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DETECTION OF SEVERAL IMAGES BY USING ARTIFICIAL NEURAL NETWORK AND IMPROVING ITS ACCURACY BY USING CONVOLUTIONAL NEURAL NETWORK

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Abstract: Although feature engineering, a drawn-out process that results in poor test data generalization, has been a characteristic of traditional neural networks, they have nonetheless produced excellent performance in image categorization. The CIFAR-10 dataset was classified using a Convolutional neural network (CNN) technique, which is shown in this study. Performance improvements can be made using this strategy without the need for feature engineering, according to earlier studies. Our goal is to use deeper networks to reduce overfitting and improve test accuracy. The purpose of this work is to provide new algorithms for image recognition and classification. Build a classifier using CNN to classify the input images into their respective classes. A total of 60,000 distinct photographs with various backgrounds, angles, distances, settings, and colors were subjected to the algorithm**.**

IndexTerms **- Artificial Neural Network, Convolutional Neural Networks, Deep learning, Machine learning, Neural networks**

I. INTRODUCTION

Since the early work of, Artificial Neural Networks (ANNs) have gained appeal for image identification and classification applications by Dr. Prasanna Kumar Singh, Shaurya, Rahi Patel, Kumar Ashish, Roshan Raj [4], which dealt with the image recognition of CIFAR-10 dataset was classified using an Artificial Neural Network (ANN) technique which is shown in their research paper. In Indian Sign Language Deepali Kaushik [6] uses neural networks to participate in hand gesture recognition in Indian Sign Language. Deepali Kaushik used a neural network-based approach to recognize his hand gestures, ISL (Indian Sign Language). The capacity of CNNs to produce high-level picture features without the need for feature engineering, a time-consuming and expensive process that leverages domain expertise to construct features for training machine learning algorithms, is one of their key advantages. A function to extract. Another major advantage of CNNs is the reduction in the number of network parameters. This can reduce computational overhead while achieving higher performance. This report explores the mechanisms of image recognition and classification, building models that can embed artificial intelligence into machines and provide state-of-the-art technology to meet the needs of this modern world. In the context of computer vision, image recognition refers to a program's ability to recognise objects, people, characters, and actions in images. Using artificial intelligence software, cameras, and machine vision technologies, computers can recognise images. Image or object recognition is a computer technique that processes images to recognize objects in them. People often confuse image recognition with image classification. Although the difference is clear. Use classification when you need to classify image elements. However, if you need to locate them, for example, find out how many objects are in the image, you should use image recognition. Image classification is the process of labelling objects in images. Various classes are used to categorise objects. For instance, the network will turn up hundreds of images, illustrations, and even sketches of dogs if you ask it to search for photographs of dogs. This is a more sophisticated form of picture recognition. Currently, neural networks must process different images containing different objects, recognize them, and classify them according to the type of object in the image. The most famous example of image recognition is the facial recognition system by A.S.Tolba [7]. Deep learning subsets include convolutional neural networks (CNN) and artificial neural networks (ANN). are necessary for image recognition software. AI, machine learning, and deep learning all make use of neural networks. Networks that simulate how the human brain functions allow computer systems to spot patterns and resolve common issues. An input layer, multiple hidden layers, and an output layer comprise the three node layers of a Convolutional neural network (CNN). A neural network design is used in this report. A 70:30 split of the full dataset is appropriate for training, with 70% of the dataset going toward training and the remaining 30% going toward testing. In this model, for training, we used 50,000 photos from the CIFAR-10 dataset's 60,000 total images, and for model testing, 10,000 photos from the same 60,000 total images.

II. MOTIVATION.

Image recognition and classification software has revolutionised internet visualisation with image recognition technology as it is used by A.S.Tolba [7], autonomous vehicles, disease detection in medicine, and even education. Applications for picture recognition have a very distant future. The development of driverless automobiles, the outstanding facial recognition systems already in use in many nations, and quick and accurate real-time item recognition are all made possible by image recognition algorithms based on machine learning used by F.I. Alam [8] Now feasible Augmented reality and image recognition technology are starting to be used in gaming environments to provide players a more realistic experience. The ability to use picture recognition to generate realism in game landscapes and characters will be very advantageous to developers. Several image recognition technologies that are employed in gaming contexts are now available. Image recognition applications identify, visualize, and analyse objects so that machines can make appropriate decisions based on the visual input they receive. Image recognition helps identify unusual activity in border areas, prevent intrusions, and make automated decisions that save soldiers' valuable lives. Social media platforms have to process thousands of images and videos every day. Image recognition enables critical classification of photo collections through image cataloguing and automates content moderation to avoid publishing prohibited social media content. Image recognition technology is used to classify and process satellite images. Satellite image classification is the most important technique used in remote sensing for computational studies of satellite information and pattern recognition. Due to the demand for image recognition technology in various fields, we learn artificial intelligence and machine learning technology, create a model for the purpose of image recognition and classification, transform artificial intelligence into machines, and help people in this modern society and to meet the modern needs of the Society.

