ANIMAL DETECTION IN AGRI LAND

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ABSTRACT

Crop damage caused by animal attacks is one of the major threats in reducing the crop yield. Due to the expansion of cultivated land into previous wildlife habitat, crop raiding is becoming one of the most antagonizing human-wildlife conflicts. Farmers in India face serious threats from pests, natural calamities & damage by animals resulting in lower yields. Traditional methods followed by farmers are not that effective and it is not feasible to hire guards to keep an eye on crops and prevent wild animals. Since safety of both human and animal is equally vital, it is important to protect the crops from damage caused by animal as well as divert the animal without any harm. Thus, in order to overcome above problems and to reach our aim, we use deep learning to detect animals, entering into our farm by using deep neural network concept, a division in computer vision. In this project, we will monitor the entire farm at regular intervals through a camera which will be recording the surrounding throughout the day. With the help of a deep learning model, we detect the entry of animals and we play appropriate sounds to drive the animal away. This report specifies various libraries and concepts of convolutional neural networks used to create the model.

CHAPTER 1

INTRODUCTION

Agriculture meets food demands of the population and also provides various raw materials for industries. Interference of animals in agricultural lands causes a huge loss of crops. Crop damage due to raiding wild animals has become a major issue of concern these days. Animals like wild buffalo, cow, and goat are extremely destructive and have also caused human casualties sometimes. The total losses in crop yield are high for potato and wheat in villages. Small farmers lose up to 40 to 50 percent of their crop to wild animals and they cannot take any harsh measures due to the strict wildlife laws. Human-animal conflict is rising intensely as elephants are

a highly conflict prone wildlife species, especially in India. Thus, there is need for a system which can help the farmers to drive away these animals as soon as they learn about their intrusion.

A good crop yield with minimal expenditure is the need of the hour, and farmers who want to try this method need not spend much. Each farmer expects a good harvest at the beginning of every planting season. Farmers of the state face serious threats from frequent natural calamities like cyclone, flood, draught etc. Besides these, sudden pest attack and crop damages by domestic and wild animals at the harvesting season results a significant lower yields or sometimes complete loss of yields. Wild animals such as wild buffalo, cow, and goat etc. cause considerable amount of crop damage in nearby crop areas of forest and hilly regions at every harvesting season.

Neither farmers nor government officials are able to solve this issue and only trying to drive these animals back to the forest regions by beating drums, lighting fire crackers etc. Researchers and planners throughout the world are trying to find some alternative methods to solve this problems of farmers. A farmer near the forest or hilly region is not sure whether he would receive a good yield of his crop and feed his family members. Though some of the methods like wire fences and electric fences may be adopted to protect the crop from wild animals, these are costlier and the cost depends on size of the area. Moreover, it is allowed only for protection against endangered animal species.

Additionally, electric fences are kept away from any possible human contact and may be sometimes life threating. Hence, it is essential to use any electronic Automation which will not cause any danger to the wild animals as well as human beings. Here in our project we are implementing the Artificial intelligence technique to detect the animal intrusion in the farming lands. We use sound waves to distract the animals from the farming lands without any harmful to the animals as well as human beings. The placement of the Passive Infrared (PIR) sensor is in such a way that it gives a wider range for detection. In t, initially a glimpse of an existing system is given followed by the hardware description of the proposed system. Objectives and scope explains the aims of the system and the purpose of implementation of different components.

1.1 ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI), digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—as, for example, discovering proofs for mathematical theorems or playing chess—with great proficiency. Still, despite continuing advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over wider domains or in tasks requiring much everyday knowledge.

On the other hand, some programs have attained the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in applications as <u>diverse</u> as medical <u>diagnosis</u>, computer <u>search engines</u>, and voice or handwriting recognition.
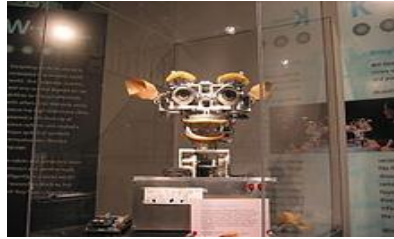
1.2 BASICS

A typical AI analyzes its environment and takes actions that maximize its chance of success. An AI's intended utility function (or goal) can be simple ("1 if the AI wins a game of Go, 0 otherwise") or complex ("Do mathematically similar actions to the ones succeeded in the past"). Goals can be explicitly defined, or induced. If the AI is programmed for "reinforcement learning", goals can be implicitly induced by rewarding some types of behavior or punishing others. Alternatively, an evolutionary system can induce goals by using a "fitness function" to mutate and preferentially replicate high-scoring AI systems, similarly to how animals evolved to innately desire certain goals such as finding food. Some AI systems, such as nearest-neighbor, instead of reason by analogy, these systems are not generally given goals, except to the degree that goals are implicit in their training data. Such systems can still be benchmarked if the non-goal system is framed as a system whose "goal" is to successfully accomplish its narrow classification task.

