Vidyavardhini's College of Engineering & Technology
Department of Artificial Intelligence & Data Science
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Project Topic

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Retroflex: Uncovering Visual Equivalences through Reverse Image Recon

Echoes of Images: Delve Deeper with Reverse Visual Search Technology

Table of Content

Introduction

- A.I. is becoming a hot topic in the rapidly developing digital world of today.
- Its applications are extensive and ever yet further growing as our understanding of it increases.
- Reverse image search is another interesting upcoming topic, of which its applications make our lives significantly easier in a number of business sectors and even in our day to day lives.
- Its implementation is when instead of text, pictures are used as search input, and similar images are returned as the result to help users of a system easier find what they are looking for.

Literature Survey

Sr. No	Paper Title	Authors	Summary
1	Deep Residual Learning for Image Recognition	Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun	The paper introduces deep residual networks (ResNets) that revolutionized deep learning by addressing vanishing gradient problems. ResNets enable training very deep networks and achieve state-of-the-art results in image recognition tasks.
2	ImageNet classification with deep convolutional neural networks	Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton	This seminal paper presents the AlexNet architecture, a deep convolutional neural network (CNN), which significantly reduces error rates in large-scale image classification, marking a breakthrough in computer vision.
3	Learning Fine-grained Image Similarity with Deep Ranking	Jianchao Yang, Kai Yu, Fan Lai, and Thomas Huang	The paper introduces a deep ranking approach for fine-grained image similarity. It focuses on learning to rank images based on their similarity, leveraging deep CNNs, and finds applications in image retrieval and similarity measurement.