III. OBJECTIVE

Its purpose is to embed artificial intelligence towards machines. The ability of machines, particularly computer systems, to mimic human intellectual functions is referred to as artificial intelligence. Developing or building models that can perform multiple image recognition using neural networks, for image recognition software. Networks that simulate how the human brain functions allow computer systems to spot patterns and resolve common issues. A Convolutional neural network's node layer is made up of different layers: the input layer, the hidden layer, and the output layer (CNN). In this report, a neural network architecture is utilised. For training, ideally, we split the entire dataset 70:30, providing 70% of the entire dataset for training purposes and the remaining 30% of the entire dataset for testing purposes. In this case, 50,000 photos from the 60,000 total images in the CIFAR-10 data set were chosen for training, and 10,000 images from the 60,000 total images in the CIFAR-10 dataset were chosen for model testing.

IV. FEASIBILITY STUDY

Different neural network algorithms for skin cancer detection and classification are described in this systematic review study. These are all non-invasive procedures. The majority of the research focuses on multiple image classification and detection. These multiple image datasets were obtained from one of Python's libraries called Sci-kit Learn or Sklearn. This dataset is called the CIFAR-10 dataset and contains a total of 60,000 multiple images from 10 different categories. Ships, Aeroplanes, Vehicles, Trucks, Cats, Dogs, Deer, Frogs, Horses, and Birds are among the several categories. In order to create a model that detects photographs and groups them into the aforementioned categories, A convolutional neural network will be used. In a convolutional neural network, a node layer is made up of three layers: the input layer, the hidden layer, and the output layer (CNN). A 70:30 split of the full dataset is appropriate for training, with 70% of the dataset going toward training and the remaining 30% going toward testing. 10,000 photos from a total of 60,000 images in the CIFAR-10 data set were chosen for model testing, and 50,000 images from a total of 60,000 images were chosen for training. To create Convolutional neural networks, use the Python programming language and platforms like Google Colab, Jupyter Notebook, and Visual Studio Code. Cloud specifications and features are offered by Google Colab. Any machine with any configuration can access the code.

V. WORKING

The three stages of this model's design are described below.

There are three distinct phases, which are as follows: -

Phase 1: The first model entails data collection. The Scikit-learn and CIFAR-10 datasets are where the photos were gathered. Phase 1 also includes the pre-processing of the photos, in which we eliminate data duplication and inconsistencies and scale the collection. The elimination of these criteria enables us to quickly and accurately identify the parameters that resemble texture, colour, size, and shape.

Phase 2- Segmentation and feature extraction are included in phase two. Colour, shape, size, and texture are extracted as features.

Phase 3-Consisting of the model's design and training, this phase is the most crucial one for our model. Our model was tested for accuracy after training using neural networks like Convolutional Neural Networks (CNN) on the dataset gathered in phase I.

