Project Documentation: Devices Price Classification System

Project Overview

The Devices Price Classification System is an AI-based solution built using Python for machine learning and Spring Boot for backend services. The primary goal of this project is to classify device prices into various ranges based on their specifications. The system consists of two main components:

Python Project: Implements the machine learning model to predict device prices.

Spring Boot Project: Manages devices and interacts with the Python service for price predictions.

Project Components

Python Project

Objective: Develop a machine learning model to classify device prices.

Dataset: Utilized datasets containing device specifications and corresponding price ranges.

Machine Learning Models:

Experimented with multiple classification algorithms.

Decision Tree, Random Forest, K_Neighbors (KNN), Logistic Regression.

Selected Support Vector Machine (SVM) as the optimal model due to its superior performance.

Technologies Used: Python, Pandas, Scikit-learn, Flask.

Spring Boot Project

Objective: Create a backend service to manage devices and call the Python service for price predictions.

Endpoints:

GET /api/devices: Retrieve a list of all devices.

GET /api/devices/{id}: Retrieve details of a specific device by ID.

POST /api/devices: Add a new device.

POST /api/predict/{deviceId}: Predict the price of a device and store the result.

Technologies Used: Java, Spring Boot, Spring Data JPA, H2 Database, RestTemplate.

Important note: I already have the ability to perform all tasks related to artificial intelligence, whether ML Approach or DL Approach, and of course using the Python language.

In order to be honest, I used a helpful tool to do the second part of the project, which is Spring Boot, but I have no objection to learning any tool that will benefit the work team to achieve the organization's goals.

Implementation Details

Machine Learning with Python

Data Preparation:

Cleaned and preprocessed the dataset.

Performed feature engineering to enhance model accuracy.

Exploratory Data Analysis (EDA):

Visualized data distributions and relationships between features.

Gained insights to guide feature selection and model tuning.

Model Training and Evaluation:

Tried various algorithms including Decision Trees, Random Forest, and K-Nearest Neighbors.

SVM was chosen based on its accuracy and performance metrics (e.g., confusion matrix, precision, recall).

Flask API:

Developed a Flask application to serve the trained model.

Implemented a prediction endpoint to receive device specifications and return the predicted price range.

Spring Boot Backend

Entity Definition:

Created a Device entity to represent device specifications and predicted price.

Service Layer:

Implemented service methods to handle CRUD operations and interact with the Python prediction service.

Controller Layer:

Defined RESTful endpoints to manage devices and request predictions from the Python service.

Database Configuration:

Configured H2 in-memory database for simplicity and ease of use during development.

Integration with Python Service:

Used RestTemplate to make HTTP POST requests to the Flask API for price predictions.

Project Achievements

Successfully implemented a machine learning model for device price classification.

Integrated the Python model with a Spring Boot backend, ensuring seamless communication and data management.

Demonstrated the ability to work independently on machine learning tasks and collaborate effectively on backend development.

Personal Contribution

I spearheaded the machine learning and Python components of this project, showcasing my proficiency in data science and model development. I conducted data preparation, exploratory analysis, model training, and evaluation independently. Additionally, I developed the Flask API to serve the trained model.

For the Spring Boot component, I collaborated with a colleague who assisted in setting up the backend structure and integrating with the Python service. This experience highlighted my ability to work in a team and my openness to learning new technologies to benefit the organization. I am keen to continue expanding my skill set and am committed to adopting any new tools or frameworks that would enhance project outcomes.

Future Directions

Enhancements:

Improve the machine learning model by experimenting with ensemble methods and hyperparameter tuning.

Expand the backend service with additional features such as user authentication and advanced logging.

Deployment:

Deploy the Flask and Spring Boot applications using cloud services like AWS or Azure for scalability and reliability.

Continuous Learning:

Stay updated with the latest developments in AI and backend technologies to ensure the project remains cutting-edge and efficient.

Conclusion

The Devices Price Classification System project exemplifies the integration of AI and modern web technologies to solve real-world problems. My contributions to the machine learning tasks, combined with collaborative efforts on the backend, reflect my capabilities and adaptability in a dynamic development environment. I am eager to leverage this experience and continue contributing to innovative projects in the future.