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Leveraging Predictive Analytics for Targeted Vehicle Marketing and Streamlined Purchases

Problem Statement

1. **Targeted Marketing:**
   By analyzing customer demographic and lifestyle variables such as gender, income, age range, household size, location, and education level, this program predicts which Toyota vehicle aligns best with a specific customer profile. Marketing teams can then leverage these insights to target their audience, ultimately optimizing resource allocation and increasing sales.

2. **Streamlined Vehicle Purchases:**
   The program is also designed to assist potential customers in the vehicle purchasing process by using their basic demographic information to suggest a vehicle that best suits their needs. This feature eliminates the lengthy process of browsing vehicle inventories by providing personalized recommendations upfront. Customers receive immediate guidance, enhancing their overall purchasing experience and increasing satisfaction.
For example, a customer who lives in a rural area, has a large family, and reports a high household income might be matched with the Toyota Highlander or Tundra. Meanwhile, an urban professional with a smaller household might be recommended the Toyota Corolla or Prius.

Development and Data Preparation

The program was developed with a structured process to ensure accuracy, relevance, and usability. Key steps included:

1. **Data Collection and Synthesis:**
   A synthetic dataset was generated to reflect real-world customer demographics and purchasing behaviors. Variables included gender, income range, age range, household size, location, and education level, alongside the target variable: the Toyota vehicle model most likely to be purchased.

2. **Data Cleaning and Balancing:**
   To ensure robust predictions, the dataset was balanced to represent all Toyota vehicle models equally. This prevented biases and allowed the model to make fair predictions across different categories.

3. **Feature Engineering:**
   Relationships between customer variables and vehicle features were identified and emphasized:
   - **Income**: Strongly influenced the price point of recommended vehicles.
   - **Household Size**: Correlated with passenger capacity needs.
   - **Location**: Influenced preferences for trucks (rural areas), SUVs (suburban areas), and compact cars (urban areas).

4. **Model Training:**
   A Random Forest Classifier was employed to develop the predictive model. The model was trained on an 80/20 train-test split of the dataset to ensure generalizability. Features were encoded using one-hot encoding, and hyperparameters were optimized for maximum accuracy.

5. **Deployment:**
   The model was integrated into a user-friendly Streamlit application. The app provides dual functionality:

- For marketers, it predicts customer preferences to guide advertising strategies.
- For customers, it offers immediate vehicle recommendations based on their demographic inputs. It then utilizes OpenAI to provide some features on the suggested vehicle.

Key Findings

The development and testing process revealed several valuable insights:

1. **Income and Price Sensitivity:**
   Higher-income customers were more likely to prefer premium models such as the Toyota Highlander, Grand Highlander, and Tundra. Lower-income customers gravitated towards economical options like the Toyota Corolla and Corolla Hatchback.

2. **Location-Based Preferences:**
   - **Urban Areas:** Compact, fuel-efficient models like the Prius and Corolla were most popular.
   - **Suburban Areas:** SUVs like the RAV4 and Highlander appealed to family-oriented customers.
   - **Rural Areas:** Trucks like the Tacoma and Tundra were favored for their utility and durability.

3. **Household Size Impact:**
   Larger households (4+ members) preferred vehicles with higher passenger capacities, such as the Sienna and Grand Highlander. Smaller households leaned towards compact or midsize vehicles.

4. **Demographic Influence:**
   Younger customers (18-25 years old) preferred budget-friendly and stylish models like the Corolla Hatchback, while older customers prioritized comfort and reliability in sedans and SUVs.