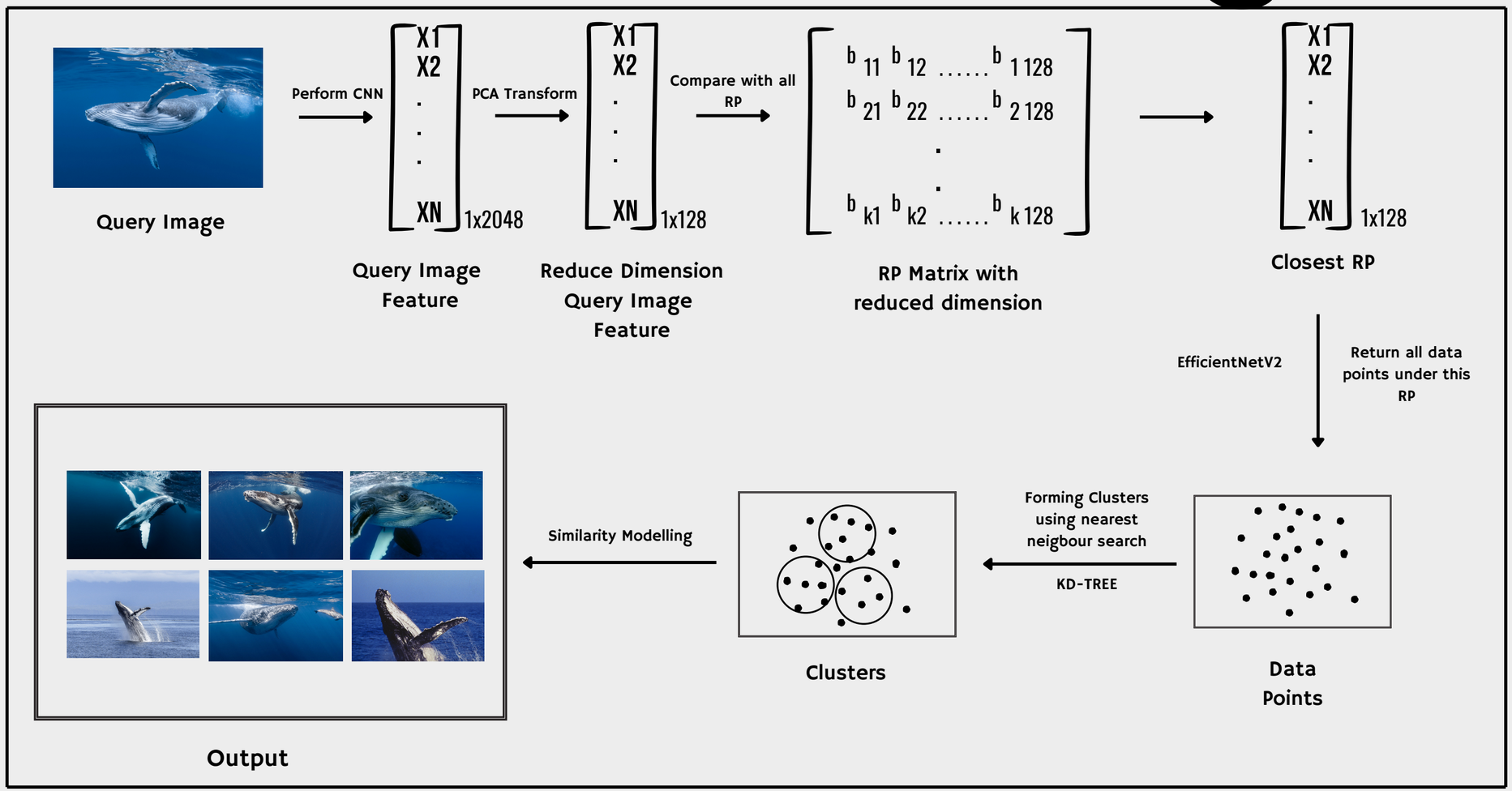
Problem Statement

- The challenge is to create an efficient and accurate reverse image search system using deep learning techniques.
- This system should allow users to query a large database of images with an input image and retrieve visually similar images.
- The primary problem is to develop a deep learning model and associated algorithms that can effectively compare and match images based on their visual content, enabling fast and accurate reverse image searches.
- The need for this system arises from the growing demand for improved image search experiences in various domains, including e-commerce, content moderation, art identification, and more.
- Existing methods often fall short in providing accurate and efficient reverse image searches, making it imperative to leverage deep learning to address this challenge.

Proposed System

- The proposed system represents a cutting-edge approach to reverse image search, empowered by deep learning techniques.
- By incorporating advanced similarity metrics, the system accurately quantifies the likeness between images, ensuring precision in image matching.
- The similarity modelling process, in which the system meticulously compares the feature vectors of the query image with the saved data, is at the heart of the system. This meticulous comparison yields a curated list of photos that bear a striking resemblance to the input query, allowing users to quickly and accurately find visually similar images.
- It enables users to discover visually related images effortlessly while maintaining precision and speed in the search process, making it a valuable asset in the field of computer vision and image analysis.