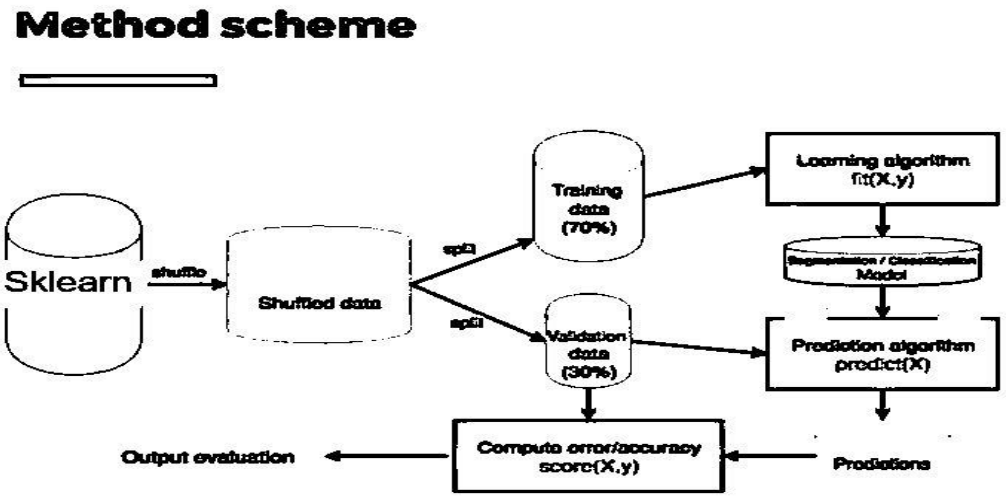

Fig: Flow diagram

The relationship between artificial intelligence and machine learning and deep learning:- Artificial intelligence refers to the simulation of human intelligence in machines programmed to think and act like humans. The term can also refer to any computer that performs human-like tasks like learning and problem solving. Machine learning is a branch of AI and computer science that uses data and

algorithms to replicate human learning processes and improve accuracy over time. AI is the broadest concept, allowing machines to mimic human behaviour. Machine learning is the application of AI to a system or machine to assist it in self-learning and continuous improvement. Deep learning iteratively trains a model or pattern using complex algorithms and deep neural networks.

Deep Learning and Neural Networks: Deep learning is a subfield of machine learning that deals with formulas based on how the brain is organised. Using images, text, or speech as input, deep learning can be used to train computer models to execute categorization operations. Using convolutional neural networks to solve complex problems is a process known as deep learning. The objective is to construct a neural network that can recognise patterns in features automatically.

Artificial Neural Networks (ANN):- Artificial neurons are networks consists of a network of connected elements, or nodes, which serves as a rough analogy to the neurons seen in the human brain. Each link has the capacity to communicate with other neurons, much like the synapses in the human brain. Artificial neurons have the ability to receive, process, and send impulses to other neurons that are connected to them. Weights on edges and neurons often change as learning progresses. Weights modify the strength of a connection's signal. A neuron can have a threshold, and only send a signal if the overall signal level is higher than that threshold. This system is made up of many neurons, which are highly interconnected processing units that cooperate to address issues and transmit data.

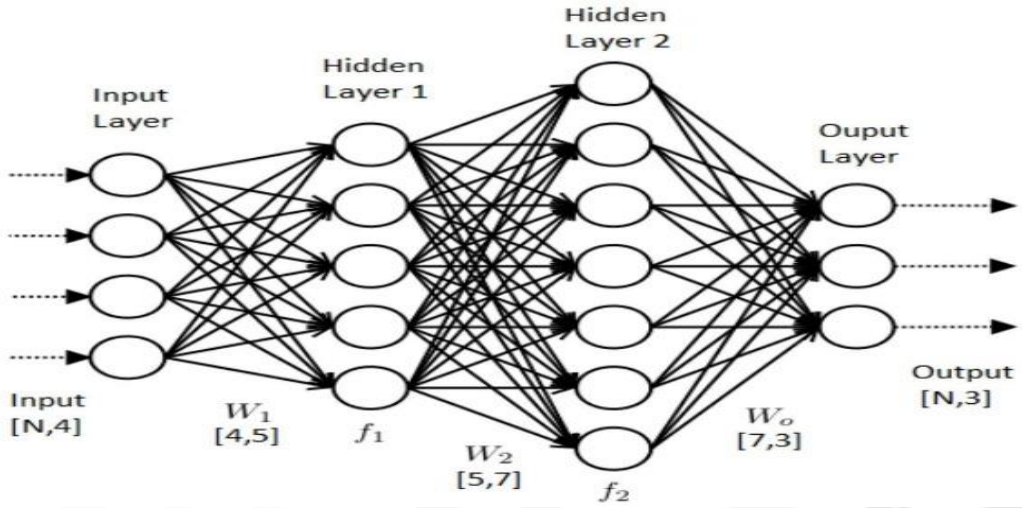

Fig: Artificial Neural Network

Neurons are layered and intricately intertwined. The input layer is where the data is received, and the output layer is where the result is produced. Usually, there is a secret layer or layers between the two. Because to this configuration, it is challenging to predict or pinpoint the precise data flow. Every link has a connection weight, and every neuron has an activation threshold. [5] Redmon J, and Angelova Computes whether each input weight is positive or negative based on the sign of the input weight. Weight affects the signal intensity of compounds [5] A neuron that only sends a signal when the overall signal is higher than its threshold. The output is generated based on the signal from the activation value, which is a weighted sum of the summation units.

The relationship between each element's weight and In the illustration, the ANN system's input and output are shown.