AI often revolves around the use of algorithms. An algorithm is a set of unambiguous instructions that a mechanical computer can execute. A complex algorithm is often built on top of other, simpler, algorithms. A simple example of an algorithm is the following (optimal for first player) recipe for play at tic-tac-toe. Many AI algorithms are capable of learning from data; they can enhance themselves by learning new heuristics (strategies, or "rules of thumb", that have worked well in the past), or can themselves write other algorithms. Some of the "learners" described below, including Bayesian networks, decision trees, and nearest-neighbor, could theoretically, (given infinite data, time, and memory) learn to approximate any function, including which combination of mathematical functions would best describe the world.

These learners could therefore, derive all possible knowledge, by considering every possible hypothesis and matching them against the data. In practice, it is almost never possible to consider every possibility, because of the phenomenon of "combinatorial explosion", where the amount of time needed to solve a problem grows exponentially. Much of AI research involves figuring out how to identify and avoid considering broad range of possibilities that are unlikely to be beneficial.

For example, when viewing a map and looking for the shortest driving route from Denver to New York in the East, one can in most cases skip looking at any path through San Francisco or other areas far to the West;

thus, an AI wielding a pathfinding algorithm like A* can avoid the combinatorial explosion that would ensue if every possible route had to be ponderously considered in turn.

The earliest (and easiest to understand) approach to AI was symbolism (such as formal logic): "If an otherwise healthy adult has a fever, then they may have influenza". A second, more general, approach is Bayesian inference: "If the current patient has a fever, adjust the probability they have influenza in such-and-such way". The third major approach, extremely popular in routine business AI applications, are analogizers such as SVM and nearest-neighbor: "After examining the records of known past patients whose temperature, symptoms, age, and other factors mostly match the current patient, X% of those patients turned out to have influenza".

A fourth approach is harder to intuitively understand, but is inspired by how the brain's machinery works: the artificial neural network approach uses artificial "neurons" that can learn by comparing itself to the desired output and altering the strengths of the connections between its internal neurons to "reinforce" connections that seemed to be useful. These four main approaches can overlap with each other and with evolutionary systems; for example, neural nets can learn to make inferences, to generalize, and to make analogies. Some systems implicitly or explicitly use multiple of these approaches, alongside many other AI and non-AI algorithms; the best approach is often different depending on the problem.

1.3 MACHINE LEARNING

Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Machine learning is an important component of the growing field of data science.

Through the use of statistical methods, algorithms are trained to make classifications or predictions, uncovering key insights within data mining projects. These insights subsequently drive decision making within applications and businesses, ideally impacting key growth metrics. As big data continues to expand and grow, the market demand for data scientists will increase, requiring them to assist in the identification of the most relevant business questions and subsequently the data to answer them.

1.4 DEEP LEARNING

Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign, or to distinguish a pedestrian from a lamppost. It is the key to voice control in consumer devices like phones, tablets, TVs, and hands-free speakers. Deep learning is getting lots of attention lately and for good reason.

It's achieving results that were not possible before In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound.

Deep learning models can achieve state-of-the-art accuracy, sometimes exceeding human-level performance. Models are trained by using a large set of labeled data and neural network architectures that contain many layers.

