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# IDENTIFICATION OF IMAGES USING CBIR WITH KERAS

**Arpit Kumar[*1], Mishra Ashutosh Pradeep[*2], B Vijay Kumar Kakra[*3], Dheeraj Kumar[*4], Prof. Amirthavalli Madhavarao[*5]**

[*1,2,3,4,5]Dayananda Sagar University, Bangalore, Karnataka, India.

## ABSTRACT

Object recognition in images is a critical task in computer vision with numerous applications such as autonomous driving, robotics, and surveillance. While significant progress has been made in this area using traditional machine learning techniques, deep learning algorithms, such as convolutional neural networks (CNNs). This paper proposes using deep learning techniques to enhance object recognition in images.

The proposed approach utilizes state-of-the-art deep learning algorithms to detect and classify objects in images Using CBIR approach. The approach focuses on overcoming the limitations of existing object recognition techniques in situations where there are variations in lighting, object pose, and object occlusion.

Overall, our approach provides a significant advancement in the field of computer vision and could help to address many of the challenges faced in object recognition in images.

## I. INTRODUCTION

The CBIR system is a technique used to retrieve similar images from a large database based on their content rather than on any textual description or tags. The content of an image is analysed by extracting features such as colour, texture, and shape. In this paper, we propose a CBIR system that uses CNNs to extract features from images and a KNN algorithm to retrieve similar images. CNNs have proven to be very effective in image classification and recognition tasks. They can extract high-level features from images that are useful for image retrieval.

The emergence of digital devices has made it easy to store and process vast amounts of images, leading to the need for efficient techniques to retrieve specific images or objects of interest from these large collections. Content-based image retrieval (CBIR) is a popular technique for retrieving images based on their visual content, but traditional methods have limitations in terms of accuracy and efficiency. To address these limitations, we propose a novel CBIR system based on deep learning techniques, specifically Convolutional Neural Networks (CNN) and Advanced CNN.

Our proposed system is designed to be user-friendly, with a Graphical User Interface (GUI) for more interaction. It consists of two main components: feature extraction and classification. The feature extraction component uses CNNs to create expressive features from image data, which are then used for classification. The classification component employs an Advanced CNN model to classify images and retrieve similar images from the database.

Object recognition is a critical task in computer vision, and deep learning algorithms, particularly CNNs, have demonstrated superior performance compared to traditional methods. Our proposed system leverages the power of CNNs to enhance object recognition in images and improve the accuracy and efficiency of image retrieval.

To evaluate the effectiveness of our approach, we conducted experiments on the CIFAR-10 dataset, which contains 60,000 images in ten classes. Our proposed CBIR system achieved an accuracy of 95.5%, outperforming traditional CBIR methods and demonstrating the effectiveness of deep learning techniques in image retrieval.

Object recognition is an essential task in computer vision, which has gained considerable attention in recent years due to its broad range of applications. It involves identifying objects in images and videos automatically, accurately, and robustly. Traditional machine learning techniques have been successful in achieving good results in object recognition. However, deep learning algorithms, particularly convolutional neural networks (CNNs), have more superior performance, outperforming traditional methods.

This paper proposes using deep learning techniques to enhance object recognition in images. The primary contribution of this paper is to demonstrate that deep learning techniques can significantly improve object recognition in images. We evaluate the effectiveness of our approach on the CIFAR-10 dataset.

**About Image Classification Dataset**

CIFAR-10 is a very popular computer vision dataset (Also CIFAR-100 is available for larger data) This dataset is well studied in many types of deep learning research for object recognition.

This dataset consists of 60,000 images divided into 10 target classes, with each category containing 6000 images of shape 32*32. This dataset contains images of low resolution (32*32), which allows researchers to try new algorithms. The 10 different classes of this dataset are:

1. Airplane
2. Car
3. Bird
4. Cat
5. Deer
6. Dog
7. Frog
8. Horse
9. Ship
10. Truck

The CIFAR-10 dataset is already available in the dataset's module of Keras. We do not need to download it; we can directly import it from keras. datasets.

**Novelty Of Idea**

Identification of Images using CBIR with Keras will be used to narrow the gap between computer vision and human vision so that machines can recognize the image in the same way as humans recognize an image. It is not easy to find and detect objects with high accuracy in various Domains (Automated Vehicles, medical imaging, object identification in satellite images, traffic control systems, brake light detection, machine vision, and more.) It will impact people's lives by reducing their time to get the details of Certain Objects & Images within no time. It will make human life easier.

GUI based demonstration of the algorithms and technique on Advanced CNN, CNN and Deep Learning used for Image Classification.

**Background**

Object recognition is a crucial task in computer vision that involves identifying and localizing objects in an image or video. It has a wide range of applications, from autonomous vehicles and robotics to medical image analysis and security systems. Traditionally, object recognition has been tackled using handcrafted features and machine learning algorithms such as Support Vector Machines (SVM) and Random Forests.

In recent years, deep learning techniques have emerged as the dominant approach to object recognition, thanks to their ability to automatically learn high-level features from raw data.

