Project Report

on

Image To Image Search Engine

Submitted to
Sant Gadge Baba Amravati University
In partial Fulfillment of the Requirement
For the Degree of
Bachelor of Engineering in
Computer Science and Engineering

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2022-23

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING,
SHEGAON – 444 203 (M.S.)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that **Mr. Tejas Masurkar, Ms. Harshita Ughade, Mr. Ashish Mehare, Ms. Shubhangi Thoke** and **Mr. Nikhil Jadhav,** students of final year B.E. in the year 2022-23 of Computer Science and Engineering Department of this institute has completed the project work entitled **"Image To Image Search Engine"** based on syllabus and has submitted a satisfactory account of his work in this report which is recommended for the partial fulfillment of degree of Bachelor of Engineering in Computer Science and Engineering.

29/5/2023
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CERTIFICATE

This is to certify that the project work entitled "**Image To Image Search Engine**" submitted by **Mr Tejas Masurkar, Ms. Harshita Ughade, Mr. Ashish Mehere, Ms. Shubhangi Thoke** and **Mr. Nikhil Jadhav,** students of final year B.E. in the year 2022-23of Computer Scienceand Engineering Department of this institute, is a satisfactory account of his work based on syllabus which is recommended for the partial fulfillment of degree of Bachelor of Engineering in Computer Science and Engineering.

Internal Examiner **External Examiner**

Date: **Date:**

Abstract

In this research, we propose a concept for a search engine that enables users to input a picture from their local database and obtain data from the internet about it. With the exception of the fact that an image is submitted here as a query rather than text-based keywords, this is very similar to the conventional keyword search utilised by the majority of search engines.

Because the image is the search query, finding the information that corresponds to the uploaded image requires analysis and matching of the image's content.

This complicates the search process. This is most apt for searching information about images of dogs or any animal or thing that is identifiable.

Acknowledgement

The real spirit of achieving a goal is through the way of excellence and lustrous discipline. I would have never succeeded in completing my task without the cooperation, encouragement and help provided to me by various personalities.

I would like to take this opportunity to express my heartfelt thanks to my guide ***Prof. V . S. Mahalle,****, for his esteemed guidance and encouragement, especially through difficult times. His suggestions broaden my vision and guided me to succeed in this work. I am also very grateful for his guidance and comments while studying part of my seminar and learnt many things under his leadership.*

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Contents

List of Figures and Tables

Abbreviations

ML	Machine Learning
EDM	Educational Data Mining
LA	Learning Analytics
AI	Artificial Intelligence
GR	Gain Ratio
DT	Decision Tree
LR	Logistic Regression
NB	Naive Bayes
CNN	Convititonal Neural Network
RF	Random Forest

Chapter 1

INTRODUCTION

1. Introduction

1.1. PREFACE

Multimedia databases have drastically increased in size over the past ten years, particularly those kept up by the big web search engines like Google, Bing, and Ask. These search engines' hypertext search techniques are strong enough to produce results that are semantically relevant in response to text queries, but it is difficult to develop semantically meaningful search techniques for multimedia data, such as photos, video, and audio files.

Because of this lack of effectiveness, the majority of current research has focused on content-based picture retrieval in particular. In a nutshell, the topic of content-based image retrieval researches ways to use meaningful content extraction and comparison algorithms for images to index, browse, and query huge image databases.

The choice to update the images on the web page is made based on the degree of significance of the changes that have occurred in the images, and these content extraction methods are also employed for web refreshing approaches involving photos.

Hence, the primary topic of research in the field of content-based image retrieval is the design and development of algorithms and methodologies that can effectively retrieve image content. Because of this, many techniques for comparing photos to one another rely on the extraction of colour or texture descriptors and the organising of that data.

Because it can be translated into a three-dimensional coordinate system that closely resembles human perception, colour information is more widely used. Yet, colour is frequently inappropriate because there may be grayscale images with corresponding colour counterparts. While there are techniques for describing texture and shape, they cannot be used on complex images since they contain numerous minute elements.

1.2. MOTIVATION

Lots of Data is getting collected from online portals related to education like LMS, Moodle, online exam systems etc. But the collected data is not used in productive manner. This data has a lot potential that will help in teaching learning process. So we decided to use some of the data that can be collected by quiz based examination platform and use it for betterment of teaching learning process.

1.3 PROBLEM STATEMENT

As an important information carrier, image has become an important form for people to acquire and transmit information. For massive images, the number of images that each user really needs is very small, so it is of great significance to find the images that users need within the effective time. Based on this, we analyze the research and application of deep learning in image recognition,hoping to further enhance the application effect of deep learning and make it play a greater role in the field of image recognition.

1.4 OBJECTIVES

1. To make a model that is efficient using various Deep Learning algorithms.
2. To create a search engine that should be able to accurately identify images that are similar to the query image based on visual features, such as color, texture, and shape.
3. To create a search engine that should be able to retrieve results quickly, even when searching through large databases of images.
4. To create a search engine that should be able to handle large volumes of images.

1.5 SCOPE AND LIMITATIONS

1.5.1 Scope

(i) Similarity-based image retrieval: This would involve developing a search engine that can retrieve images that are visually similar to a given query image. This could be useful in various applications such as image search, product recommendation, or content-based image retrieval.