1.5 CONVOLATIONAL NEURAL NETWORK

- **Layers in CNN**
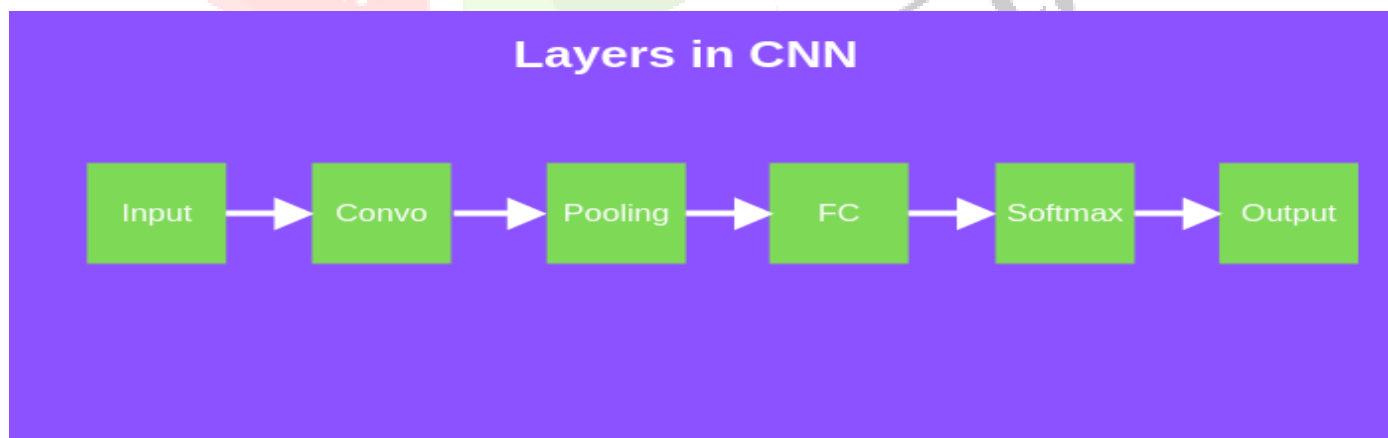
There are five different layers in CNN

- **Input layer**

Convo layer (Convo + ReLU)

Pooling layer

Fully connected(FC) layer

Softmax/logistic layer

- **Output layer**

1.6 Different layers of CNN

Input Layer

Input layer in CNN should contain image data. Image data is represented by three dimensional matrix as we saw earlier. You need to reshape it into a single column. Suppose you have image of dimension 28 x 28 =784, you need to convert it into 784 x 1 before feeding into input. If you have "m" training examples then dimension of input will be (784, m).

Convo Layer

Convo layer is sometimes called feature extractor layer because features of the image are get extracted within this layer. First of all, a part of image is connected to Convo layer to perform convolution operation as we saw earlier and calculating the dot product between receptive field (it is a local region of the input image that has the same size as that of filter) and the filter. Then we slide the filter over the next receptive field of the same input image by a Stride and do the same operation again. We will repeat the same process again and again until we go through the whole image. The output will be the input for the next layer.Convo layer also contains ReLU activation to make all negative value to zero.

Pooling Layer
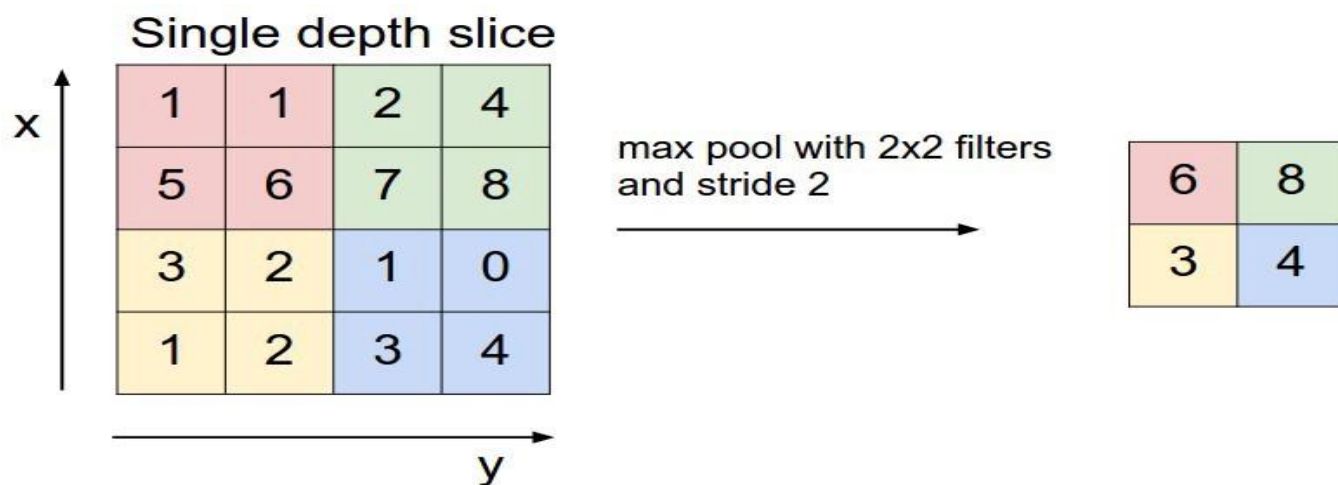
Pooling layer is used to reduce the spatial volume of input image after convolution. It is used between two convolution layer. If we apply FC after Convo layer without applying pooling or max pooling, then it will be computationally expensive and we don't want it. So, the max pooling is only way to reduce the spatial volume of input image.