Business Impact

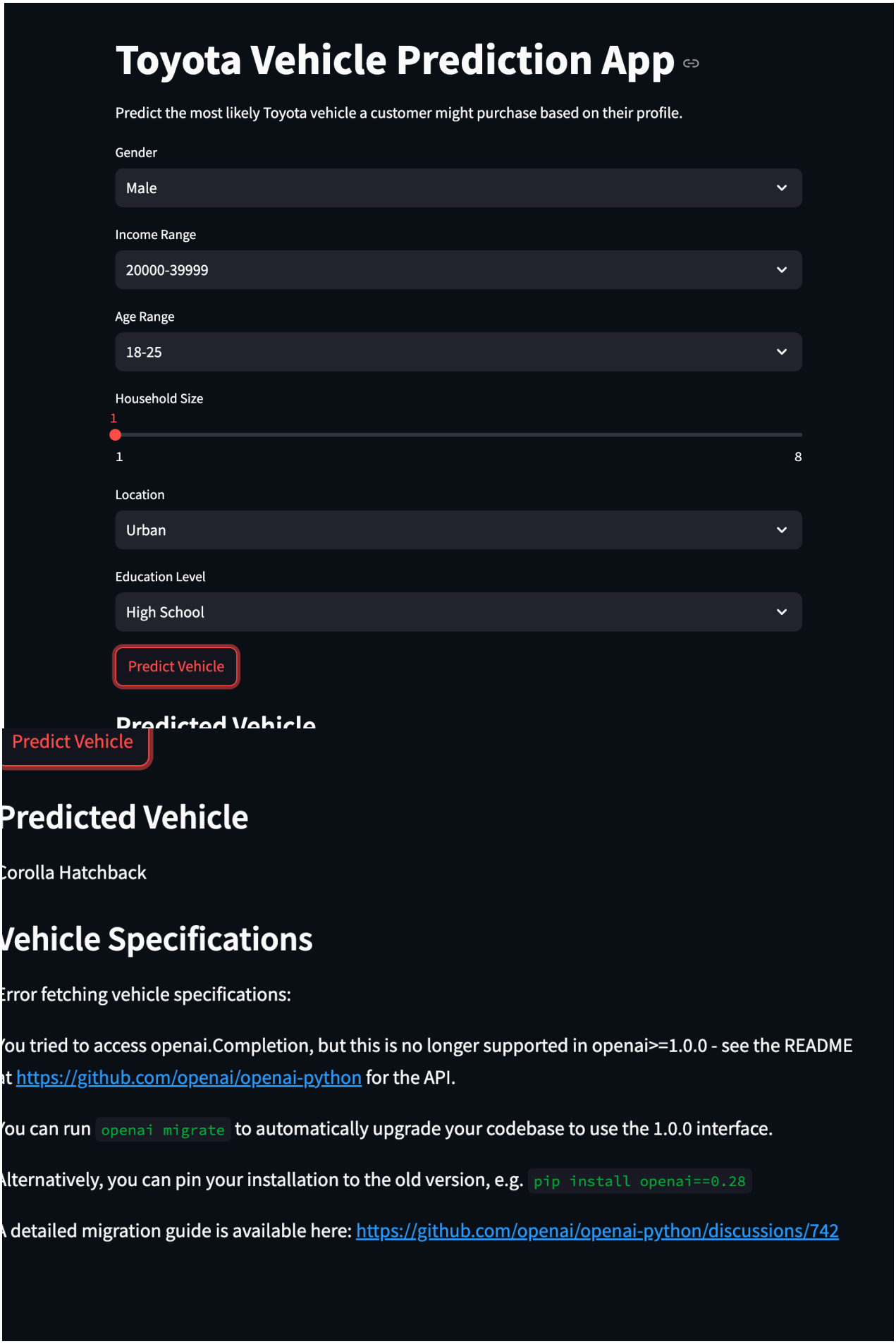
1. **Enhanced Marketing Strategies:**
   Marketers now have a tool that aligns vehicle advertising strategies with customer profiles, increasing engagement and improving ROI. Campaigns can focus on specific demographics, ensuring that advertisements reach the right audience at the right time.

2. **Simplified Customer Experience:**
   For customers, the program serves as a personal assistant, offering immediate and personalized vehicle suggestions. This reduces decision fatigue and accelerates the purchasing process, ultimately enhancing customer satisfaction and loyalty.

Conclusion

This predictive model not only empowers Toyota's marketing team to make data-driven decisions but also transforms the customer experience by simplifying the vehicle selection process. By aligning recommendations with customer preferences and needs, Toyota can achieve greater customer satisfaction, streamline sales, and maintain a competitive edge in the automotive market. This dual-purpose tool exemplifies the power of predictive analytics in bridging business objectives with customer-centric solutions.

https://vehiclepredictionmodel-5pnv6zxazlnhz3tbjqioed.streamlit.app/


Toyota Vehicle Prediction App
Predict the most likely Toyota vehicle a customer might purchase based on their profile.
Gender
Male
Income Range
20000-39999
Age Range
18-25
Household Size
1
1
8
Location
Urban
Education Level
High School
Predict Vehicle
Predicted Vehicle
Predict Vehicle
Predicted Vehicle
Corolla Hatchback
Vehicle Specifications
Error fetching vehicle specifications:
You tried to access openai.Completion, but this is no longer supported in openai>=1.0.0 - see the README at https://github.com/openai/openai-python for the API.
You can run openai migrate to automatically upgrade your codebase to use the 1.0.0 interface.
Alternatively, you can pin your installation to the old version, e.g. pip install openai==0.28
A detailed migration guide is available here: https://github.com/openai/openai-python/discussions/742

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Further improvements to this application I believe would be not only to have the Openai additional feature be functional using updated an updated open that I could not figure out how to get working, but also would be to have a cleaner well designed user interface to possibly be used in a real world instance. I have come to really become enamored with the idea of this project and these improvements will be coming for my Capstone.