(ii) Reverse image search: This would involve developing a search engine that can identify the source of a given image or find similar images that match a specific visual pattern. This could be useful in applications such as copyright infringement detection, brand monitoring, or visual search engines.

(iii) Image annotation and tagging: This would involve developing a search engine that can automatically tag or annotate images based on their visual content.This could be useful in applications such as image categorization, object detection,or image captioning.

1. Visual similarity-based clustering: This would involve developing a searchengine that can cluster images based on their visual similarity, thereby enabling efficient browsing and navigation of large image collections. This could be useful in applications such as visual analytics, image management, or digital libraries.

2. Domain-specific search: This would involve developing a search engine that can retrieve images based on specific domain knowledge or criteria, such as medical images, satellite images, or artistic images. This could be useful in applications such as medical diagnosis, environmental monitoring, or art historyresearch.

3. Hybrid search engines: This would involve developing a search engine that combines different types of search methods and sources, such as text-based search,metadata-based search, or social media-based search, with image-to-image similarity search. This could be useful in applications such as multimedia search,

e-commerce, or social media analytics.

Overall, the scope of an image-to-image search engine project would depend on the specific use case, domain knowledge, data availability, and performance requirements..

ii. Limitations

1. Image-to-image search engines may not always be accurate in matching images based on visual similarity, especially when dealing with complex or abstract images thatdo not have a clear visual structure..

2. Image-to-image search engines may not perform well when dealing with low-quality or low-resolution images, or when the database has limited or biased image samples.

3. Image-to-image search engines may not be effective in capturing the semantic meanings or contexts of images, which can be important in some applications such as text-image retrieval or image-based question answering.

4. This can limit the scalability and real-time performance of the search engine.

b. ORGANIZATION OF PROJECT

The project is organized as follows:-

Chapter 1 gives introduction to the project.

Chapter 2 provides literature survey of the project.

Chapter 3 explains materials and methods required to complete the project.

Chapter 4 provides analysis of project.

Chapter 5 provides design phase of the project.

Chapter 6 provides how the project is implemented.

Chapter 7 provides result of the project.

Chapter 8 gives conclusion and discusses future work.

Chapter 2

LITERATURE SURVEY

2. LITERATURE SURVEY

Paper [1] Zhiping Wang1, *, Cundong Tang1, 2, Xiuxiu Sima1 , Lingxiao Zhang1 1 Software Engineering College, Nanyang Institute of Technology, Nanyang 473004, China 2School of Information Science and Technology, Northwest University, Xi'an 710127, Chinae-mail: nykaoshi@163.comDataset Features: -

Abstract—Image classification is an important research direction in the field of computer vision. Image classification algorithm can distinguish different kinds of pictures by classifying the features extracted from the original pictures. In essence, deep learning is actually the technology of simulating and analyzing the human brain through the construction of deep neural network, or learning and interpreting related data by simulating the human brain. As an important information carrier, image has become an important form for people to acquire and transmit information. For massive images, the number of images that each user really needs is very small, so it is of great significance to find the images that users need within the effective time. Based on this, this paper analyzes the research and application of deep learning in image recognition, hoping to further enhance the application effect of deep learning and make it play a greater role in the field of image recognition.

Paper [2] Payal A. Jadhav, Dr. Prashant N. Chatur, and Kishor P. Wagh 1 Master of Technology Scholar, 2 Head, Department of Computer Science and engineering, 3 Assist. Prof. Department of Information Technology Govt. COE Amravati, Maharashtra, India-444604 (e-mail: payal.a.jadhav@ gmail.com, prashant_chatur@rediffmail.com, kishorwagh2000@yahoo.com).

Abstract— Todays diversified user query over web search engine for information retrieval; semantic information for relevant web document on web has been plethora of web search research. A lot many web search engine developed based on semantic meaning like ontolook, swoogle etc., for finding relevant information, which helps to find user based semantic meaning related documents. The concept of semantic similarity or semantic information widely focused in many important fields such as Machine Learning, Artificial Intelligence, Cognitive Science, Natural Language Processing and Web Information Retrieval etc.,

Traditional web search engines and semantic web search engines relates user keyword with terms, entities, texts, documents which have semantic correlation with user query. Both search engines does not use images within web pages to find more relevant information. Now in this paper we have formulated a web document integrated ranking method based on text semantic information and image based object matching information. This integrated approach presented in this paper does not depend upon semantic information of user query but also consider image appearing within web pages to find more relevant information. Approach proposed in this paper includes finding semantic information using ontology based meaning of user query and feature based object matching over image to find image matching score. In proposed approach combined use of ontology based semantic information and image based object matching score will improve web document ranking.

Paper [3] Probabilistic Visual Search for Masses Within Mammography Images using Deep Learning

Mehmet Giinhan Ertosun, PhD Department of Radiology Stanford School of Medicine Stanford, CA USA gunhan@stanford.edu

Abstract- We developed a deep learning-based visual search system for the task of automated search and localization of masses in whole mammography images. The system consists of two modules: a classification engine and a localization engine. It first classifies mammograms as containing a mass or no mass using a deep learning classifier, and then localizes the mass(es) within the image using a regional probabilistic approach based on a deep learning network. We obtained 85% accuracy for the task of identifying images that contain a mass, and we were able to localize 85% of the masses at an average of 0.9 false positives per image. Our system has the advantages of being able to work with an entire mammography image as input without the need for image segmentation or other pre-processing steps, such as cropping or tiling the image, and it is based on deep learning with unsupervised feature discovery, so it does not require pre-defined and hand-crafted image features.