In the above example, we have applied max pooling in single depth slice with Stride of 2. You can observe the 4 x 4 dimension input is reduce to 2 x 2 dimension.There is no parameter in pooling layer but it has two hyperparameters — Filter(F) and Stride(S).

In general, if we have input dimension W1 x H1 x D1, then

- W2 = (W1−F)/S+1

- H2 = (H1−F)/S+1

- D2 = D1

Where W2, H2 and D2 are the width, height and depth of output.

Fully Connected Layer (FC)

- Fully connected layer involves weights, biases, and neurons. It connects neurons in one layer to neurons in another layer. It is used to classify images between different categories by training.

- **Softmax / Logistic Layer**

- **Softmax** or Logistic layer is the last layer of CNN. It resides at the end of FC layer. Logistic is used for binary classification and softmax is for multi-classification.

Output Layer

- Output layer contains the label which is in the form of one-hot encoded.
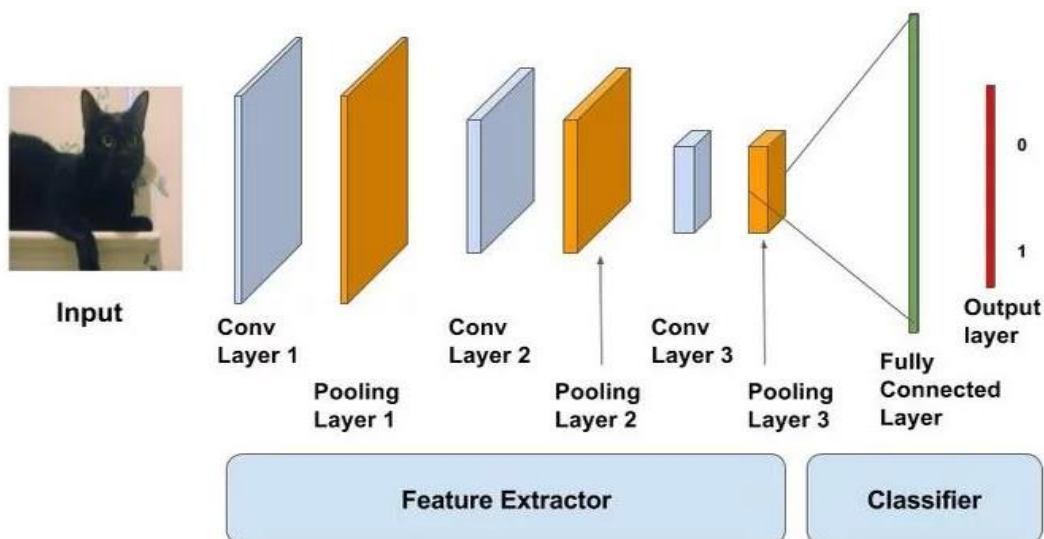
CHAPTER 2

OBJECTIVES

- ❖ To study Image processing techniques and apply an algorithm for convolutional neural network.
- ❖ To design an automatic system to control animal crop detection using image processing.
- ❖ In the field of Deep Learning to provide a monitoring and repelling system for Animal crop attack.

2.1 ADVANTAGES

1. Reduction in Human Error

One of the biggest advantages of Artificial Intelligence is that it can significantly reduce errors and increase accuracy and precision. The decisions taken by AI in every step is decided by information previously gathered and a certain set of algorithms. When programmed properly, these errors can be reduced to null.

2. Zero Risks

Another big advantage of AI is that humans can overcome many risks by letting AI robots do them for us. Whether it be defusing a bomb, going to space, exploring the deepest parts of oceans, machines with metal bodies are resistant in nature and can survive unfriendly atmospheres. Moreover, they can provide accurate work with greater responsibility and not wear out easily.

3. New Inventions

AI has helped in coming up with new inventions in almost every domain to solve complex problems. A recent invention has helped doctors to predict early stages of breast cancer in women using advanced AI-based technologies.

