Customer Clustering Using Deep Learning and Flask Web Application

Introduction

Customer segmentation is a crucial aspect of marketing and business strategy. It allows organizations to group customers based on similarities, enabling targeted marketing and personalized services. In this project, we have implemented a customer clustering model using deep learning techniques and deployed it through a Flask-based web application. The model leverages an autoencoder for dimensionality reduction and K-Means clustering to segment customers based on their age, income, and spending behavior.

Objective

The primary goal of this project is to build an interactive web application that allows users to input customer details and obtain their predicted cluster. The objectives include:

1. Developing an autoencoder-based feature extractor.

2. Implementing a K-Means clustering algorithm for segmentation.

3. Designing an intuitive web interface using Flask and Bootstrap.

4. Visualizing the clustering results using t-SNE plots.

Methodology

1. Data Preprocessing

- The input data consists of customer attributes such as age, income, and spending score.

- The data is normalized using a standard scaler to ensure uniform distribution.

2. Model Development

- A deep autoencoder is trained to extract meaningful representations from the input data.

- The encoder part of the autoencoder is used to transform the scaled data into a lower-dimensional latent space.

- A K-Means clustering algorithm is then applied to group similar customers into clusters.

3. Web Application Development

- Flask is used to create a web-based interface for users to interact with the model.

- Users can enter customer details through a form, and the model predicts their cluster.

- The clustering result is visualized using a t-SNE plot to show the new customer's position relative to existing clusters.

Implementation Details

- **Backend**: Implemented using Flask, TensorFlow, Scikit-Learn, Matplotlib, and Seaborn.

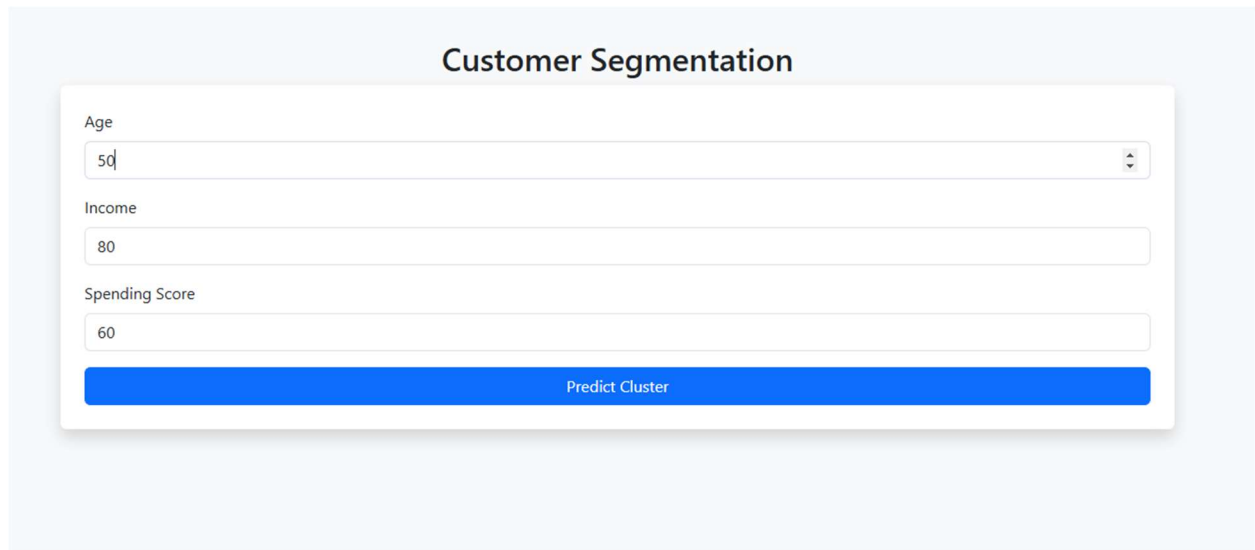- **Frontend**: Designed using HTML, CSS, and Bootstrap for an elegant user experience.

- **Visualization**: The t-SNE technique is applied to project high-dimensional features into a 2D space for intuitive visualization.

Results

- The web application successfully classifies customers into distinct clusters based on the given input.

- The interactive visualization provides an insightful representation of customer segmentation.

- The solution is lightweight, scalable, and easily extendable for real-world applications.
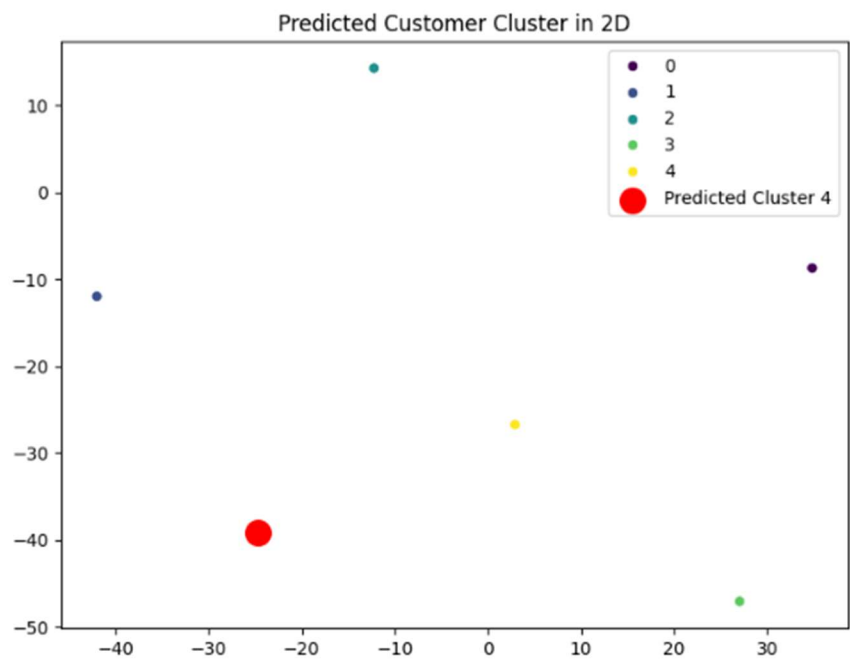
Conclusion

This project demonstrates how deep learning and unsupervised learning techniques can be leveraged for customer segmentation. By deploying the model using Flask, we have created a user-friendly application that enables businesses to categorize customers efficiently. Future improvements may include incorporating additional customer attributes and integrating real-time data for enhanced predictions.

Prediction Result

Predicted Cluster: 4

Predicted Customer Cluster in 2D

Try Again