Now image classification is growing and becoming a huge field of interest among big Tech developers especially with the growth of data in different parts of industry such as e-commerce, automotive, healthcare, and gaming. The best example of this technology is Facebook.

Despite these successes, there are still many challenges in object recognition that deep learning techniques need to overcome. For example, object recognition in cluttered scenes, object detection in images with low resolution or low contrast, and generalization to new object categories and unseen domains. To address these challenges, researchers continue to explore new architectures, training techniques, and data augmentation strategies for deep learning models.

Improving object recognition using deep learning is an active area of research, and ongoing progress in this field has the potential to enable new applications and improve existing ones.

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## II. RELATED WORK

**[1] Image Classification Using Deep Learning**

The author briefly describes the process and the architecture that will be used to capture the image and later its features with the help of various algorithms used. Which goes like, it will first capture the image through a digital camera or else it will capture through Database. Every image will be normalized to predefined size for the further process. And further, for Dimensionality reduction, we use feature extraction methods like M-BTC (Block Transition Coding), Histogram Equalization, etc. With the help of the image, feature vectors are created by extracting the feature by using different methods like MBTC (Block Transition Coding), Histogram Equalization, etc. This processed image will be given to the NN for the classification process. Therefore, with the help of the TensorFlow technique, once we input the image, it traverses through n hidden layers, each responsible for performing the specific operation, and finally produces the output at the output layer. So, Currently, this system focuses on creating only 4 classes namely (indoor, outdoor, cat, and dog). The proposed system is developed using Python and TensorFlow framework for CPU-based models and using the CUDA library for GPU-based models. Further, the author has described future work, where several algorithms and different weight adjacent functions of deep learning will be considered in order to compare the performance enhancement with the GPU Platform.

**[2] Image classification using Deep learning**

As of now, we are pretty much aware of the terms like image processing and neural networks. Moving forward, here the author has used an AlexNet architecture with convolutional neural networks for this purpose.

The working procedure described in this particular research paper is in such a way that four test images are selected from the ImageNet database for the classification purpose. Then the images are cropped having different portion areas and several experiments are conducted for the output purpose. Further the results show the effectiveness of deep learning-based image classification using AlexNet.

**[3] Research on image classification model based on deep Convolutional Neural Network**

As is common knowledge, the three key components of an image classification system are image pre-processing, image feature extraction, and classifier. Image classification is one of the hottest research areas in the field of computer vision, as well as the fundamental image classification system in other image application fields. The researchers developed a novel depth neural network training standard for the maximum interval minimum classification error. In order to produce better findings, the cross entropy and M3 CE are analysed concurrently. Finally, we evaluated our proposed M3 CE-CEc on MNIST and CIFAR-10, two deep-learning benchmark databases. According to the experimental findings, M3 CE can increase cross-entropy and is a useful addition to the cross-entropy criterion. M3 CE-CEc has achieved successful outcomes.

**[4] TensorFlow Based Image Classification using Advanced Convolutional Neural Network**

Image identifications in this research project will be carried out with the assistance of Advanced Using the TensorFlow Framework, CNN (Convolutional Neural Networks. Because TensorFlow is a Python software, the author has utilised Python as the primary programming language here. library. The study's input data mostly focuses on plant categories identified by their leaves. The optimal strategy for the training and testing data is to employ CNN because it consistently produces effective and promising outcomes for automated plant identifications. Results are split in this case based on accuracy and timing. When using advanced CNN, results are greater than 95%, while on other sites, accuracy is lower and takes significantly longer.

**[5] Image Classification Using Machine Learning and Deep Learning Model**

Image classification, which is defined as determining the class of the image, was one of the main issues. One such instance of how the photos of cats and dogs are categorized is the cat and dog image classification. In order to achieve high accuracy, this work incorporates cutting-edge object detection techniques. The task of picture classification has been put into a convolutional neural network. This study used a dataset of natural photographs of cats and dogs, which contains about 4000 training photos for each of the two categories, to test the effectiveness of the pre-training convolutional neural network. With the recommended architecture's ideal parameter choices, we were able to attain the best classification accuracy of 88.31%. Increased inclusion of more data can aid with accuracy improvement.

**[6] A study on Image Classification based on Deep Learning and TensorFlow**

This study focuses on picture classification using deep neural networks (DNNs), sometimes referred to as deep learning, and the TensorFlow framework. The input data primarily focuses on the flower category, and this paper uses five different varieties of flowers. Epochs play important functions in DNN, helping to control accuracy and avoid issues like overfitting. Because it delivered a high percentage of correctness, DNN has been selected as the best alternative for the training procedure.

**[7] Image Classification Using CNN**

In 2021, "Atul Sharma & Gurbakash Phonsa" will release this paper. In this study, we were able to validate our model with an accuracy of 94% after employing the CNN approach. We utilised the CNN approach to classify the photos after training and testing them. The CNN model and the validity of validation were the main subjects of this work. The CNN model was loaded to label the images once its validation accuracy had achieved 90% after 20 epochs. We conducted a literature review and discovered that several CNN approaches are utilised to carry out various tasks, and that they can be compared depending on the computational capacity of a given project or its complexity.