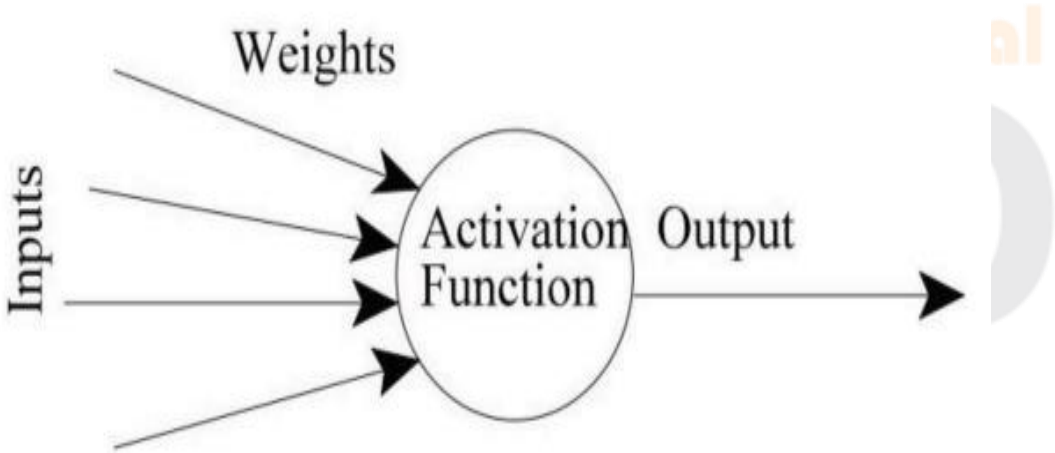

Fig: Weight of every component, as well as input and output, of the ANN system.

Convolutional Neural Networks (CNN):-

A common artificial neural network used in deep learning for object and image recognition and classification is the convolutional neural network, or CNN Deep Learning uses a CNN to identify items in photos. CNNs are crucial for a number of tasks, including speech recognition in natural language processing, localization and segmentation in computer vision, video analysis, and self-driving car obstacle detection. CNNs are particularly well-liked in Deep Learning since they are important in these quickly developing and new fields. A neural network typically consists of an input layer, hidden layers, and an output layer. The structure of the brain serves as inspiration for CNNs. Like neurons in the brain, artificial neurons or nodes in CNNs take inputs, process them, and send the outcome as an output. The image is used as input. Arrays of picture pixels are accepted as input by the input layer. CNNs may have multiple hidden layers that extract features from images by performing calculations. Such techniques include convolution, pooling, rectified linear units, and fully connected layers. The first layer that extracts features from an input image is convolution. The fully connected layer classifies and identifies the object in the output layer. CNNs are feed forward networks because information flows only one way, from inputs to outputs. CNNs are biologically inspired, as are artificial neural networks (ANN).