Paper [4] The study of this paper tested a pre-trained convolutional neural network using natural images of a cat-dog dataset with around 4000 images for each category. The optimal parameter settings resulted in a classification accuracy of 88.31%, and further testing with various epochs and restricted layers showed limited potential for improvement.The study suggests that increasing training data or refining the network design and hyperparameters could improve test accuracy.

Chapter 3
MATERIALS & METHODOLOGY

3. MATERIALS & METHODOLOGY

3.1 MACHINE LEARNING

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values. Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well assupports the development of new products. Many of today's leading companies, suchas Facebook, Google and Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies. Machine learning (ML) is the study of computer algorithms that can improve automatically through experience and by the use of data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

A subset of machine learning is closely related to computational statistics, whichfocuses on making predictions using computers; but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. Some implementations of machine learning use data and neural network in a way that mimics the working of a biological brain. In its application across business problems, machine learning is also referred to as predictive analytics. Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well as supports the development of new products. Many of today's leading companies, such as Facebook, Google and Uber, make machine learninga central part of their operations. Machine learning has become a significant competitive differentiator for many companies.

3.2 TYPES OF MACHINE LEARNING ALGORITHMS

Based on the methods and way of learning, machine learning is divided into mainly four types, which are:

1. Supervised Machine Learning
2. Unsupervised Machine Learning
3. Semi-Supervised Machine Learning
4. Reinforcement Learning

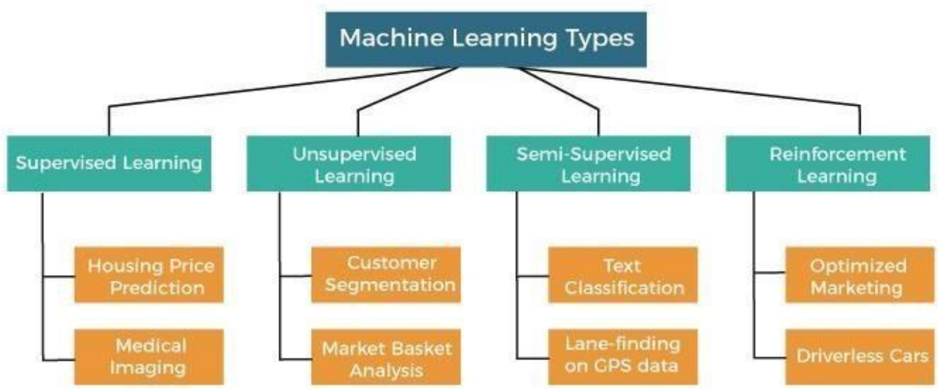

Figure 1: Types of Machine Learning

3.2.1 Supervised Machine Learning

As its name suggests, Supervised machine learning is based on supervision. It means in the supervised learning technique, we train the machines using the "labelled" dataset, and based on the training, the machine predicts the output. Here, the labelled data specifies that some of the inputs are already mapped to the output. More preciously, we can say; first, we train the machine with the input and corresponding output, and then we ask the machine to predict the output using the test dataset. The main goal of the supervised learning technique is to map the input variable(x) with the output variable(y).

Categories of Supervised Machine Learning :

Supervised machine learning can be classified into two types of problems, which are given below:

a) Classification

b) Regression

a) Classification

Classification algorithms are used to solve the classification problems in which the output variable is categorical, such as "Yes" or No, Male or Female, Red or Blue, etc. The classification algorithms predict the categories present in the dataset.

b) Regression

Regression algorithms are used to solve regression problems in which there is a linear relationship between input and output variables. These are used to predict continuous output variables, such as market trends, weather prediction, etc.

Some popular Regression algorithms are given below:

- Simple Linear Regression Algorithm
- Multivariate Regression Algorithm
- Decision Tree Algorithm

3.2.2 Unsupervised Machine Learning

Unsupervised learning is different from the Supervised learning technique; as its name suggests, there is no need for supervision. It means, in unsupervised machine learning, the machine is trained using the unlabeled dataset, and the machine predicts the output without any supervision.

In unsupervised learning, the models are trained with the data that is neither classified nor labelled, and the model acts on that data without any supervision. The main aim of the unsupervised learning algorithm is to group or categories the unsorted datasetaccording to the similarities, patterns, and differences. Machines are instructed to find the hidden patterns from the input dataset.

In this project our aim is to predict the type of learner i.e. slow and active learner. For the purpose we need a classification algorithm that can give most accurate results. As per the research done till date, we have found that decision tree is the most suited algorithms for the concerned purpose . Although we have shown the comparison of several other algorithms in the upcoming part.

3.3 SUPERVISED ALGORITHMS

3.3.1 Decision Tree

- Decision Tree is a Supervised learning technique that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where internal nodes represent the features of a dataset, branches represent the decision rules and each leaf node represents the outcome.
- In a Decision tree, there are two nodes, which are the Decision Node and Leaf Node. Decision nodes are used to make any decision and have multiple branches, whereas Leaf nodes are the output of those decisions and do not contain any further branches.
- The decisions or the test are performed on the basis of features of the given dataset.
- It is a graphical representation for getting all the possible solutions to a problem/decision based on given conditions.
- It is called a decision tree because, similar to a tree, it starts with the root node, which expands on further branches and constructs a tree-like structure.