Data Process Diagram



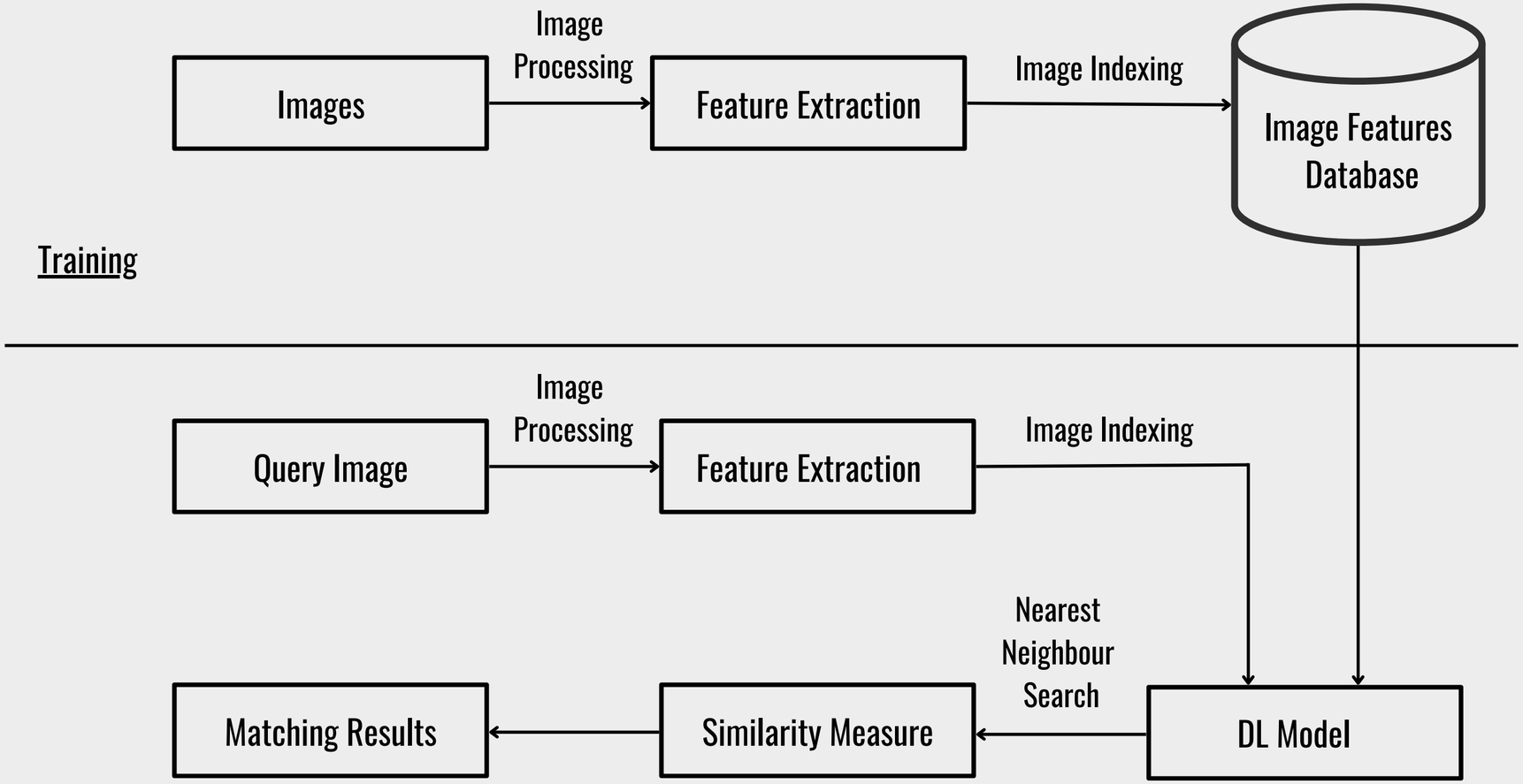
Comparison

Aspect	ResNet-50	EfficientNetV2	OpenAI CLIP
Architecture	Deep convolutional network	Convolutional Neural Network with efficient architecture	Vision and Language Transformer
Pre-training	Yes	Yes	Yes
Versatility	Image Classification, Object Detection, Segmentation	Image Classification, Object Detection, Segmentation	Vision and Language Tasks
Vision Tasks Supported	Various vision tasks	Various vision tasks	Vision and Language Tasks
Training Data	Large-scale ImageNet	Large-scale ImageNet	Large-scale Text-Image Pairs
Transfer Learning	Effective	Effective	Effective
Use Cases	Image-based tasks	Image-based tasks	Vision and Language Tasks

Model	Version	Year	Accuracy(%) (ImageNet)	Characteristics
EfficientNetV2	-S, -M, -L	2021	83.9, 85.1, 85.7	FixRes, Fused-MBConv, NAS
ResNet	50, 101,110, 1202	2015	77.15, 78.25	Residual learning
VGGNet	16	2014	74.4	Small filter size, Blocks of layers
Contrastive Language-Image Pretraining	1.0	2021	76.2	Shared representation space for images and text, contrastive learning

Model	Pre-training	Transfer Learning	Versatibility	Use cases
KDTree	No	Not applicable	Limited to spatial indexing and nearest neighbor search	Nearest neighbor search, spatial indexing, clustering in multidimensional space
ANNOY	No	Not applicable	Specialized for approximate nearest neighbor search	Efficient approximate nearest neighbor search, especially in high-dimensional spaces
OPENAI CLIP	Yes	Yes	Versatile, designed for a wide range of vision-language tasks	Image and text understanding, zero-shot learning, image classification, natural language understanding, and various vision-language tasks

System Architechture



Methodology

- Developing a deep learning-based reverse image search system involves a systematic software engineering approach to ensure the project's success.
- Requirements Gathering: Define project goals and user needs.
- Feasibility Study: Assess technical and resource feasibility.
- System Design: Plan system architecture and components.
- Data Collection: Gather and preprocess image datasets.
- Model Development: Create and train deep learning models.
- Integration: Combine model, database, and user interface.
- UI Design: Create a user-friendly interface.
- Testing: Conduct thorough testing and quality assurance.
- Optimization: Optimize model and database queries.
- Deployment: Deploy the system and monitor it.
- User Support: Provide training and support.
- Maintenance: Regularly update and maintain the system.
- Evaluation: Continuously assess system performance.
- Future Enhancements: Plan for system improvements.

Software Requirements

Hardware

1. Processor: Intel Core i5 or AMD Ryzen 5 processor
2. Memory (RAM): 4 GB to 8 GB of RAM, allowing for smooth Processing applications.
3. Storage: A minimum of 256 GB solid-state drive (SSD) or a 500 GB hard disk drive (HDD) for storing operating system files.
4. Operating System: A pre-installed operating system such as Windows 10, macOS, or a Linux distribution, depending on user preference and requirements.

