

Image Based Search Engine Without Metadata

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Abstract

This project attempts to create a image basedsearch engine which searches the relevant image from the set of images. In this we used multiple feature extraction techniques along with deep learning model to extract features and applied similarity measures to reach out to most relevant search results

Motivation

Content based image retrieval is also known as query by image content. Content based means that the search analyzes the content of the image rather than the metadata such as keyword tags or descriptions associated with the image. Most of the search engines retrieve images onthe basis of traditional text-based approaches that rely on captions and tags or other metadata associated with the image. This approach fails when a tag or a keyword represents multiple entirely different object. Content-Based Image Retrieval extracts all relevant features and constructs a multi-dimensional vector and then all further operations are done on this feature vector.

Methodology

A. Dataset

CBIR is implemented on Shoe DataSet that has more than 14000 images belonging to various categories of shoes. The dataset is divided into 4 main categories that are furtherdivided into sub categories. Another dataset that was usedwas Holiday dataset. It contained high resolution images ofvarious holiday destinations. A subset of the dataset withmore than 800 images was used for image search.

B. Preprocessing

Holiday dataset images were of different dimesntion and aspect ratio. In order to train models for these image, theywere scaled to minimum dimensions present in the dataset (240px X 240px). The images were not square therefore images were cropped from the centre for further implementation. Shoe dataset contains atomic object so a mask is created for object detection by applying gray scale conversion, edge detection, gaussian blur and, thresholding.

C. Feature Extraction

To minimize search time and get more relevant images, we extracted features of about 1000 dimensions from an image using these feature extraction techniques and got better results on combining some of them. Some techniques and their uses are as follows

- Hog Feature is an edge detection technique which workson the principal of histogram.

- Histogram matching for images is an important feature for searching similar images as it gives a measure of similarity in color distribution. Similar images have similar color distribution over the image.
- Segmented Histogram feature was used to overcome drawbacks of simple histogram where important features are localized in a segment of an image rather thanwhole image.
- Hu Moment feature is a global feature extraction technique used to extract shape of an important objectfrom images.