3.3.2 Deep Learning In Image Recognition

Artificial neural networks, which are network structures with several hidden layers, are the source of deep learning. To categorise static photos, CNN (Convolutional Neural Network Model) is typically used. Back propagation algorithm was created as a result of artificial neural network research entering a bottleneck with the continued advancement of social science and technology. The artificial neural network's learning level gradually deepens as a result of this technology's ability to adapt to more complex data calculations.

Convolution kernels are the type of shared weights that neurons inside the same feature plane can use. Through learning during network training, the convolution kernel can acquire appropriate weights, and at the same time, sharing weights can reduce connections between networks at all levels, effectively lowering the fitting risk. Databases are crucial to the work of classifying images, particularly in the deep learning-dominated world of today. The quality of the trained model is frequently heavily influenced by the quality of the database. The images in the training set and the test set should ideally be positioned uniformly.

The most logical way to raise the depth and breadth of deep convolutional neural networks, where depth is the number of layers and width is the number of nodes in each layer, is to improve the performance of these networks. Deep learning shows the network's depth, tries to learn features at various levels, and then stresses the value of learning, or learning high-level features from low-level features. A multi- layer network is built so that the input data takes the sequential action of multiple hidden layers, that is, the output of one hidden layer is the input of another hidden layer, and the feature maps of various levels are obtained. This allows complex function problems to be solved by solving relatively few parameters. The cooperativetraining algorithm was initially created for multiview data, but later, when dealing with single-view data, better algorithms emerged that made use of various classification learning algorithms, various data sampling techniques, and even various parameter settings to make a noticeable difference.

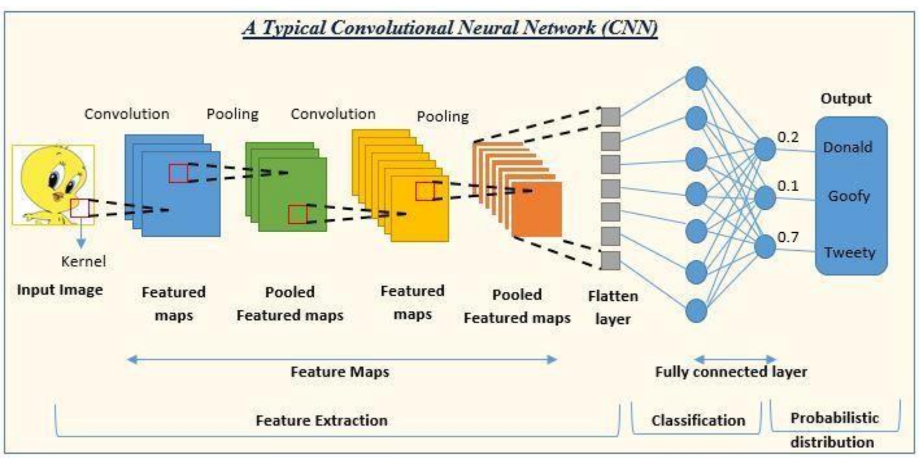

Fig. Convolutional Neural Network(CNN)

3.3.3 VGG 16 Model

The Visual Geometry Group (VGG) at the University of Oxford created the convolutional neural network (CNN) architecture known as VGG16. In the realm of computer vision, it is a widely used model, especially for picture classification applications. VGG16's architecture consists of 16 layers, including 3 fully connected levels and 13 convolutional layers. The 3x3 convolutional layers' filters have a stride 1 and padding 1 value. The final output layer has 1000 neurons, which correspondsto the 1000 classes in the ImageNet dataset, while the fully linked layers have 4096 neurons each.

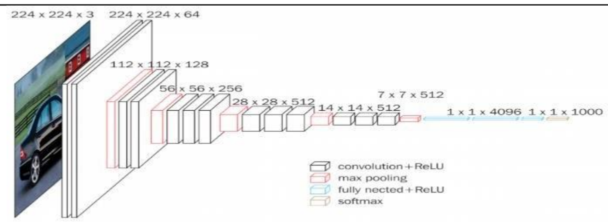

Fig - VGG16 – Convolutional Network For Classification And Detection

VGG16 is remarkable for using a modest (3x3) filter size throughoutthe network, allowing for deeper topologies without substantially increasing the number of parameters. Its homogeneous architecture, which makes it simple to comprehend and use, is another advantage. In a number of image classification benchmarks, notably the ImageNet Large Scale Visual Recognition Competition (ILSVRC) in 2014, VGG16 has produced state-of-the-art results. Unfortunately, due to the 138 million parameters, it is computationally expensive and unusable for some applications. VGG19, a modification of the VGG architecture with 19 layers, as well as lesser iterations like VGG11 and VGG8, have been suggested as solutions to this problem. In addition, rather than starting from scratch, pre-trained VGG models can be improved using transfer learning techniques on smaller datasets.

3.3.5 Application Of Keras And Flask

Keras is an open-source neural network library written in Python. It is designed to provide a user-friendly interface for building deep learning models with support for convolutional neural networks, recurrent neural networks, and other common architectures. Keras is built on top of TensorFlow, allowing it to leverage the underlying computational graph capabilities of TensorFlow. It has become a popular choice for both beginners and experienced deep learning practitioners due to its simplicity, flexibility, and ease of use. Keras also provides pre-trained models for a wide range of tasks, making it easy to start building high-performing models without requiring extensive domain expertise. Keras is a high-level neural networks API, written in Python and capable of running on top of popular deep learning frameworks such as TensorFlow, Microsoft Cognitive Toolkit, and Theano. It was developed with a focus on enabling fast experimentation and prototyping of deep learning models.