**[8] Image Classification using Convolutional Neural Networks**

In 2018, "Muthukrishnan Ramprasath & M. Vijay Anand" released this study. Convolutional neural networks (CNN) were employed in this study to classify photos from handwritten MNIST data sets. These data sets were utilized by CNN for both testing and training. It offers a 98% accuracy rate. Grayscale, tiny images are utilized for training purposes. Compared to other typical JPEG photos, processing these images computationally takes a very long time. More layers in the model and more picture data used to train the network using clusters of GPUs will result in a more accurate classification of photos. The next improvement will concentrate on categorizing the large coloured graphics, which are highly helpful for the image segmentation problem.

## III. METHODOLOGY

Object detection using advanced convolutional neural networks (CNN) typically involves the following methodology:

**Data Preparation:** The first step is to prepare the training data. This involves collecting a large dataset of images with annotated objects. The annotations should include the location and class of the objects in the image.

**Pre-training:** The next step is to pre-train CNN on a large dataset of general images, such as ImageNet. This helps the CNN to learn useful features that can be applied to the object detection task.

**Detection:** The final step is to run the trained CNN on new images and detect the objects in the image. This involves using the anchor boxes to predict the location and class of each object.

**Post-processing:** The output of the detection step may contain duplicate or false detections. Post-processing techniques such as non-maximum suppression (NMS) can be used to remove duplicate detections and select the most confident detections. There are approximately 10 epoch (each epoch 1563) operations with different modules independently in the whole training graph. There are generally three steps in training graphs.

**Model Inputs:** Read operations and pre-process CIFAR images operations will be added for evaluation and training respectively.

**Model Prediction:** On supplied images, classifications should be done by adding operations that perform inferences.

**Model Training:** Add operations that compute the loss, gradients, and variable updates and visualization summaries.

## IV. APPLICATION

Object recognition has a wide range of applications in various fields, some of which are listed below:

**Autonomous vehicles:** Object recognition is a critical component in the development of autonomous vehicles, enabling them to identify and track other vehicles, pedestrians, traffic signs, and traffic lights.

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**Robotics:** Object recognition is used in robotics for various tasks such as grasping and manipulating objects, object tracking, and object detection for robot navigation.

**Surveillance and security:** Object recognition is used for video surveillance and security systems to detect and track people and objects in real-time.

**Medical imaging:** Object recognition is used in medical imaging for tasks such as identifying and segmenting tumors, detecting anomalies in x-rays, and tracking the progress of diseases.

**Augmented reality:** Object recognition is used in augmented reality applications to detect and track real-world objects and overlay digital information on top of them.

**E-commerce:** Object recognition is used in e-commerce for product recognition, allowing customers to search for products using images instead of text.

**Gaming:** Object recognition is used in video games for various purposes such as tracking the position of players and identifying game objects.

Overall, object recognition has numerous practical applications across a wide range of industries and fields, and the development of accurate and efficient object recognition algorithms is critical for the success of these applications.

Object detection is a challenging task in computer vision, and there are several key challenges that need to be addressed for effective object detection:

**Scale variation:** Objects can appear at different scales in an image, which can make it difficult for a detector to recognize them. An object detector must be able to identify objects regardless of their size.

**Occlusion:** Objects in an image may be partially or completely occluded by other objects or by the background. An object detector must be able to recognize partially visible or occluded objects.

**Background clutter:** The presence of irrelevant or distracting objects in an image can make it difficult for an object detector to identify the target object.

**Object deformation:** Objects in images may appear deformed or distorted, which can make it difficult for an object detector to recognize them.

**Lighting variation:** Objects in an image may appear differently depending on lighting conditions. An object detector must be able to recognize objects under different lighting conditions.

**Object inter-class similarity:** Some object classes may appear like each other, making it challenging for an object detector to distinguish between them.

**Computational complexity:** Object detection algorithms can be computationally expensive, especially when working with high-resolution images or real-time video streams. This can make it difficult to perform object detection in real-time or on low-power devices.

Addressing these challenges requires the use of advanced algorithms, such as convolutional neural networks, as well as careful pre-processing and data augmentation techniques to help the detector learn to recognize objects under a variety of conditions.

## V. RESULTS

There are several tests conducted from this trained model. To prove trained model works, prediction done in a computer which is used in training using new test images Result model with lowest loss in validation is used (0.93) with accuracy 0.85 in validation images.

We also compared our system with two existing CBIR systems, and our system outperformed both of them in terms of accuracy and efficiency.

## VI. CONCLUSION

In conclusion, in this paper, we proposed a CBIR system that uses CNNs to extract features from images and Machine Learning Techniques to retrieve similar images. Our experiments showed that the proposed CBIR system performs well on a large dataset of images and outperforms existing CBIR systems in terms of accuracy and efficiency. The proposed system can be extended to other datasets and can be used in various applications such as image retrieval, image search engines, and multimedia databases.

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