

Report

Approach:

For this assignment we were asked to rank documents on the basis of similarity.

In part 1 we fetched the image from the url and applied some preprocessings (same that we applied while processing dump) then with the help of **Resnet18** we extracted relevant features and compare them to the features of images already extracted beforehand. On the basis of cosine similarity we fetched the document respective to that image and ranked them on their scores. We ensured that top 3 documents retrieved are all different (in case of multiple images belonging to a doc).

In part 2 we fetched the text, preprocessed it which involved- tokenization, removal of stop word etc. and computed **tf-idf** (term frequency-inverse document frequency) for each term of each doc and stored the results. Now for a input text I preprocessed the text as before and computed the tf-idf. Now with every document I computed cosine similarity and ranked on the basis of scores. Top 5 documents were retrieved and returned.

In part 3 we computed the composite score which is average of the two scores and ranked the docs on the basis of these new scores.

From the observations: Top three of composite score ranking had two of them from the image retrieval methods which indicates Image retrieval performed better than text retrieval.

Reason can be:

- 1) Performance of Resnet Model in extracting features
- 2) Tf-Idf not being a very efficient method in comparing the text.
- 3) Data bias

Challenges:

I felt extracting features from images and computing TF-Idf scores for images and texts was a challenging process. Also handling such large vectors for the purpose of cosine similarity was a challenge in itself.

Potential Improvements:

Using some other metrics like BM-25 or any other more powerful CNN will help.

Also instead of cosine similarity other similarity metrics will produce better results.

Methodologies:

- Features extracted were saved using pickel module locally in ExtractedFeatures.obj
- TF-IDF scores were computed and Term Frequency of each term and the IDF was also saved.
- Cosine Similarity: A simple Dot product was carried out to compute Cosine Similarity

```
def cosinesim(tensor1, tensor2):
    tensor1 = np.array(tensor1)
    tensor2 = np.array(tensor2)
    len1 = len(tensor1)
    len2 = len(tensor2)
    if(len1 != len2):
        print("Invalid Vector Size")
        return 1
    else:
        sum = 0
        sum1 = 0
        sum2 = 0
        for x, y in zip(tensor1, tensor2):
            sum += x * y
            sum1 += x * x
            sum2 += y * y
        if((sum1 == 0) or (sum2 == 0)): return 0
        return (sum / (math.sqrt(sum1) * math.sqrt(sum2)))
```

Assumptions:

- I have assumed that the image provided will be present in the database already.
- Since in the document some entries had multiple images while computing the respective image score for a text based retrieval. First Image of the list is taken for comparison (mentioned in assignment).
- Top 3 results of each retrieval method are presented.
- Normalization of extracted features
- Atleast three steps are done in both image and text preprocessing.

Results:

Results of each step are mentioned below:

```
Enter Image Link: https://images-na.ssl-images-amazon.com/images/I/716zfnagrk._SY88.jpg
Enter Review: I have been using Fender locking tuners for about five years on various strats and teles. Definitely helps with tuning stability and way faster to restring if there is a break.
USING IMAGE RETRIEVAL
1) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/71btrfddgt._SY88.jpg']
Review: I have been using Fender locking tuners for about five years on various strats and teles. Definitely helps with tuning stability and way faster to restring if there is a break.
Cosine similarity of image [Image used for ranking]: 0.8958204763856533
Cosine similarity of text - 1.0
Composite similarity score: 0.9479102301928266

2) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/719-SQM0ol._SY88.jpg']
Review: These locking tuners look great and keep tune. Good quality materials and construction. Excellent upgrade to any guitar. I had to drill additions holes for installation. If your neck already comes with pre-drilled holes, the
Cosine similarity of image [Image used for ranking]: 0.698708967956975
Cosine similarity of text - 0.07807430535830717
Composite similarity score: 0.38839120107354225

3) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/71Uold5ohrl._SY88.jpg', 'https://images-na.ssl-images-amazon.com/images/I/71eh74Ug0dwl._SY88.jpg']
Review: Fit my 2000 American Standard Telecaster PERFECTLY!
These fit my 2011 MIM Strat so well I ordered another set !!
So easy to install, work fantastic, and look great!!
Cosine similarity of image [Image used for ranking]: 0.683538899136791
Cosine similarity of text - 0.0
Composite similarity score: 0.34167694495683953

USING TEXT RETRIEVAL
1) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/71btrfddgt._SY88.jpg']
Review: I have been using Fender locking tuners for about five years on various strats and teles. Definitely helps with tuning stability and way faster to restring if there is a break.
Cosine similarity of image [First Image from list]: 0.9999999999999999
Cosine similarity of text - 1.0
Composite similarity score: 1.0

2) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/610Dycand8L._SY88.jpg']
Review: I went from fender chrome non-locking to fender gold locking. It made my guitar look beautiful and play beautiful. I think locking tuners are the way to go. If you are new to locking tuners look on YouTube for instructions.
Cosine similarity of image [First Image from list]: 0.14988248151707843
Cosine similarity of text - 0.2730186815275922
Composite similarity score: 0.2114496015223313

3) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/011WNd5iKh._SY88.jpg']
Review: I have both Teles and Strats, and they both rite in this case perfectly. The extra storage areas are great, and you don't get outside storage pockets on a hard case. The case is very well made, durable, and light. I think the
Cosine similarity of image [First Image from list]: 0.22361919119828808
Cosine similarity of text - 0.13024280813764785
Composite similarity score: 0.1769309996796796

USING COMBINED RETRIEVAL
1) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/71btrfddgt._SY88.jpg']
Review: I have been using Fender locking tuners for about five years on various strats and teles. Definitely helps with tuning stability and way faster to restring if there is a break.
Composite similarity score: 1.0

2) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/719-SQM0ol._SY88.jpg']
Review: These locking tuners look great and keep tune. Good quality materials and construction. Excellent upgrade to any guitar. I had to drill additions holes for installation. If your neck already comes with pre-drilled holes, the
Composite similarity score: 0.38839120107354225

3) Image URL: ['https://images-na.ssl-images-amazon.com/images/I/71Uold5ohrl._SY88.jpg', 'https://images-na.ssl-images-amazon.com/images/I/71eh74Ug0dwl._SY88.jpg']
```

References:

For Scraping dump files from the csv I have made use of ChatGpt and modified @anokas code according to my need:

Code: <https://www.kaggle.com/anokas/py3-image-downloader-w-progress-bar>

Thereby I don't claim any ownership of the code.