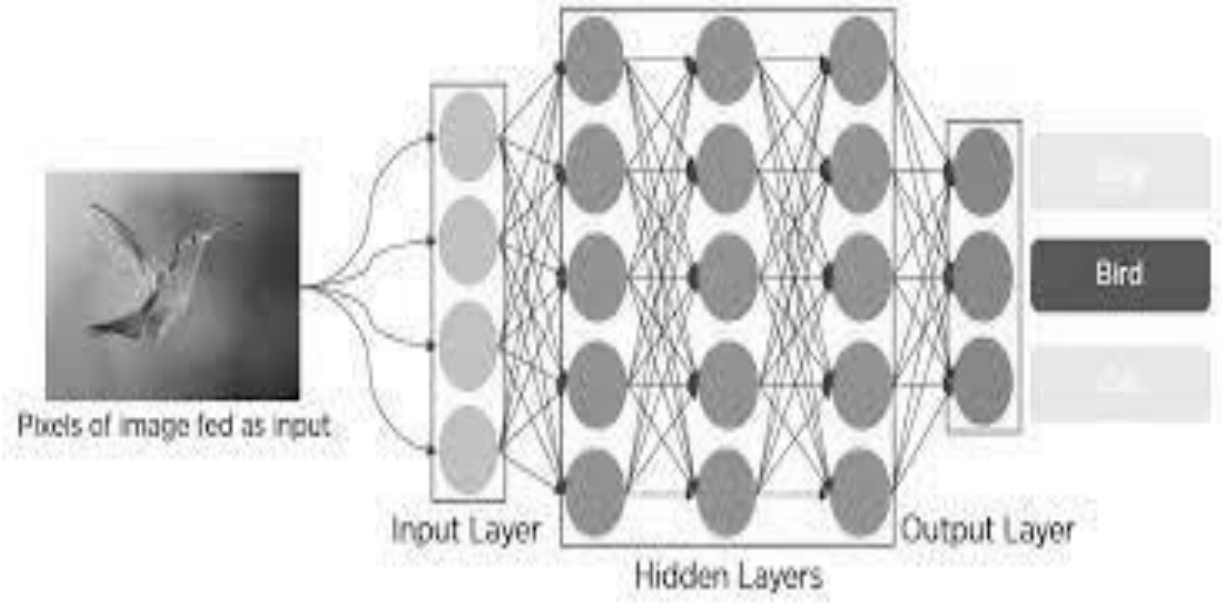

Fig: Convolutional Neural Network

VI. APPLICATION

The Convolutional Neural Network has several business applications. Every industry in the world strives for a system that can fix any issue based on the inputs. The business applications that we discussed in this paper are listed below [4, 5, 6 and 7]. .

4 Detection of Several Images By Using Artificial Neural Network And Improving Its Accuracy By Using Convolutional Neural Network.

5.Convolutional neural networks for real-time grasp detection (CNN).

6.Using neural networks to recognise Indian Sign Language hand gestures

7 Face recognition using neural networks.

8.Classification of Hyperspectral Images Using Conditional Random Field and Deep Feature Learning.

VII. RESULTS AND DISCUSSION

The Results and classification report of this project is shown in the figure below.

Classification Report:

	precision	recall	f1-score	support
0	0.72	0.37	0.49	1000
1	0.73	0.39	0.51	1000
2	0.46	0.21	0.29	1000
3	0.29	0.43	0.35	1000
4	0.57	0.16	0.25	1000
5	0.42	0.34	0.38	1000
6	0.35	0.80	0.49	1000
7	0.61	0.45	0.51	1000
8	0.61	0.59	0.60	1000
9	0.39	0.77	0.52	1000
accuracy			0.45	10000
macro avg	0.51	0.45	0.44	10000
weighted avg	0.51	0.45	0.44	10000

Fig: Classification Report of Convolutional Neural Network

```
Epoch 1/10
1563/1563 [==============================] - 35s 22ms/step - loss: 1.4610 - accuracy: 0.4793
Epoch 2/10
1563/1563 [==============================] - 33s 21ms/step - loss: 1.0876 - accuracy: 0.6188
Epoch 3/10
1563/1563 [==============================] - 33s 21ms/step - loss: 0.9572 - accuracy: 0.6666
Epoch 4/10
1563/1563 [==============================] - 36s 23ms/step - loss: 0.8706 - accuracy: 0.6973
Epoch 5/10
1563/1563 [==============================] - 36s 23ms/step - loss: 0.7990 - accuracy: 0.7259
Epoch 6/10
1563/1563 [==============================] - 36s 23ms/step - loss: 0.7490 - accuracy: 0.7401
Epoch 7/10
1563/1563 [==============================] - 36s 23ms/step - loss: 0.7001 - accuracy: 0.7562
Epoch 8/10
1563/1563 [==============================] - 36s 23ms/step - loss: 0.6562 - accuracy: 0.7719
Epoch 9/10
1563/1563 [==============================] - 38s 24ms/step - loss: 0.6206 - accuracy: 0.7830
Epoch 10/10
1563/1563 [==============================] - 37s 23ms/step - loss: 0.5832 - accuracy: 0.7966
<keras.callbacks.History at 0x1e30b50bdc0>
```

Fig: Result of Convolutional Neural Network

VIII. SUMMARY AND FURTHER WORKS

In our model, we build a Convolutional neural network architectures for classifying images in the CIFAR10 dataset. By building a Convolutional Neural Network we build an Image recognition and classification model which can recognise and classify this CIFAR-10 dataset into 10 different classes and recognise and label each image of the CIFAR-10 dataset. This led to the conclusion that, as technology advances daily, artificial intelligence is becoming increasingly necessary due only to parallel processing. The demand for parallel processing is greater now than ever before since it is the only way we can consistently save time and money on tasks involving computers and robots. If we talk about the future work, we can only say that in order to go over the Convolutional Neural Network's constraints, we need to create a lot more algorithms and different methods of problem resolution. The prediction accuracy of the CNN is 75-80% in this model, clearly demonstrating the Convolutional neural network's good efficiency. Further work we will do in a specific domain such as Satellite image recognition and classification in which we can perform the function of recognition of images and classify those images into there specific classes. Which is commonly used for Weather Forecasting.

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