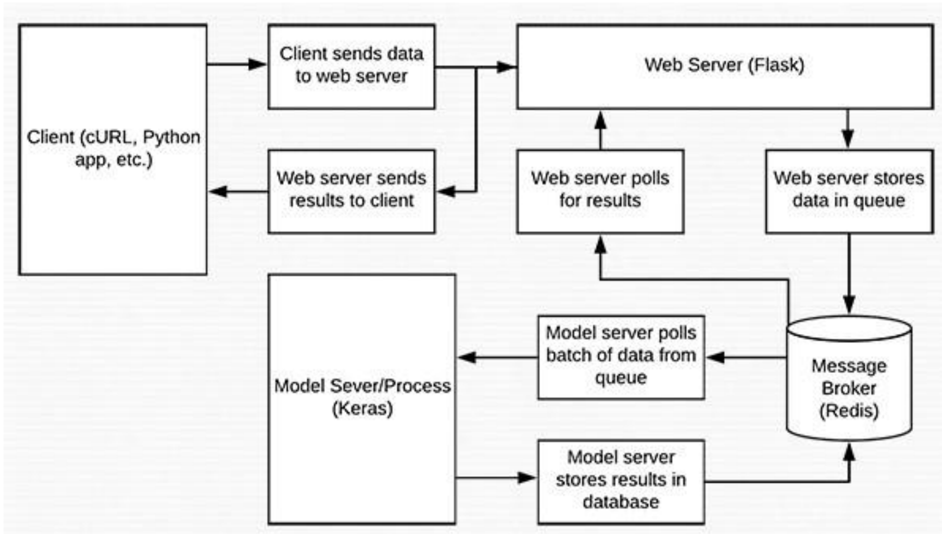

Fig. Keras and Flask Model

Keras provides a simple and intuitive interface for building neural networks, including support for convolutional neural networks (CNN), recurrent neural networks (RNN), and combinations of the two. It also includes a wide range of pre- trained models, which can be used for a variety of tasks such as image classification,object detection, and natural language processing. One of the key features of Keras isits ability to run seamlessly on both CPU and GPU, allowing for fast training and inference of deep learning models. It also includes a range of tools for data preparation and preprocessing, such as data normalization, data augmentation, and feature scaling. Keras has gained widespread popularity in the deep learning community due to its ease of use, flexibility, and scalability. It has become one of themost widely used deep learning frameworks in both academia and industry.

3.4 Methodology

3.4.1 Data Collection

Data collection is a critical step in developing an image-to-image search engine as it directly impacts the accuracy and performance of the search engine. The following are some considerations for data collection in an image-to-image search engine:

Data sources: There are several sources of data for image-to-image search engines, including public datasets, user-generated content, and commercial image databases. The choice of data source depends on the specific use case and the availability of data.

Image selection: The selection of images for the search engine should be representative of the target domain or application. This ensures that the search engine can generalize well to unseen images and produce accurate results. It is also important to ensure that the selected images cover a wide range of visual variations and complexities.

Image preprocessing: The quality of the images in the dataset is crucial for the performance of the search engine. Image preprocessing techniques such as resizing, cropping, and normalization can help standardize the image size and quality, and remove any noise or artifacts that may negatively impact the search engine performance.

Labeling and annotation: In order to train an image-to-image search engine, it is necessary to label and annotate the images with relevant information such as image captions, keywords, or semantic labels. This information can help improve the accuracy and efficiency of the search engine by enabling semantic search and filtering.

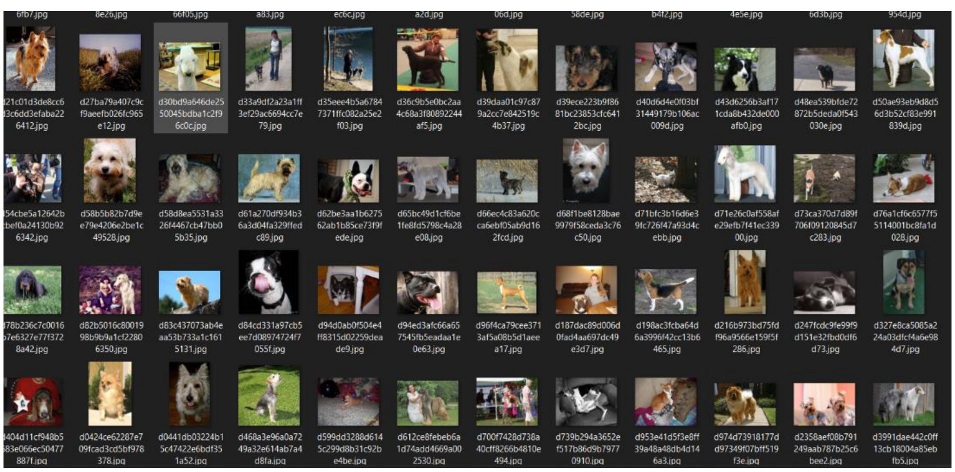

Fig. dataset used in the project

4.4.3 Model Selection

The selection of a model for an image-to-image search engine is critical for achieving high accuracy and efficient performance. The following are some considerations for model selection:

Type of model: There are several types of models that can be used for image-to-image search engines, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and graph neural networks (GNNs). CNNs are the most commonly used model for image feature extraction due to their ability to capture spatial information in images.

