Title of the Project:

SmartSize AI: Machine Learning-Based Clothing Size Recommender

Abstract:

Inaccurate size selection is a significant issue in online clothing retail, contributing heavily to product returns, customer dissatisfaction, and operational inefficiencies. One of the main challenges stems from the lack of standardized sizing across brands and the absence of personalized fitting guidance. *SmartSize AI* addresses this problem by proposing a machine learning-based clothing size recommender system that predicts the most suitable size for individual users.

The proposed system collects data such as user demographics (age, gender), body measurements (height, weight, chest, waist, etc.), and historical purchase and return behavior. After preprocessing and applying feature selection techniques to identify the most relevant variables, supervised machine learning algorithms—such as Decision Trees, Random Forests, and Support Vector Machines (SVM)—are trained on labeled datasets sourced from fashion e-commerce platforms.

Model performance is evaluated using standard metrics including accuracy, precision, recall, and F1-score. The system is further enhanced by a user-friendly interface where users can input their data and receive immediate, personalized size recommendations. This ensures ease of adoption and seamless integration with existing e-commerce workflows.

By delivering accurate size suggestions, *SmartSize AI* aims to significantly reduce return rates caused by sizing issues, improve customer satisfaction, and enhance overall operational efficiency. The project draws inspiration from recent research such as “A Deep Learning System for Predicting Size and Fit in Fashion E-Commerce” by Sheikh et al. (ACM RecSys 2019), and contributes a practical, scalable solution tailored to real-world retail challenges.

Problem Statement

Online clothing retailers experience high product return rates, with sizing issues accounting for a significant proportion of these returns. These challenges arise due to inconsistent sizing standards across different brands, non-uniform size charts, and the absence of personalized fitting assistance during the purchase process. Customers often resort to guesswork when selecting sizes, which results in frustration, increased logistics costs for retailers, and environmental impacts due to reverse shipping and waste. As e-commerce continues to grow, these inefficiencies pose major hurdles to profitability and customer loyalty. Addressing this problem requires a smart, data-driven solution capable of adapting to individual user profiles and brand-specific sizing schemes.

Objectives

- To design and develop an intelligent clothing size recommender system using machine learning techniques.
- To minimize product return rates by improving the accuracy of size predictions for individual users.
- To enhance customer satisfaction by offering personalized size recommendations tailored to both user profiles and brand-specific sizing.
- To enable seamless integration of the solution into existing e-commerce platforms, thereby improving operational efficiency.
- To contribute to sustainability efforts by reducing the carbon footprint associated with returns and logistics.

Proposed Methodology/Approach

The SmartSize AI system employs supervised machine learning algorithms to predict the most appropriate clothing size for a given user. The approach involves:

- **Data Collection:** Gathering comprehensive datasets comprising user demographics (age, gender), anthropometric data (height, weight, chest, waist, hip measurements), and behavioral data such as purchase and return history.
- **Preprocessing and Feature Engineering:** Data is cleaned, normalized, and enriched using feature selection methods to identify the most influential attributes.
- **Model Training:** Various machine learning models, including Decision Trees, Random Forests, and Support Vector Machines (SVM), are trained on labeled datasets obtained from retail partners or public sources.
- **Model Evaluation:** Models are assessed using performance metrics such as accuracy, precision, recall, F1-score, and confusion matrix to determine predictive quality.
- **Interface Design:** A front-end interface is developed where users can input their measurements or link past purchase history to receive personalized size recommendations instantly.
- **Brand-Specific Adaptability:** The model accounts for brand-wise variations by incorporating brand-specific size mapping and clustering techniques.
- **Continuous Learning:** The system will include feedback loops to continuously improve performance based on new data and user feedback over time.

Expected Outcome

The outcome of this project will be a scalable, accurate, and user-friendly size recommender system capable of integrating with major e-commerce platforms. The solution is expected to:

- Reduce return rates significantly by improving size accuracy.
- Enhance the user shopping experience with personalized and confident size selections.
- Improve retailer operational efficiency by lowering logistics costs and managing inventory more effectively.

- Support sustainable retail practices by minimizing the environmental impact of returns.
- Provide data insights to retailers for improving product sizing and inventory planning.

Base Research Paper Reference

Sheikh, A. S., Al-Rfou, R., Brandenburger, K., & others. (2019).

"*A Deep Learning System for Predicting Size and Fit in Fashion E-Commerce*. In *Proceedings of the 13th ACM Conference on Recommender Systems (RecSys 2019")*.

Link: https://arxiv.org/abs/1907.09844