineligible policies before recommendation. It uses constraints such as financial capability, coverage requirements, policy duration, and user preferences to filter out unsuitable options. This step ensures that only relevant and feasible policies are passed to the next stage, improving system efficiency and reliability.

3) Weighted Scoring Ranking Algorithm: This algorithm ranks the filtered policies based on multiple weighted factors such as similarity score, premium affordability, coverage amount, and user financial goals. Each factor is assigned a weight, and a final score is computed for every policy. The system then selects the top three policies with the highest scores, ensuring optimal and personalized recommendations for the user.

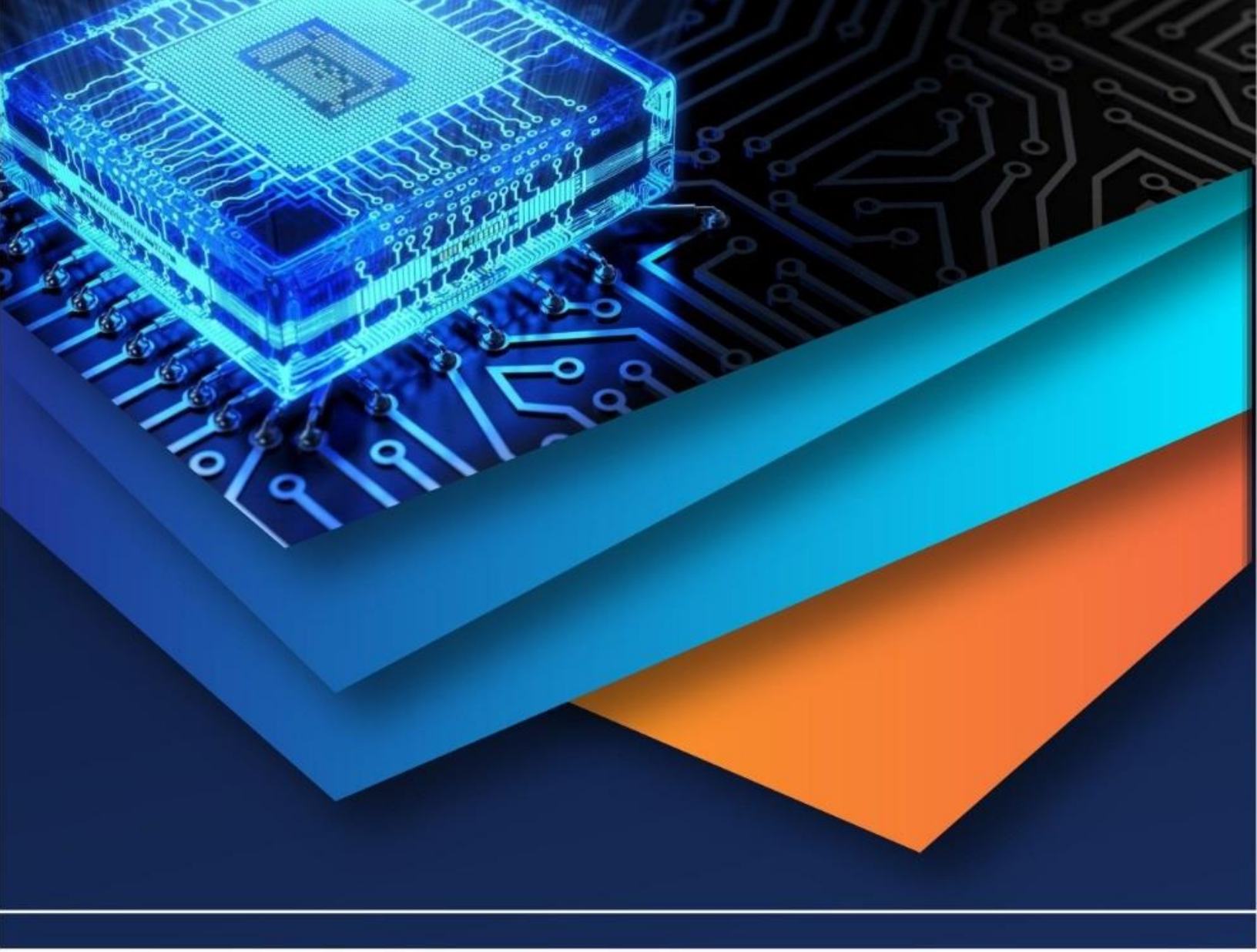
X. CONCLUSION AND FUTURE WORK

The Policy Advisor system successfully automates the insurance recommendation process using intelligent data-driven techniques. It provides accurate, consistent, and personalized policy suggestions without human intervention. By integrating machine learning and explainable AI, the system improves transparency and user trust. Overall, it enhances efficiency, scalability, and decision-making compared to traditional advisory methods. The PolicyAdvisor.AI system can be further enhanced with advanced features to improve accuracy, usability, and real-world applicability. Future improvements include integrating real-time insurance data from official APIs to ensure up-to-date policy information. The system can also incorporate deep learning models and user behaviour analytics to provide more personalized and dynamic recommendations.

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