Architecture: The architecture of the model should be selected based on the specific use case and the complexity of the images. For example, a simple CNN architecture such as AlexNet may be suitable for low-resolution images, while a more complex architecture such as ResNet or Inception may be required for high-resolution or complex images.

Pretrained models: Pretrained models that have been trained on large datasets such as ImageNet can be used as a starting point for image feature extraction. This can help reduce the amount of training required and improve the performance of the search engine.

Transfer learning: Transfer learning techniques can be used to fine-tune pretrained models for the specific domain or application. This involves retraining the last few layers of the model with a smaller dataset to adapt the model to the specific task.

Optimization algorithms: Optimization algorithms such as stochastic gradient descent (SGD) or Adam can be used to optimize the model parameters and improve the accuracy and efficiency of the search engine.

Chapter 4
ANALYSIS

4. Analysis

4.1. Detailed Problem Statement:

As an important information carrier, image has become an important form for people to acquire and transmit information. For massive images, the number of images that each user really needs is very small, so it is of great significance to find the images that users need within the effective time. Based on this, we analyze the research and application of deep learning in image recognition, hoping to further enhance the application effect of deep learning and make it play a greater role in the field of image recognition.

An image-to-image search engine is a type of search engine that allows users to find visually similar images based on an example image. Instead of relying on text-based queries, users can input an image and the search engine will analyze the visual features of that image and search for other images with similar characteristics. This type of search engine is particularly useful for findingimages that are difficult to describe in words or for identifying variations of a particular image. Image-to-image search engines use advanced computer vision and machine learning algorithms to compare and match images based on color, texture, shape, and other visual features. These search engines have a wide range of applications, including e-commerce, art and fashion, and visual search engines for the web.

Image-to-image search engines can also be used to build visual search engines for the web. This technology is particularly useful for search engines that specialize in finding images, such as stock photography websites or art databases. With image-to-image search, users can easily find variations of a particular image or similar images that match their aesthetic preferences.. Overall, image-to-image search engines are a powerful tool for visual search and discovery. As computer vision and machine learning algorithms continue to improve, we can expect these search engines to become even more accurate and useful for a wide range of applications.

4.2. Requirement Analysis:

4.2.1. Functional Requirement

Functional requirement defines a function of a system or its component. A function is described as a set of inputs, the behaviour, and outputs. Basically requirements are statements that indicate what a system needs to do in order to provide a capability.

Hardware Requirement:

RAM: 2GB

Operating System :Windows 7(or above)

Processor: Intel core i3(or above)

Hard disk: 50GB

Software Requirement:

Jupyter or Colaboratory

Python Language

Visual Studio Code

4.2.2. Non Functional Requirement

The non-functional requirement elaborates a performance characteristic of the system. Non-functional requirements of this project are:

- Accessibility: The system is easily accessible.
- Availability: The system is available 24*7
- Recoverability: The system is easily recovered.
- Maintainability: The system is easy to be understood and maintain.
- Simplicity: The system has easy to interact User Interface.
- Efficiency: The system is very efficient.
- Robustness: The system is strong.

4.2.3. System Diagram

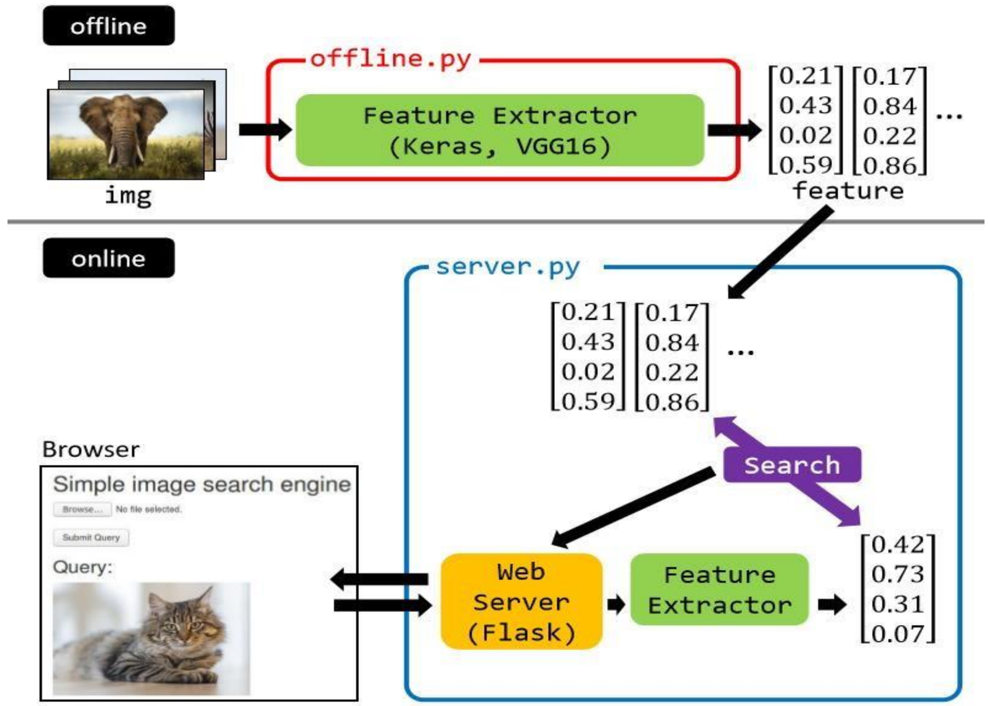

Figure 8: Diagram of System

Chapter 5
DESIGN

5. Design

1.1 Design goal:

The design goal for an image-to-image search engine project would be to create a system that can efficiently and accurately match input images with visually similar images in a database.