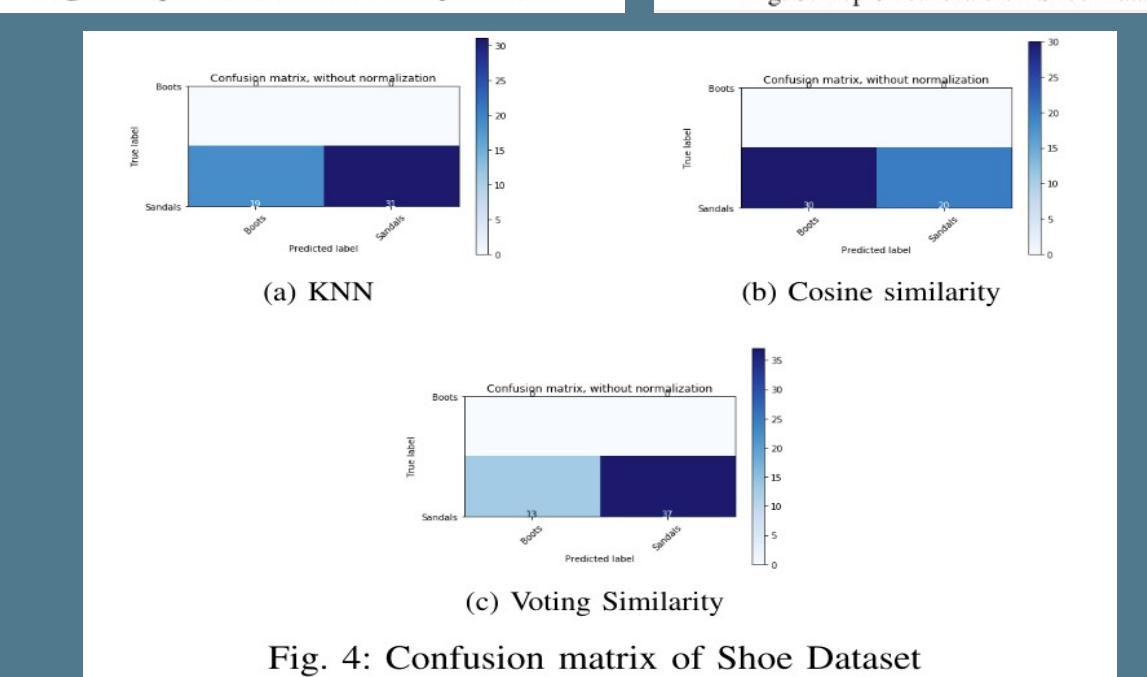
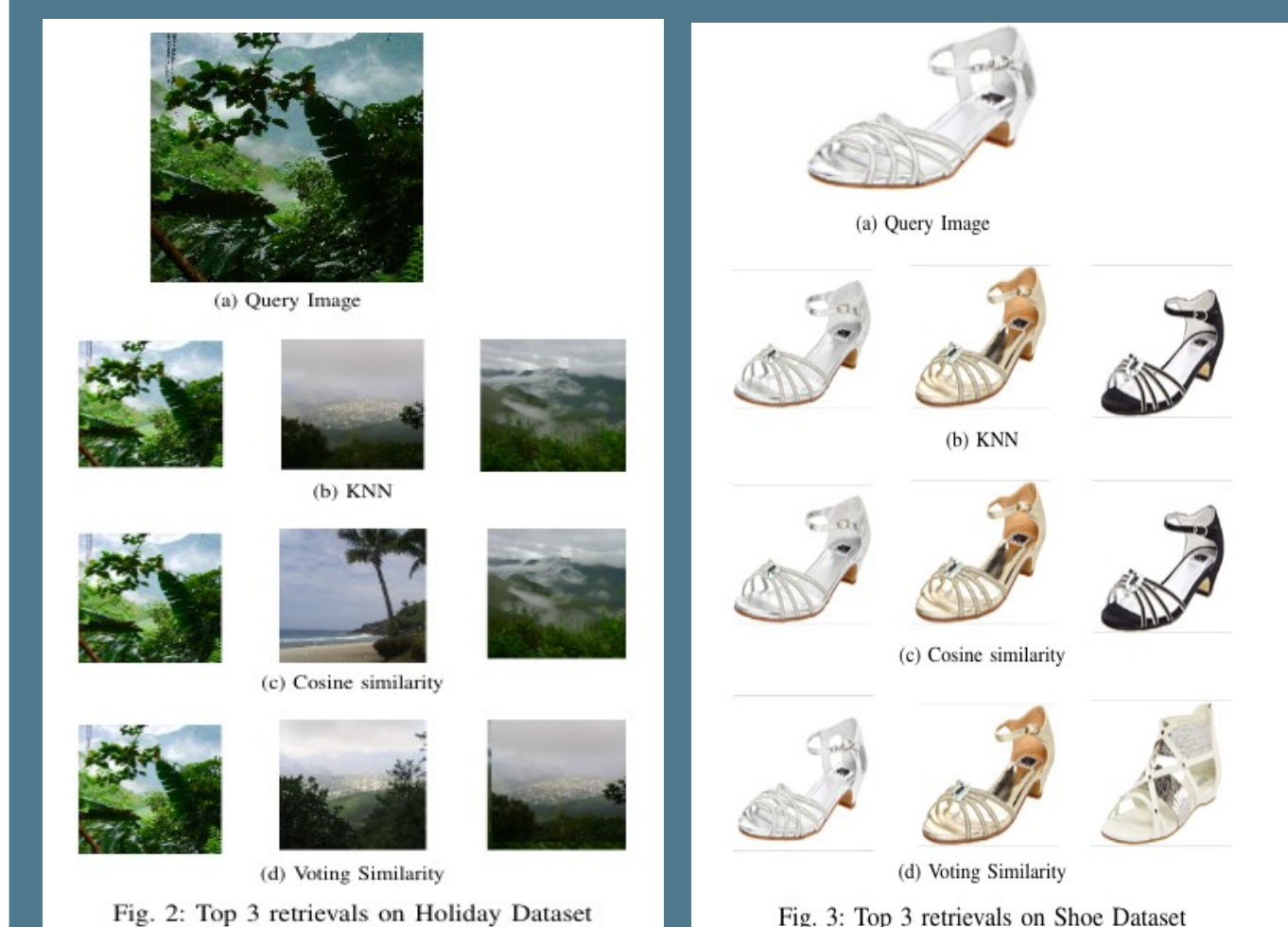
D. Retrieval Techniques

1) K Nearest Neighbours: For a given image, its distance from all images in the dataset is measures and top k nearest images to the query image are retrieved. Analysis was one on multiple distance metrics and it was seen that different query images, show slightly varying results for different metrics.

2) Cosine Similarity: It is a robust and widely used metric to measure similarity between images. Cosine similarity generally produces efficient results compared to basic distance measures like Manhattan Distance.

3) Similarity Voting: Here multiple models like kNN withvariations in distance metric or feature set are used and their results are combined to provide more efficient image searching.

Results



Observation

- Segmented histogram has an advantage over normalhistogram as it incorporates localization of color distribution in images.
- VGG is a powerful feature extraction technique that givepromising results.
- kNN in itself may be very naive but when multiple kNN are used in combination, results produced are morereliable.

References

[1] Z. Rian, V. Christanti and J. Hendryli, "Content Based Image Retrievalusing Convolutional Neural Networks," 2019 IEEE International Conference on Signals and Systems (ICSigSys), Bandung, Indonesia,2019, pp. 1-7, doi: 10.1109/ICSIGSYS.2019.8811089.