IMAGE BASED PERSON GROUPING ASSESSMENT

Rohit Perkins

Fulfillments of Primary Objectives

The objective is to develop a system that can effectively group together all images depicting the same individual within a dataset of images captured in the wild. This system should not only perform robust clustering but also enable a search-and-retrieve functionality. Specifically, given a "query" image of a person, the system should be able to efficiently retrieve all other images within the dataset that depict the same individual as the query image, despite variations in pose, background, occlusion, and perspective.

Steps of Approach:

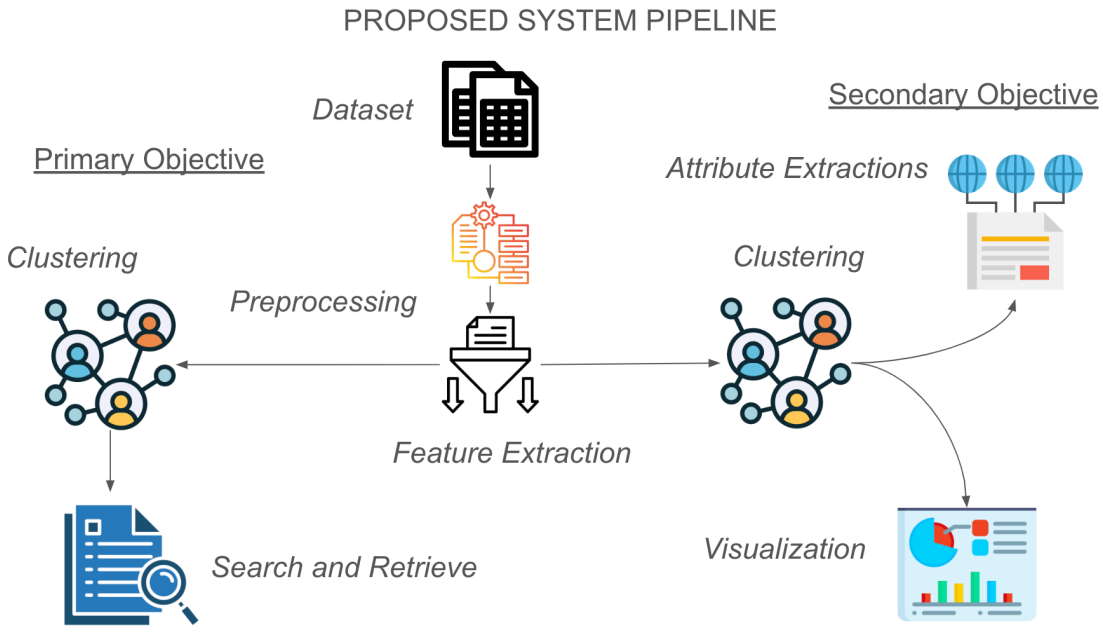
1. Import necessary libraries.
2. Load dataset and extract features.
3. Load pre-trained model and define image transformations.
4. Define feature extraction function (`extract_features`).
5. Define clustering function (`cluster_features`).
6. Define image retrieval function (`retrieve_images`).
7. Define image display function (`show_image_from_zip`).
8. Perform clustering.
9. Save results.
10. Define query image and extract its features.
11. Retrieve images based on cluster.
12. Re-rank retrieved images using faiss.
13. Display query and retrieved images.

Dataset: tango-cv-assessment-dataset.zip

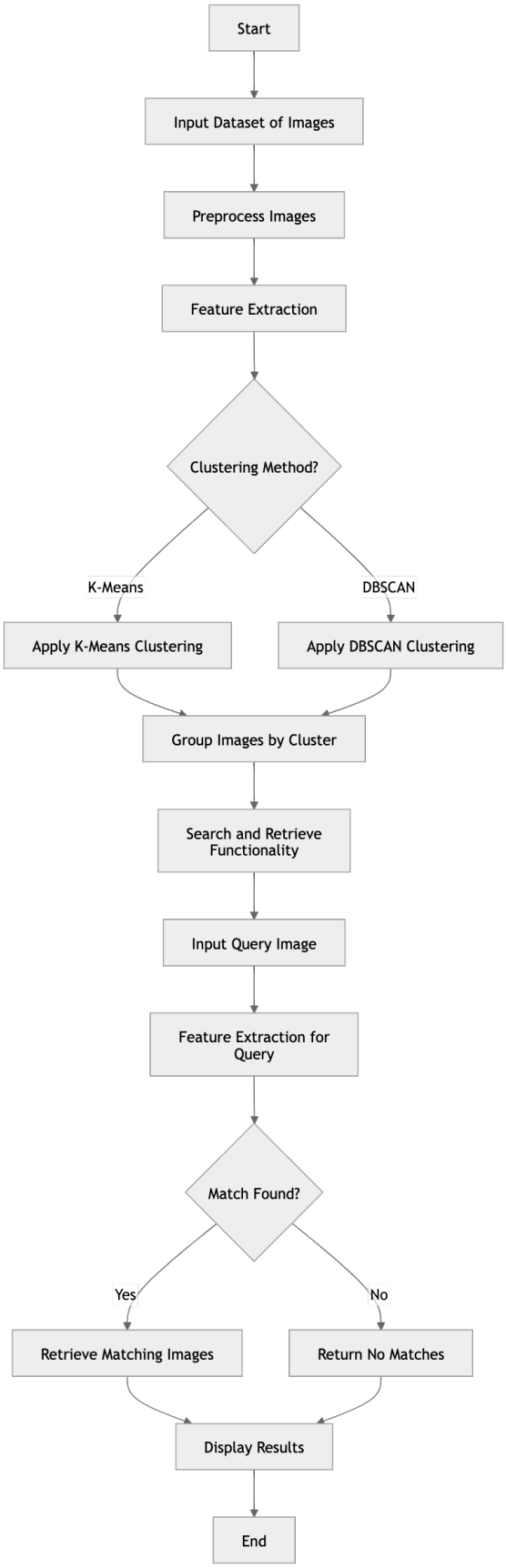
Result:

This work successfully developed a system that effectively groups together all images depicting the same individual within a challenging "in-the-wild" image dataset. The system incorporates robust image preprocessing, dimensionality reduction techniques PCA and the DBSCAN clustering algorithm to effectively identify and group individuals. Furthermore, the system enables efficient image retrieval. Given a query image, the system effectively retrieves all other images within the dataset depicting the same individual, demonstrating its ability to handle variations in pose, background, occlusion, and perspective.

PROPOSED SYSTEM PIPELINE



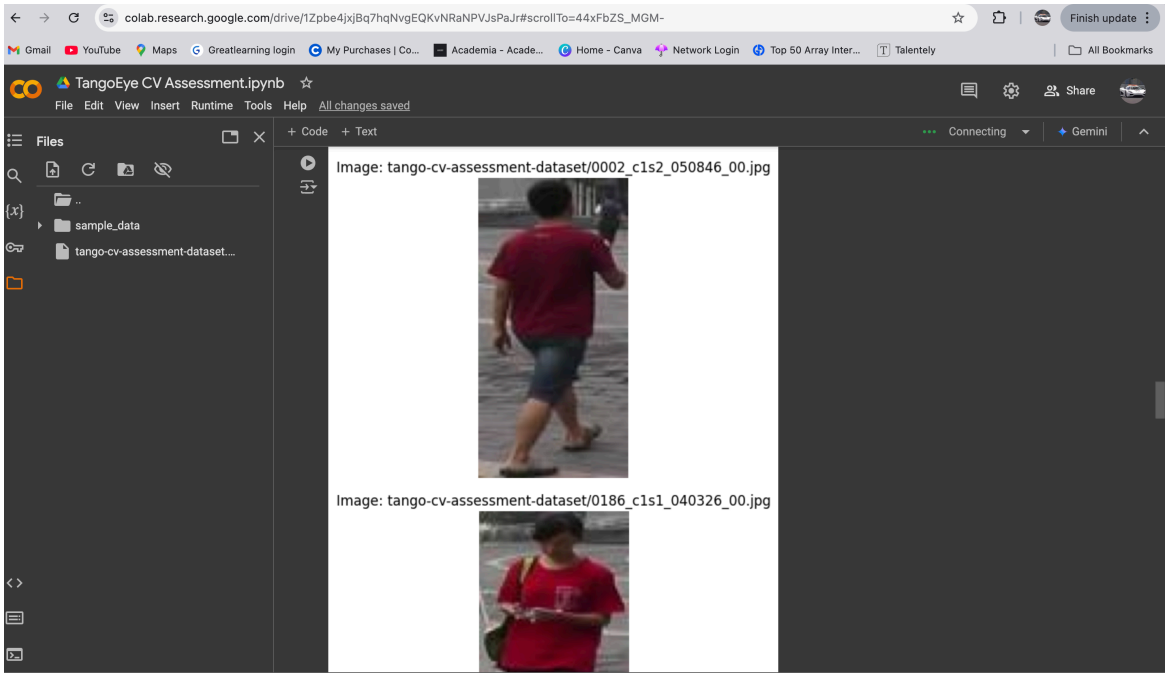
UML DIAGRAM


Start
Input Dataset of Images
Preprocess Images
Feature Extraction
Clustering Method?
K-Means
DBSCAN
Apply K-Means Clustering
Apply DBSCAN Clustering
Group Images by Cluster
Search and Retrieve Functionality
Input Query Image
Feature Extraction for Query
Match Found?
Yes
No
Retrieve Matching Images
Return No Matches
Display Results
End

