

Overview:

The provided code implements a retrieval system that combines image and text-based similarity scores to find relevant matches for a given image URL and review text. The system uses image features extracted from a pre-trained ResNet50 model and TF-IDF scores for textual data.

Approach and Methodologies:**1. Image Processing and Feature Extraction:**

- Images are processed using techniques like resizing, contrast adjustment, rotation, flipping, brightness adjustment, and exposure modification.
- The pre-trained ResNet50 model is used to extract features from the processed images.
- Features are normalized and saved for further use.

2. Text Preprocessing and TF-IDF Calculation:

- Text data undergoes preprocessing steps, including tokenization, removal of stop words, stemming, lemmatization, and removal of non-alphabetic characters.
- TF-IDF scores are calculated for each review text, considering the entire corpus.

3. Cosine Similarity Calculation:

- Cosine similarity is employed to measure the similarity between image features and TF-IDF scores.
- Separate functions are implemented for image and text retrieval, considering both individual and composite similarity scores.

4. Composite Similarity and Ranking:

- Composite similarity scores are calculated by averaging the cosine similarity of image features and text TF-IDF scores.
- The results are ranked based on composite similarity, and the top three matches are selected.

5. User Interaction:

- The user is prompted to input an image URL and review text.
- The system retrieves and presents the top three matching pairs based on both image and text retrieval.

Assumptions:

1. In the input, only data from the A2_Data.csv file will be allowed.
2. The TF-IDF calculation considers the entire corpus of review texts for IDF values.
3. The image retrieval considers the top URL match, and the text retrieval considers the top three matches.
4. In the text retrieval, cosine similarity of only first URL will be calculated instead of all.

Results:

The system successfully provides the top three composite similarity matches for a given image URL and review text. The composite similarity score combines both image and text-based similarity, providing a more comprehensive measure of relevance.

Challenges and Potential Improvements:

1. **Data Quality:**
 - Challenge: Variations in image quality and textual expressions.
 - Improvement: Robust preprocessing and data augmentation.
2. **Model Performance:**
 - Challenge: Domain-specific nuances not captured by pre-trained models.
 - Improvement: Fine-tune models on domain-specific data.
3. **Limited Training Data:**
 - Challenge: Insufficient labeled data for deep learning models.
 - Improvement: Augment training data or explore transfer learning.
4. **Semantic Gap:**
 - Challenge: Gap between low-level image features and high-level semantics.
 - Improvement: Integrate semantic information from text.
5. **User Feedback Integration:**
 - Improvement: Implement a feedback loop for continuous improvement.

Conclusion:

The retrieval system effectively combines image and text-based similarity scores, offering a practical solution for finding relevant matches. Continuous monitoring and user feedback integration are crucial for refining and enhancing the system's performance over time.

Based on the observed results, the **Text Retrieval Technique** provides **better similarity scores** compared to image retrieval. The richer semantic information present in textual data enables more accurate matching and higher composite similarity scores. Therefore, in this scenario, text retrieval appears to be a more effective technique for finding relevant matches.