Software

1. Python: For Building Pre-trained models of CNN.
2. Deep learning Framework: Tensorflow, Keras (For Feature Extraction and Similarity Modelling.
3. Feature Extraction Models: Efficientnet v2, ResNet, MobileNet (Feature Extraction models to capture meaningful representation of images).

Technical and Economical Feasibility

Technical Feasibility:

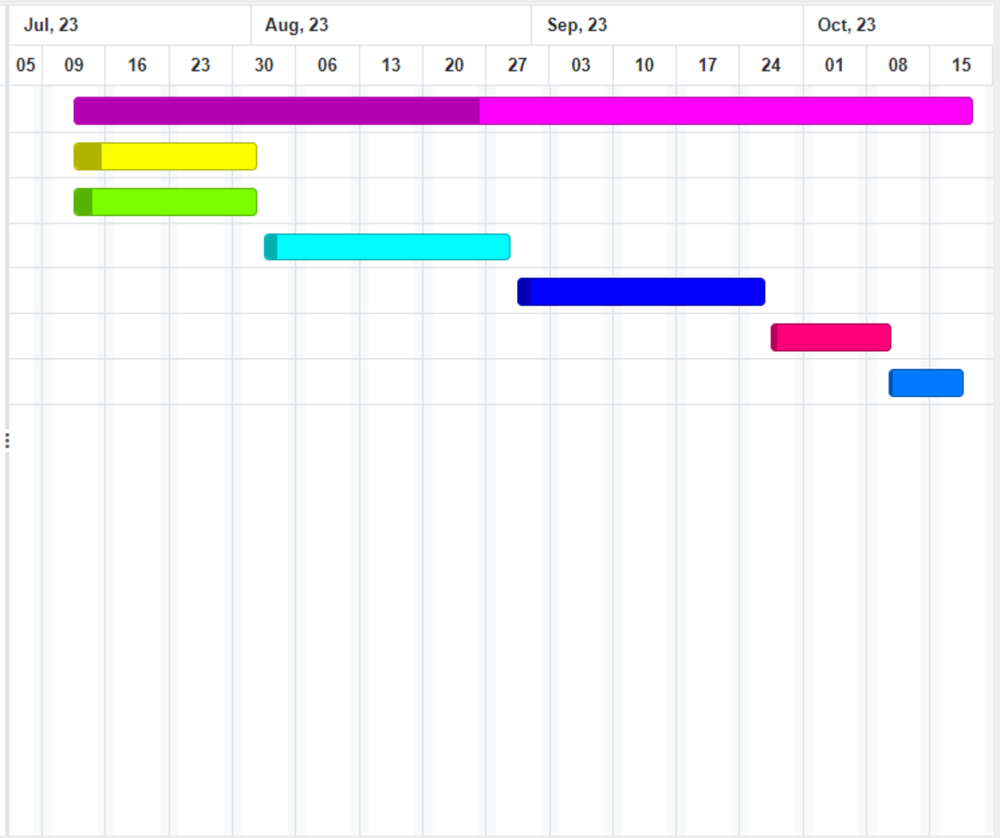
- Feature Extraction and Semantic Understanding:
  Achievable with established deep learning techniques and pre-trained models.
- Anomaly Detection (if applicable):
  Achievable with well-researched anomaly detection techniques.
- User Interface (UI):
  Feasible with standard UI development frameworks.
- Scalability and Performance Optimization:
  Feasible with proper design and optimization strategies.

Economic Feasibility:

- Cost of Development:
  Determining the budget for development, including expenses for software, hardware (if necessary), and human resources.
- Maintenance and Support Costs:
  Estimating the ongoing costs associated with system maintenance, updates, and user support.
- Long-term Sustainability:
  Evaluating the long-term sustainability of the system.

Timeline Chart and WBS

Name	Start Date	End D...	Duration	Progress %	Color
Retroflex: Uncovering Visual Equivalences through Reverse Image Recon	Jul 12, 2023	Oct 19, 2023	72 days	45	
Research	Jul 12, 2023	Aug 01, 2023	15 days	15	
Literature Servey	Jul 12, 2023	Aug 01, 2023	15 days	10	
Image Feature and Extraction	Aug 02, 2023	Aug 29, 2023	20 days	5	
Search Processing	Aug 30, 2023	Sep 26, 2023	20 days	5	
Evaluation	Sep 27, 2023	Oct 10, 2023	10 days	5	
Optimization	Oct 10, 2023	Oct 18, 2023	7 days	5	



Thank You