4. 24x7 Availability

There are many studies that show humans are productive only about 3 to 4 hours in a day. Humans also need breaks and time offs to balance their work life and personal life. But AI can work endlessly without breaks. They think much faster than humans and perform multiple tasks at a time with accurate results. They can even handle tedious repetitive jobs easily with the help of AI algorithms.

5. **Digital Assistance**

Almost all the big organizations these days use digital assistants to interact with their customers which significantly minimizes the need for human resources. You can chat with a chatbot and ask them exactly what you need. Some chatbots have become so intelligent these days that you wouldn't be able to determine whether you are chatting with a chatbot or a human being.

2.2 SCOPE

1. To plan a security system for farm assurance

2. Restrict the passage of animal into the farm

3. Use GSM module for cautioning us

4. Plan a system that sounds through solar animal anti-agents when animal attempts   to go into the farm

CHAPTER 3

LITERATURE SURVEY

1."IoT Concept for Animal Detection Using ANN to Prevent Animal Vehicle Collision on Highways"-IEEE-2019

This paper uses two major algorithms such as the motion detection algorithm with the sensors and object recognition algorithm using artificial neural networks. In this paper we have used the motion detection PIR sensor to detect the animal movement near roads and the ANN for object recognition. Once the motion is detected the object recognition algorithm recognizes whether the motion detected was due to an animal movement or any other factors. If it is because of an animal movement it sends alerts through the LED signage boards and to the android application which uses Google maps to show alerts on the corresponding area through MQTT.

2. "ANIMAL DETECTION USING DEEP LEARNING ALGORITHM"-ISSN-2020

This proposed work develops an algorithm to detect the animals in wild life. Since there are many different animals manually identifying them can be a difficult task. This algorithm classifies animals based on their images so we can monitor them more efficiently. Animal detection and classification can help to prevent animal-vehicle accidents, trace animals and prevent theft. This can be achieved by applying effective deep learning algorithms.

3. "Wild-Animal Recognition in Agriculture Farms Using W-COHOG for Agro-Security"-IEEE-2017

In this paper, we proposed an algorithm to detect animals in a given image. WCoHOG is a Histogram oriented gradients based feature vector with better accuracy. It is an extension of Co-occurrence Histograms of Oriented Gradients (CoHOG). In this paper LIBLINEAR classifier is used in order to get better accuracy for high dimensional data. The experiments were conducted on two benchmark datasets called Wild-Anim and CamaraTrap dataset. Experimental results prove that W-CoHOG performs better than existing state of the art methods.

4. "Animal Behavior Classification Using DeepLabCut"-IEEE-2020

In this paper, we introduce a method to classify animal behaviors from videos taken by a fixed-point camera. In order to classify animal behavior, it is necessary to detect and track the animals. Conventional approaches for detecting moving objects are based on background subtraction and frame subtraction. Conventional methods are not suitable for detection of animals kept indoors since they are susceptible to sunlight and shadow. We propose a method to track animals and classify their behavior using skeletal information obtained by DeepLabCut.

5. "Smart Intrusion Detection System for Crop Protection by using Arduino"-IEEE-2020

Traditional systems like humanoid scarecrows are used even today in an agricultural field to stop birds and animals from disturbing and feeding on growing crops. There are many loopholes in such ideas and so enhancing agricultural security has become a major issue these days. Thus, this paper focuses on proposing a system which detects the intruders, monitors any malicious activity and then reports it to the owner of the system. It acts as an adaptable system which provides a practicable system to the farmers for ensuring complete safety of their farmlands from any attacks or trespassing activities.

CHAPTER-4

SYSTEM DESIGN

4.1 EXISTING SYSTEM

- According to previous research in crop's security, developing countries, which are using traditional storage facilities for staple food crops, can't protect them, leading to 20- 30% loss of agricultural products such as rice, corn etc.

- Currently available solutions targets only insects, pests and grain pathogens. While other study states 5 to 10% loss in rice crops on average, in Asia is due to damage caused by rodents.

