**Project Report: Facial Image Analysis for Outfit Recommendation**

Abstract:

This project aims to develop a system that recommends outfits based on facial image analysis. Leveraging the CelebA dataset for facial attributes and the Fashion MNIST dataset for outfit categories, the system analyzes facial features and matches them with appropriate fashion styles to provide personalized outfit recommendations.

1. Introduction:

Fashion plays a significant role in self-expression and personal identity. With the rise of image analysis and machine learning techniques, there is an opportunity to leverage facial attributes for personalized outfit recommendations. This project explores the integration of facial image analysis and fashion categorization to create an innovative outfit recommendation system.

2. Methodology:

2.1 Data Collection and Preprocessing:

Datasets:

* The CelebA dataset containing facial images with 40 attribute labels was utilized for facial analysis.
* The Fashion MNIST dataset was used for outfit categories.

Relevant Facial Attributes:

* Focused on attributes that are likely related to fashion preferences: Male, Young, Wearing\_Necktie, Wearing\_Necklace, Eyeglasses, Gray\_Hair, Heavy\_Makeup, Goatee, Wearing\_Hat, Rosy\_Cheeks.

Data Imbalance Handling:

* Addressed imbalances by sampling the data to ensure a more balanced representation of the selected attributes.

2.2 Facial Image Analysis:

* Mapping Facial Attributes to Fashion Categories:
  + Developed a mapping function to classify individuals into specific fashion categories based on the following logic:

def map\_to\_fashion\_mnist(row):

# Criteria for Male Casual

if (row['Male'] == 1 and row['Young'] == 1 and row['Heavy\_Makeup'] == -1):

return 'Young Male Casual'

if (row['Male'] == 1 and row['Young'] == -1 and row['Heavy\_Makeup'] == -1):

return 'Old Male Casual'

# Criteria for Female Casual

if (row['Male'] == -1 and row['Young'] == 1 and row['Heavy\_Makeup'] == -1):

return 'Young Female Casual'

if (row['Male'] == -1 and row['Young'] == -1 and row['Heavy\_Makeup'] == -1):

return 'Old Female Casual'

# Criteria for Male Formal

if (row['Male'] == 1 and row['Young'] == 1 and row['Heavy\_Makeup'] == 1):

return 'Young Male Formal'

if (row['Male'] == 1 and row['Young'] == -1 and row['Heavy\_Makeup'] == 1):

return 'Old Male Formal'

# Criteria for Female Formal

if (row['Male'] == -1 and row['Young'] == 1 and row['Heavy\_Makeup'] == 1):

return 'Young Female Formal'

if (row['Male'] == -1 and row['Young'] == -1 and row['Heavy\_Makeup'] == 1):

return 'Old Female Formal'

return 'Unknown'

2.3 Outfit Recommendation:

* Fashion Categories:
  + Young Male Casual, Old Male Casual, Young Female Casual, Old Female Casual, Young Male Formal, Old Male Formal, Young Female Formal, Old Female Formal.
* Outfit Mapping:
  + Developed a function to suggest outfits based on the fashion category:

def recommend\_outfit(fashion\_category):

outfit\_mapping = {

'Young Male Casual': ['Pullover', 'Trouser', 'Sneaker'],

'Old Male Casual': ['T-shirt/top', 'Trouser', 'Sneaker'],

'Young Female Casual': ['T-shirt/top', 'Trouser', 'Sneaker'],

'Old Female Casual': ['Dress', 'Sandal'],

'Young Male Formal': ['Shirt', 'Trouser', 'Ankle boot'],

'Old Male Formal': ['Shirt', 'Trouser', 'Ankle boot'],

'Young Female Formal': ['Dress', 'Sandal', 'bag'],

'Old Female Formal': ['Dress', 'Sandal', 'bag'],

'Unknown': ['Shirt','Trouser']

}

return outfit\_mapping.get(fashion\_category, [])

* Generating Recommendations:
  + Applied the recommendation function to the fashion category labels and saved the results in a CSV file.

3. Results:

* The system successfully classified individuals into the specified fashion categories based on their facial attributes and provided outfit recommendations accordingly.
* The generated recommendations included a combination of casual and formal attire, depending on the inferred fashion category.

4. Discussion:

* Challenges:
  + Handling data imbalances and selecting relevant attributes were critical steps in the project.
  + The mapping criteria were developed using domain knowledge and iterative refinement.
* Future Work:
  + Incorporating more advanced supervised learning techniques and labeled data to improve classification accuracy.
  + Involving fashion industry experts to enhance the logic for outfit recommendations and better align with current fashion trends.

5. Conclusion:

The project demonstrated the potential of using facial image analysis for personalized outfit recommendations. By leveraging facial attributes and machine learning techniques, the system provided valuable insights into fashion preferences. Future research and development efforts, including expert involvement and advanced modeling, are recommended to enhance the system's accuracy and applicability.

6. References:

CelebA Dataset: <https://mmlab.ie.cuhk.edu.hk/projects/CelebA.html>

Fashion MNIST Dataset: <https://github.com/zalandoresearch/fashion-mnist>

Github:<https://github.com/ManavBVijayan/Style-Recommendation-System-Using-Face-Attributes.git>

Colab:<https://drive.google.com/drive/folders/18irzDa2QYFZrSz5TF1-rF5SGrr5sjGc6?usp=sharing>