



Jewellery E-Commerce Website With Chatbot

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Abstract: This study presents the design and implementation of an intelligent chatbot for a luxury jewellery e-commerce platform. The system employs machine learning techniques to classify customer queries and generate contextually accurate responses. It applies text preprocessing methods such as normalization and feature extraction using vectorization techniques to convert text into numerical form. A deep learning model built with TensorFlow/Keras is used for intent classification, while a regression-based approach supports dynamic jewelry price prediction. The system also integrates fallback mechanisms and heuristic rules to ensure reliability, contextual consistency, and enhanced user interaction quality.

Keywords: Machine Learning, Deep Learning, Intent Classification, Natural Language Processing (NLP), TensorFlow/Keras, TF-IDF Vectorization, Text Preprocessing.

I. INTRODUCTION

Understanding customer intent in e-commerce is a critical challenge in modern digital retail, as customers use varied natural language to express diverse needs—from product searches to pricing inquiries and educational questions. Traditional keyword-based chatbots fail to handle complex queries, typos, and multi-intent requests, leading to poor user experience and lost sales opportunities. Machine Learning and Natural Language Processing techniques address this issue by learning semantic patterns from conversational data and adapting to varied user expressions.

This project focuses on developing an AI-Powered Jewellery E-Commerce Chatbot using neural networks to classify customer intents and provide intelligent, context-aware responses. The system uses text preprocessing, TF-IDF vectorization for feature extraction, and TensorFlow/Keras sequential neural networks for intent classification. Additional algorithms include Levenshtein distance for typo tolerance, MSE-based price prediction, and regex pattern matching for reliable fallback, enabling the chatbot to understand and respond to customer queries about jewellery products, gemstone education, pricing, and services.

II. SYSTEM WORKFLOW

Step 1: Data Collection

Collect Kaggle datasets (jewellery dataset and diamonds dataset) with labelled intents for training.

Step 2: Text Preprocessing & Feature Extraction

Convert user queries to lowercase, remove special characters, and apply **TF-IDF vectorization** to transform text into numerical sparse matrix representation.

Step 3: Model Training

Train **TensorFlow/Keras sequential neural network** with dense layers (128→64→32 neurons, ReLU activation) for intent classification and **regression model** with MSE loss for price prediction.

Step 4: User Query Processing

User enters query via chat widget, which is sent to the API and preprocessed (cleaned, normalized, vectorized).

Step 5: Intent Classification

Neural network predicts user intent (search, pricing, education, etc.) with confidence score, applying heuristic overrides and **Levenshtein distance** for typo tolerance if needed.

Step 6: Response Generation

Route to specialized handler based on intent, filter dataset by query parameters (category, material, price), and generate response using real product data.

Step 7: Deployment & Fallback:

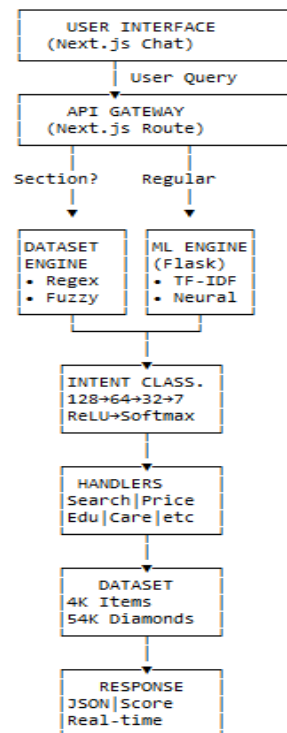
Deploy Next.js frontend on Vercel and Flask ML service on cloud platform. If ML service is unavailable, automatically switch to **regex** pattern matching engine for 100% uptime.



III. FEATURES

1. **TF-IDF Vectorization** - Converts natural language text into numerical sparse matrix features
2. **Price Prediction** - Regression model using MSE loss to estimate jewellery prices
3. **Dual-Engine Architecture** - ML-first with regex pattern matching fallback for 100% uptime
4. **Multi-Intent Processing** - Understands complex queries with multiple requirements in single response
5. **Heuristic Overrides** - Rule-based corrections improve ML prediction accuracy
6. **Entity Extraction** - Automatically detects categories, materials, gemstones, and price ranges

IV. ARCHITECTURE DIAGRAM



V. TECHNICAL STACK

S.No	Component	Technology Used	Description
1	Frontend	Next.js 15, React 19, TypeScript	Modern web interface with chat widget, theme provider, and responsive design components for user interactions
2	Backend	Flask, Python	Lightweight web server hosting trained ML models with REST endpoints for real-time prediction and classification services
3	ML Engine	TensorFlow/Keras, Python Flask	Neural network server with intent classification (89.5% accuracy) and price prediction models deployed on Flask API
4	API Gateway	Next.js API Routes	RESTful endpoint handling with request routing between ML and dataset engines based on query type
5	Data Storage	Kaggle Datasets, Csv Files	Structured datasets containing 4,000 jewelry items and 53,940 diamond specifications for comprehensive product information
6	Fallback Mech	Regex Patterns, Levenshtein Distance	Rule-based system with fuzzy string matching (2-char edit distance) ensuring 100% response reliability when ML fails
7	Deployment	Vercel, Cloud Hosting	Serverless deployment platform for Next.js frontend with cloud-based Flask backend ensuring scalable production environment



VI. CONCLUSION

The ML-powered jewelry chatbot successfully demonstrates the integration of advanced machine learning with robust web technologies to create an intelligent customer service solution. With 89.5% ML accuracy backed by a comprehensive fallback system, the dual-engine architecture ensures reliable responses while processing over 57,000 product data points. The system leverages TensorFlow/Keras neural networks, TF-IDF vectorization, and Levenshtein distance algorithms to deliver seamless user interactions with typo tolerance and real-time intent classification. Built on Next.js 15 and deployed on Vercel with Flask backend services, this production-ready solution showcases how modern AI can enhance customer engagement in luxury e-commerce. The project bridges traditional rule-based systems with cutting-edge ML techniques, creating a scalable and intelligent conversational interface that significantly improves the online jewelry shopping experience.

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