- This paper is oriented to accentuate the methods to solve such problems like identification of rodents, threats to crops and delivering real time notification based on information analysis and processing without human intervention. In this device, mentioned sensors and electronic devices are integrated using Python scripts. Based on attempted test cases, we were able to achieve success in 84.8% test cases.
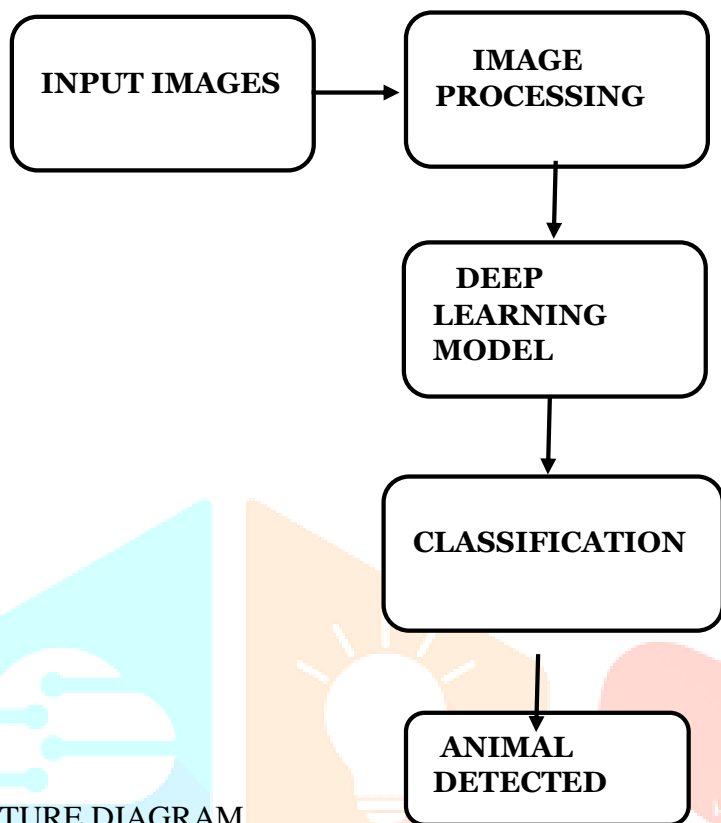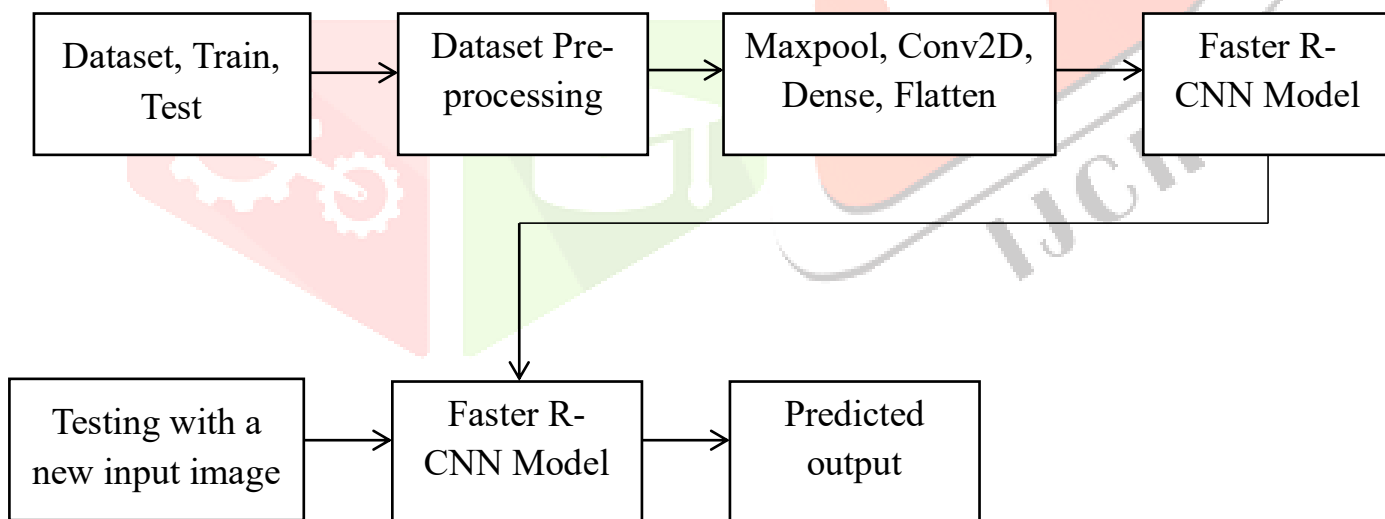
4.2 EXISTING BLOCK DIAGRAM

4.3 PROPOSED SYSTEM

- The main aim of our project is to protect the crops from damage caused by animal as well as divert the animal without any harm.