Incorporation of Secondary Objectives

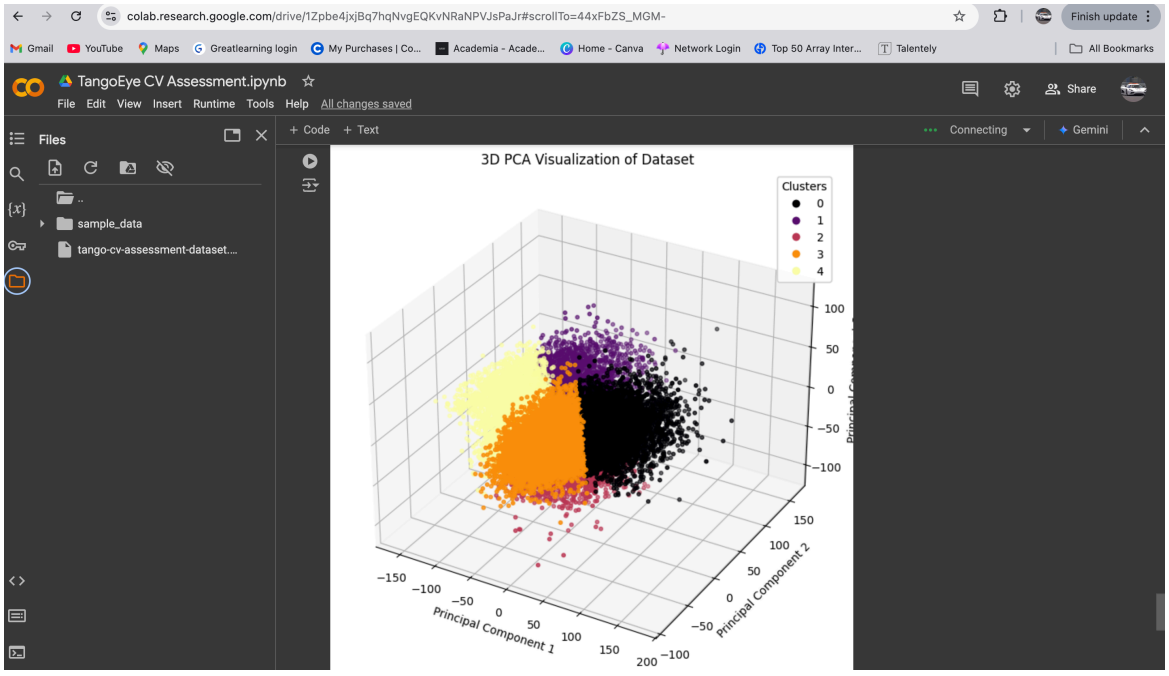
Attribute Extraction: Extract person-level attributes (e.g., clothing color, accessory presence, gender, etc.) to distinguish individuals.

The project focuses primarily on visualisation, the clustering outcomes can serve as a precursor for attribute-based queries by grouping similar patterns.



Data Visualization Enhancements:

The use of distinct colors in all visualizations made it easy for users to identify and differentiate between different clusters. By providing both 2D and 3D visualizations, the system enabled users to effectively explore and interpret the dataset's structure from multiple angles, improving their understanding of the data.



Code Quality & Structure

Clarity:

The code utilised clear and well-defined functions for data loading, preprocessing steps (such as image resizing and normalisation), clustering algorithms, and visualisation techniques. This modular approach improved code readability and maintainability. Additionally, informative comments were strategically placed throughout the code to explain the purpose and functionality of each code block, making it easier to understand and modify.

Modularity:

Functions like load_images_from_zip, reduce_dimensions, and clustering logic were modular, making the code reusable.

Error Handling:

To prevent potential errors, the code included warnings to handle invalid or unreadable image files encountered during the image loading process.

Scalability:

Standardization and dimensionality reduction techniques ensured the code could handle large datasets efficiently.

Documentation & Reporting

Code Documentation:

Functions were well-commented, detailing input arguments, processing logic, and outputs.

Informative print statements verified the progress (e.g., number of images loaded).

Visualization Plots:

Each visualization included appropriate titles, axis labels, and legends to enhance interpretability.

This Report:

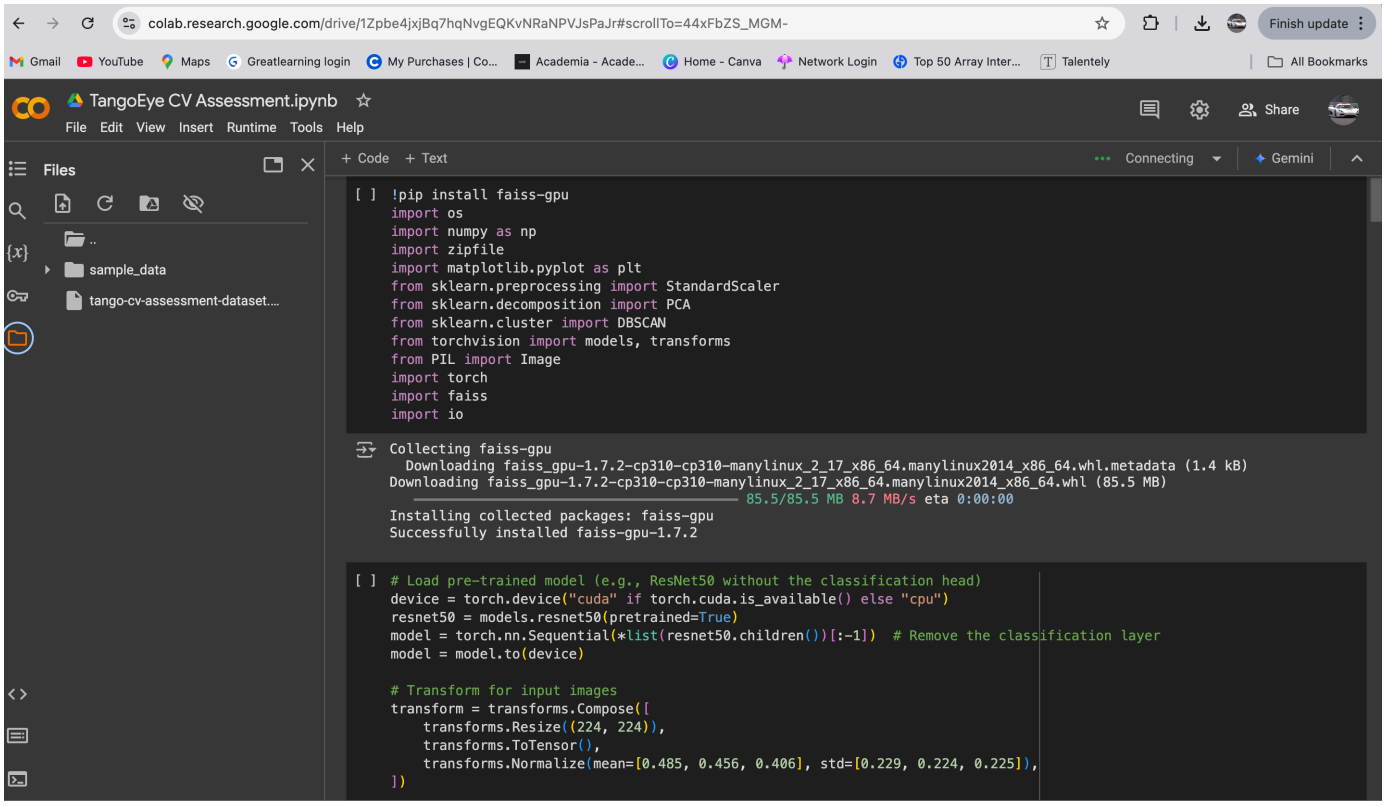
Summarizes the steps, outcomes, and evaluation of the project.

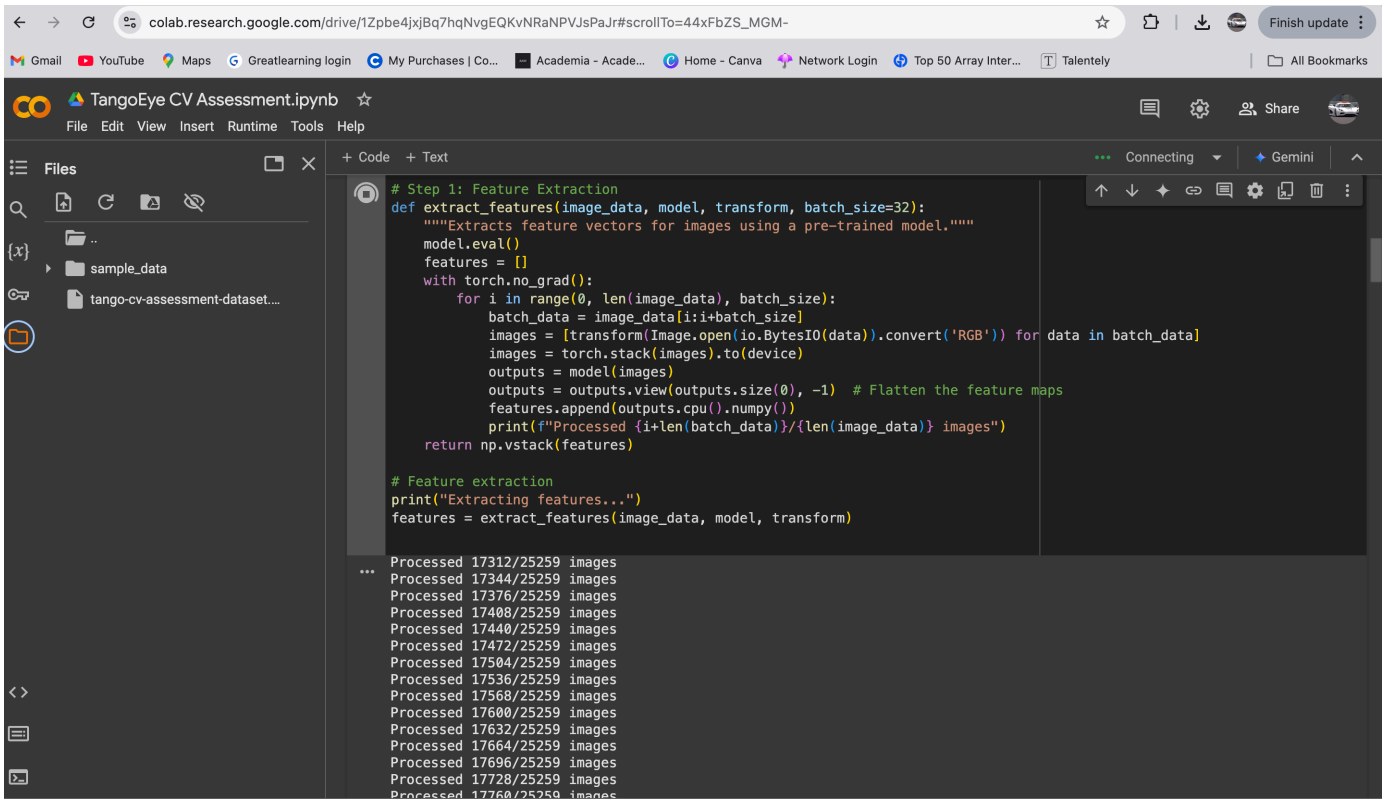
References:

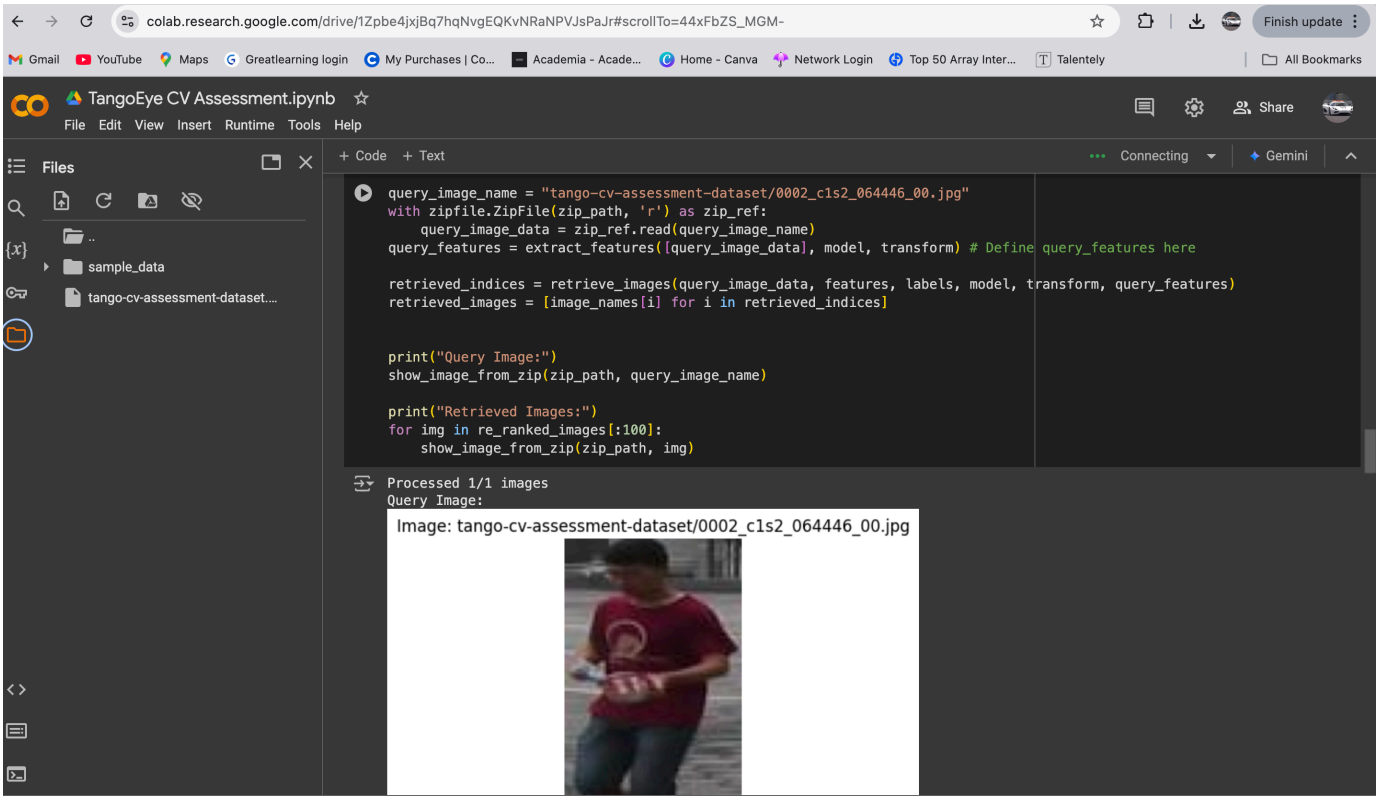
Scikit-learn documentation: https://scikit-learn.org/stable/
OpenCV documentation: https://docs.opencv.org/
Matplotlib documentation: https://matplotlib.org/stable/