To achieve this, the project should aim to:

Develop an effective image feature extraction algorithm that can accurately capture the key visual characteristics of an image and represent them in a feature space.
Design a search algorithm that can efficiently search through the feature space to find the most visually similar images to a given query image.
Build a large and diverse image database that covers a wide range of image categories and contains high-quality images.
Ensure that the system can handle large-scale image search queries and deliver results in a timely manner.
Develop a user-friendly interface that allows users to easily upload query images and view search results.
Continuously improve the system's performance through regular updates and algorithm optimization.
Ensure that the system is robust and can handle various image variations, such as changes in lighting, color, orientation, and size.
Maintain the privacy and security of user data and ensure that the system adheres to ethical and legal standards for image search engines.

1.2 Design Strategy:

To design a strategy for an image-to-image search engine, I would suggest the following steps:

Define the scope and objectives of the project: The first step is to clearly define the scope and objectives of the image-to-image search engine project. This includes determining the types of images that will be included in the database, the features that will be used to match images, the expected accuracy and speed of the system, and any other requirements or constraints.

Develop an image feature extraction algorithm: The next step is to develop an algorithm that can extract features from images in the database. This algorithm should be able to represent the visual characteristics of images in a feature space, which can then be used to match query images with similar images in the database. Common feature extraction techniques include deep learning-based methods such as convolutional neural networks (CNNs) and transfer learning.

Design a search algorithm: Once the feature extraction algorithm is developed, the next step is to design a search algorithm that can efficiently search through the feature space to find visually similar images. One common approach is to use a nearest neighbor search algorithm, such as k-NN or ball tree search.

Build a database of images: To test and train the system, a database of images is required. This database should be large and diverse, covering a wide range of image categories and containing high-quality images.

Optimize the system: Once the system is developed, it needs to be optimized for accuracy and speed. This includes tuning the feature extraction and search algorithms, as well as optimizing the database and hardware to ensure that the system can handle large-scale image search queries.

Develop a user-friendly interface: To make the system accessible to users, a user-friendly interface should be developed. This should allow users to easily upload query images and view search results. The interface should also be optimized for speed and ease of use.

Testing and evaluation: Test and evaluate the performance of the image-to-image search engine on a validation dataset using appropriate metrics such as precision, recall, and F1 score. Continuously monitor and optimize the system based on user feedback and usage patterns.

Deployment: Deploy the image-to-image search engine on a web server or cloud platform to make it accessible to users worldwide. Ensure that the system is secure, scalable, and robust to handle large volumes of traffic and queries.

Chapter 6

IMPLEMENTATION

6. Implementation

6.1. Implementation Strategy:

We used flak to develop our system. This system has three level of access admin,teacher and student. The functionalities are distributed within them according to the requirement. To make the system more usefull we used a apporach where admin can add new course and subjects to the existing system and enroll students and teachers to it. Teacher and student enrolled in specific course will have access to functionality for accessing data related to that course only. This help in widening of the score of application of our project.
Keras is an open-source neural network library written in Python. It is designed to provide a user-friendly interface for building deep learning models with support for convolutional neural networks, recurrent neural networks, and other common architectures. Keras is built on top of TensorFlow, allowing it to leverage the underlying computational graph capabilities of TensorFlow.

It has become a popular choice for both beginners and experienced deep learning practitioners due to its simplicity, flexibility, and ease of use. Keras also provides pre-trained models for a wide range of tasks, making it easy to start building high-performing models without requiring extensive domain expertise. Keras is a Python-based high-level neural network API that can run on top of popular deep learning frameworks such as TensorFlow, Microsoft Cognitive Toolkit, and Theano. It was created with the goal of allowing for rapid experimentation and prototyping of deep learning models.

Keras provides a simple and intuitive interface for building neural networks, including support for convolutional neural networks (CNN), recurrent neural networks (RNN), and combinations of the two. It also includes a wide range of pre-trained models, which can be used for a variety of tasks such as image classification, object detection, and natural language processing. One of the key features of Keras is its ability to run seamlessly on both CPU and GPU, allowing for fast training and inference of deep learning models. It also includes a range of tools for data preparation and preprocessing, such as data normalization, data augmentation, and feature scaling. Keras has gained widespread popularity in the deep learning community due to its ease of use, flexibility, and scalability.

It has become one of the most widely used deep learning frameworks in both academia and industry.

6.2. Hardware Platform Used:

The hardware requirement may serve as the basis for a contract for the implementation of the system and should therefore be complete and consistent in specification.
The hardware used for the system is mentioned below.

- PROCESSOR: Intel CORE i3(above)
- RAM: 3.00GB(above)
- HARD DISK: 50 GB

It should be noted that better the hardware facilities available, higher would be response time of the system.