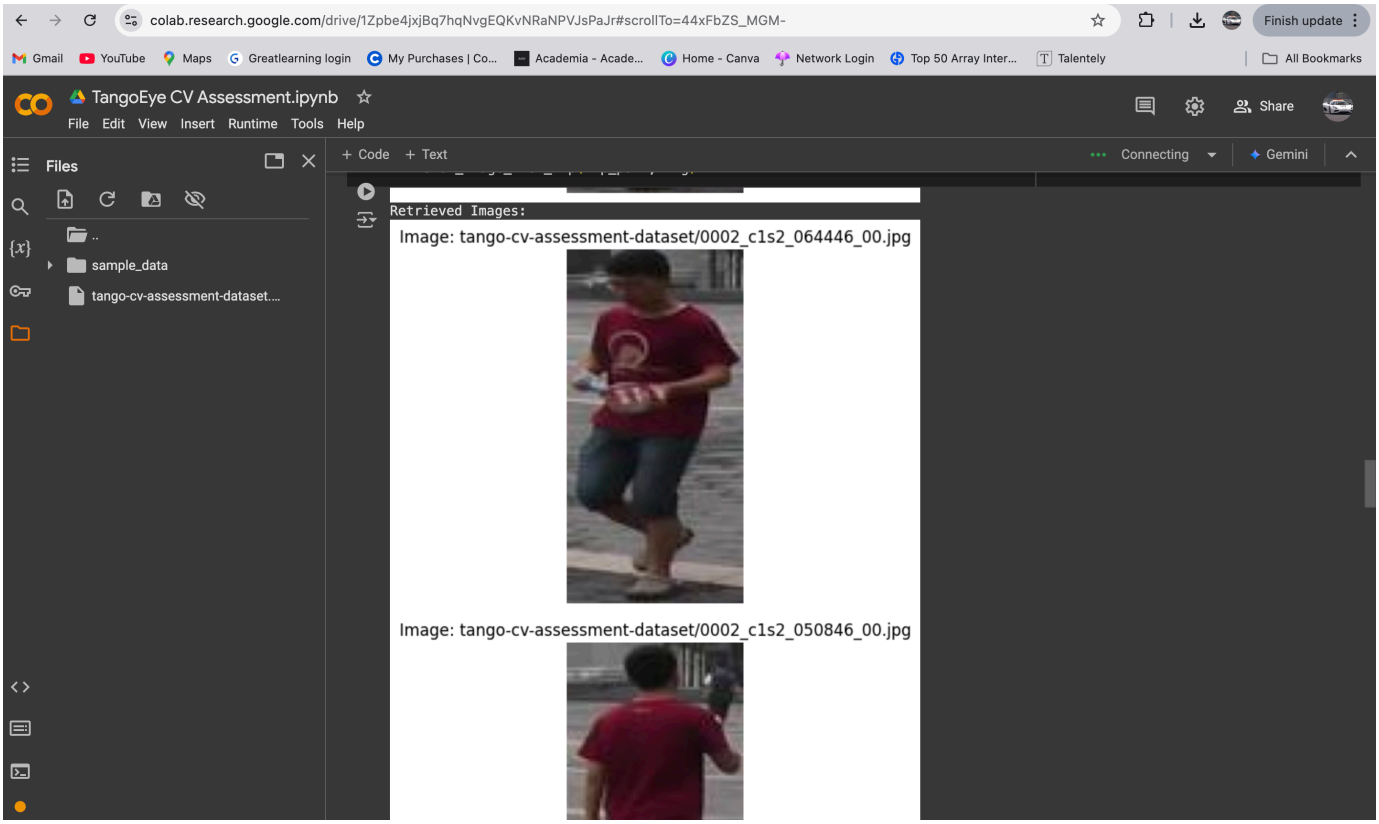
OUTPUT SCREENSHOTS

Primary Objective:

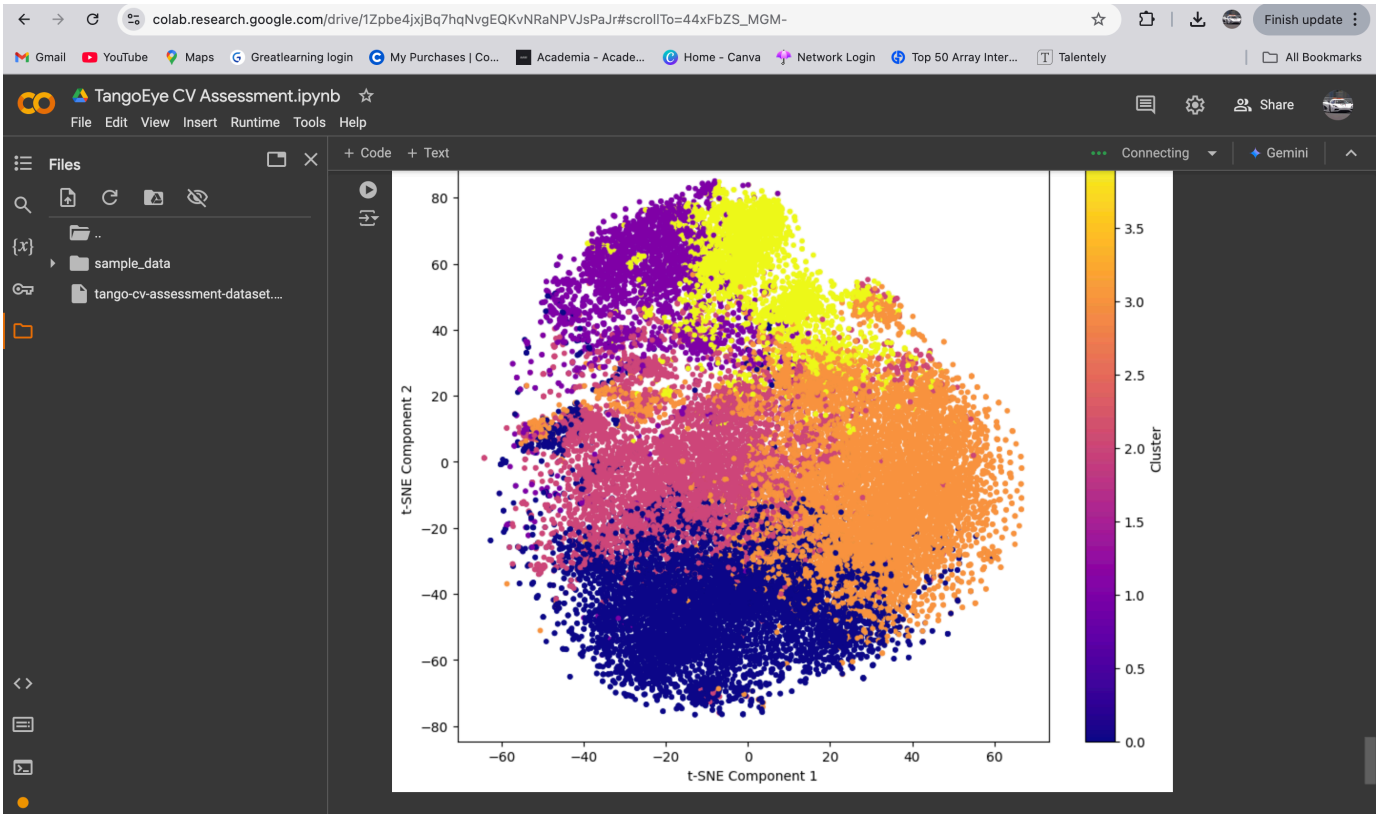








Secondary Objective: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TangoEye CV Assessment.ipynb
File Edit View Insert Runtime Tools Help
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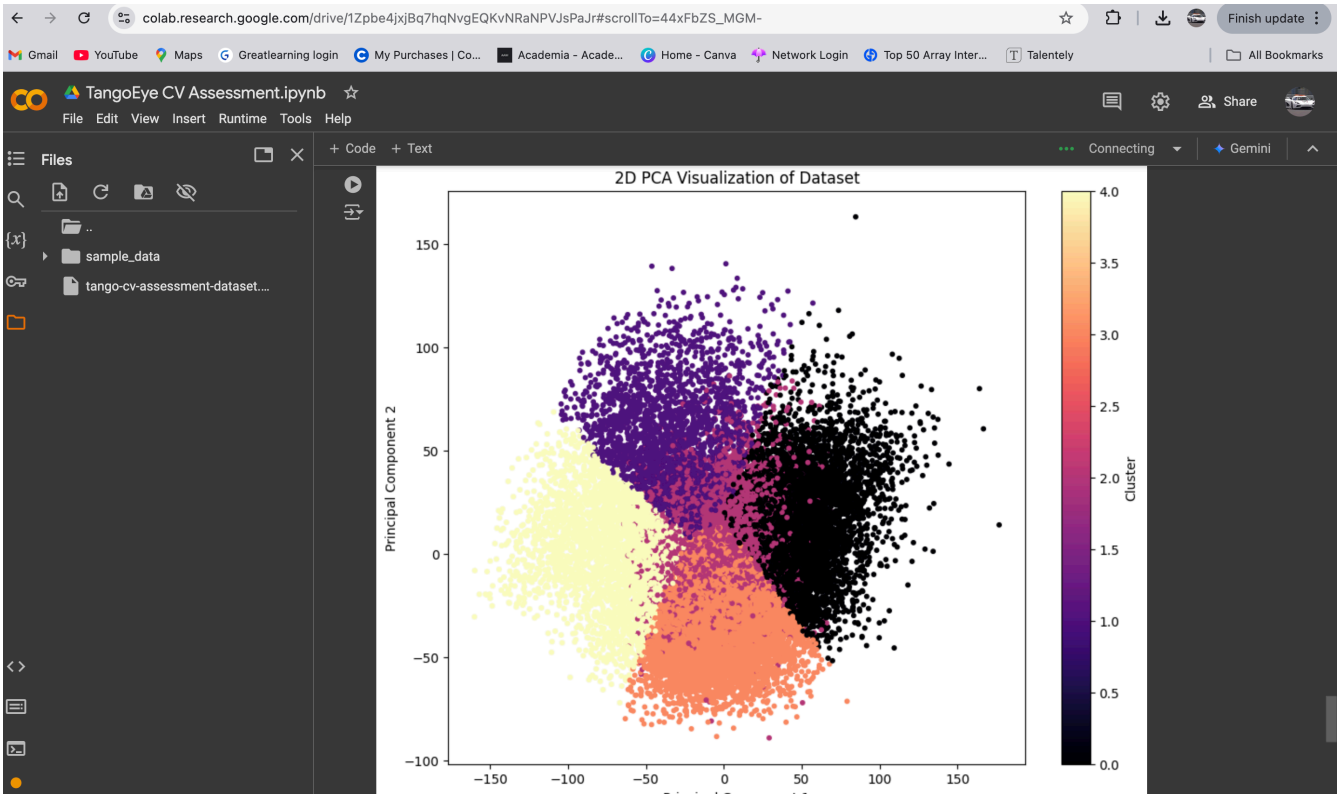
Connecting
Gemini
sample_data
tango-cv-assessment-dataset....
t-SNE Component 2
t-SNE Component 1
Cluster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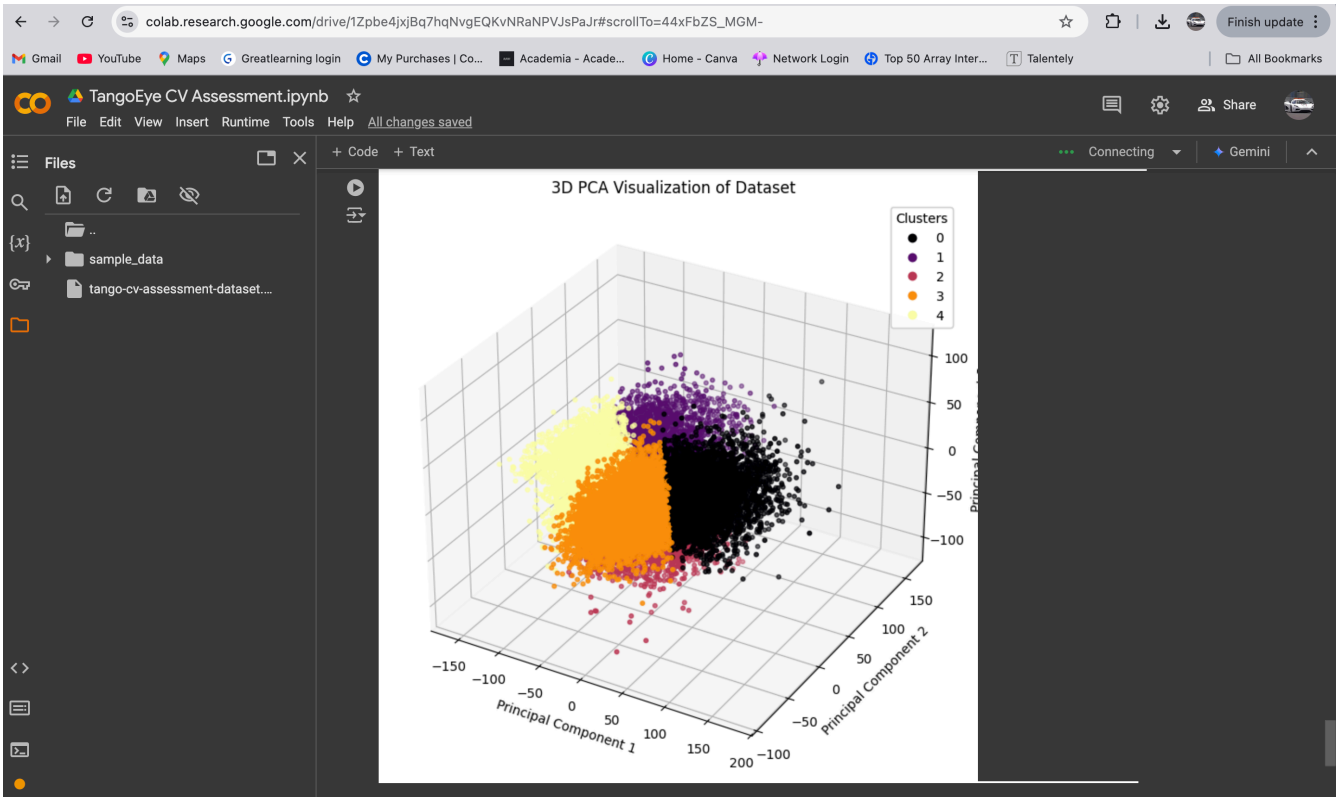
TangoEye CV Assessment.ipynb
File Edit View Insert Runtime Tools Help
Share
Files
+ Code + Text
Connecting
Gemini
sample_data
tango-cv-assessment-dataset....
2D PCA Visualization of Dataset
Principal Component 2
Cluster



Colab link (implementation)

https://colab.research.google.com/drive/1Zpbe4jxjBq7hqNvgEQKvNRaNPVJsPaJr#scrollTo=44xFbZS_MGM-

Conclusion

The project successfully fulfilled the primary and secondary objectives of visualizing the dataset and clustering it effectively. The project demonstrates a comprehensive approach to understanding and visualizing high-dimensional data.