6.3. Libraries And Software Platform Used:

The software requirement document is the specification of the system. The software requirement provides a basis for creating the software requirements specification.
OPERATING SYSTEM: Windows7 (above)
SYSTEM TYPE: 32-bit , intel CORE i3
SOFTWARE: Jupyter, Colaboratory
TECHNOLOGIES: Python,
LIBRARIES: Flask, pandas, NumPy, pickle

6.3.1 Flask:

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. However, Flask supports extensions that can add application features as if they were implemented in Flask itself. Extensions exist for object-relational mappers, form validation, upload handling, various open authentication technologies and several common framework related tools.

6.3.2 VGG16 Model

The Visual Geometry Group (VGG) at the University of Oxford created the convolutional neural network (CNN) architecture known as VGG16. In the realm of computer vision, it is a widely used model, especially for picture classification applications. VGG16's architecture consists of 16 layers, including 3 fully connected levels and 13 convolutional layers. The 3x3 convolutional layers' filters have a stride 1 and padding 1 value. The pool size for the max pooling layers is 2x2 with stride 2. The final output layer has 1000 neurons, which corresponds to the 1000 classes in the ImageNet dataset, while the fully linked layers have 4096 neurons each

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Chapter 7

RESULT & DISCUSSION

Result and Discussion

We began by creating a small CNN from scratch our made-from-scratch CNN has a straightforward architecture, with seven convolutional layers followed by a single densely-connected layer. Using the old CNN to produce an accuracy score, we discovered that we had a 58% accuracy score. With this accuracy score, the from-scratch CNN performs just reasonably well. We could improve the accuracy if we had a large enough training dataset, which we don't have. After utilizing VGG 16 model and fine-tuning it we got an accuracy of 90.31%. We needed to Fine-tune the VGG 16 because it is trained of millions of images of datasets which we don't have. We have done Fine tuning on the fruits dataset.

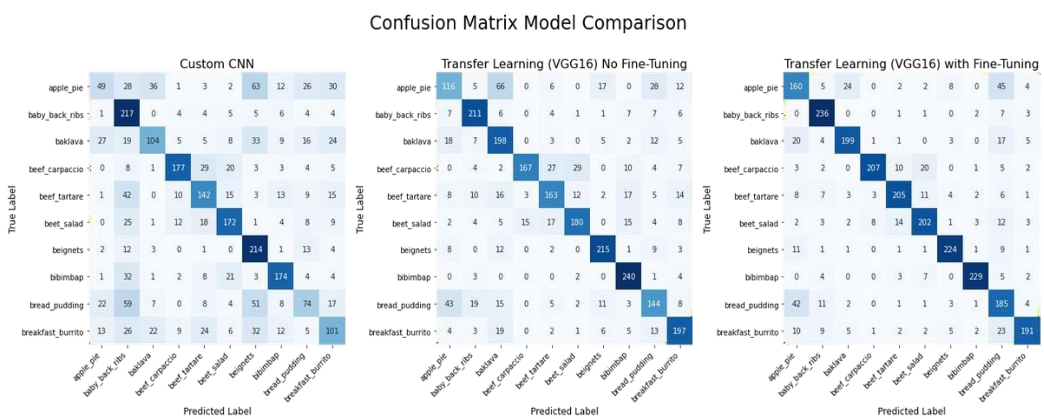

Fig. 2.2 Results of Transfer Learning With & Without Fine Tuning

Chapter 8
CONCLUSION

8. Conclusion

This paper describes the successful implementation and testing of a method for extracting image content, and the results were deemed satisfactory. This method can be used in a search engine, where a user can input an image for which they have no information, and the search engine will provide relevant information related to the image. This type of search engine has the potential to advance computing to the next level.

The successful implementation and testing of this method indicates that it is effective in accurately identifying and extracting relevant information from images. This can be especially useful in situations where users have access to an image but do not have any information about it. By inputting the image into the search engine, they can retrieve information about it quickly and easily.

The potential for this type of search engine to advance computing to the next level lies in its ability to provide users with relevant and accurate information quickly and efficiently. With the increasing use of images in various industries, including healthcare, education, and entertainment, the ability to extract and analyze image content will be critical for making informed decisions and advancements in these fields. In conclusion, the successful implementation and testing of this method for image content extraction has the potential to revolutionize the way we use imagesin computing.

The ability to extract relevant information from images quickly and accurately will be invaluable in many industries, and will undoubtedly lead to further advancements in the field of computing.

Chapter 9
FUTURE SCOPE

9. Future Scope

Image to image search engines have a lot of potential for the future as they can improve the way people search for and find visual content online. Here are some potential future scopes for image to image search engines:

Improved accuracy: As machine learning algorithms and computer vision technology continue to advance, image to image search engines are likely to become even more accurate and effective at recognizing and matching images.

Augmented reality: With the increasing popularity of augmented reality (AR) technology, image to image search engines could be used to identify real-world objects and overlay relevant information or virtual objects onto them.

Visual commerce: As more consumers turn to online shopping, image to image search engines could help retailers improve their product discovery and recommendation systems. This could include features such as visual search recommendations, product tagging, and personalized product suggestions.

Cultural heritage: Image to image search engines could be used to preserve and share cultural heritage by allowing users to search for and access images of historical artifacts. .

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