- Animal detection system is designed to detect the presence of animal and offer a warning. In this project we used to detect the movement of the animal.

- In this project, we will monitor the entire farm at regular intervals through a camera which will be recording the surrounding throughout the day. With the help of a deep learning model, we detect the entry of animals and we play appropriate sounds to drive the animal away.

- This report specifies various libraries and concepts of convolutional neural networks used to create the model.

- If any of the Animal is detected using CNN algorithm in the Agricultural land and send sms.
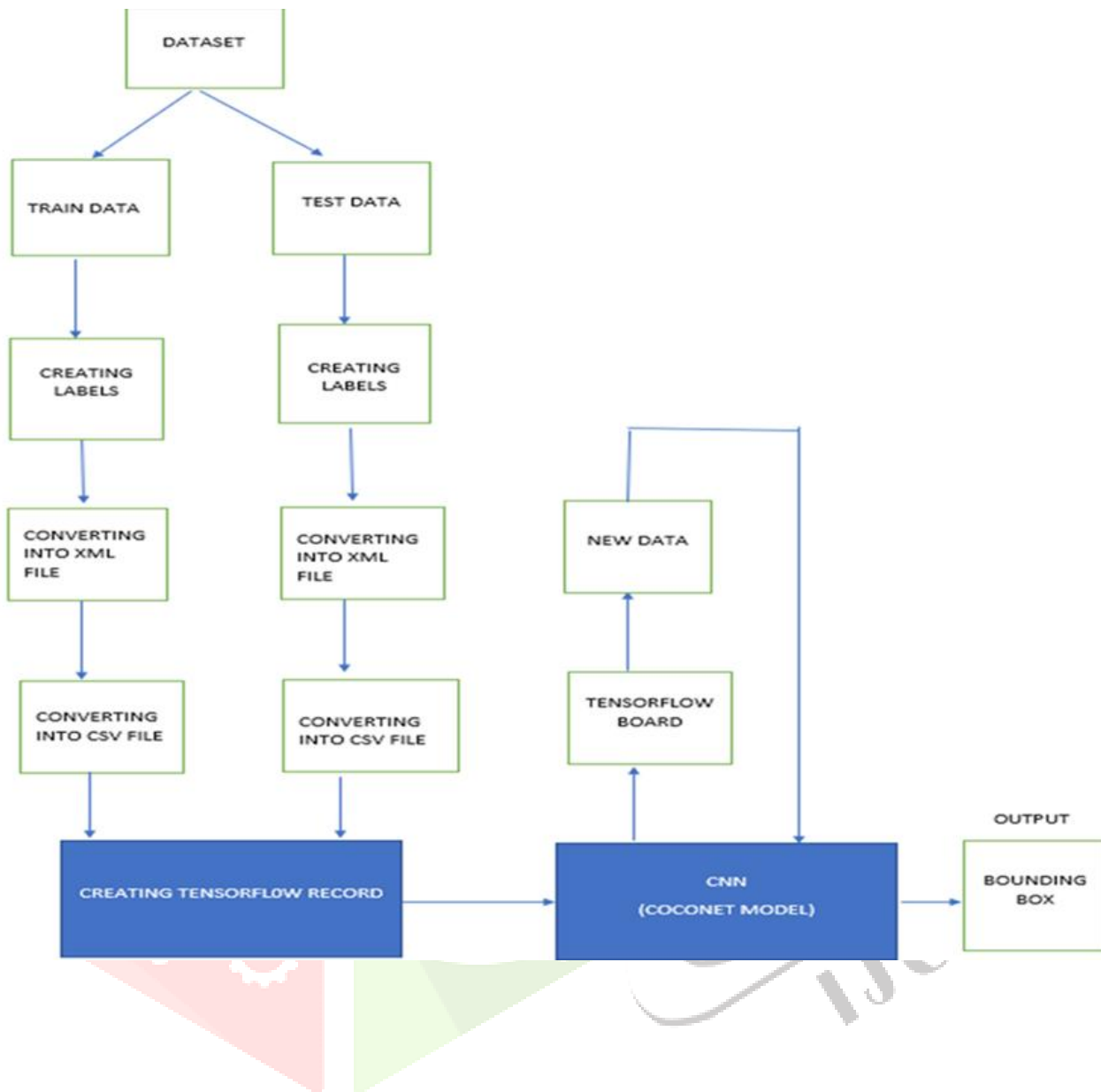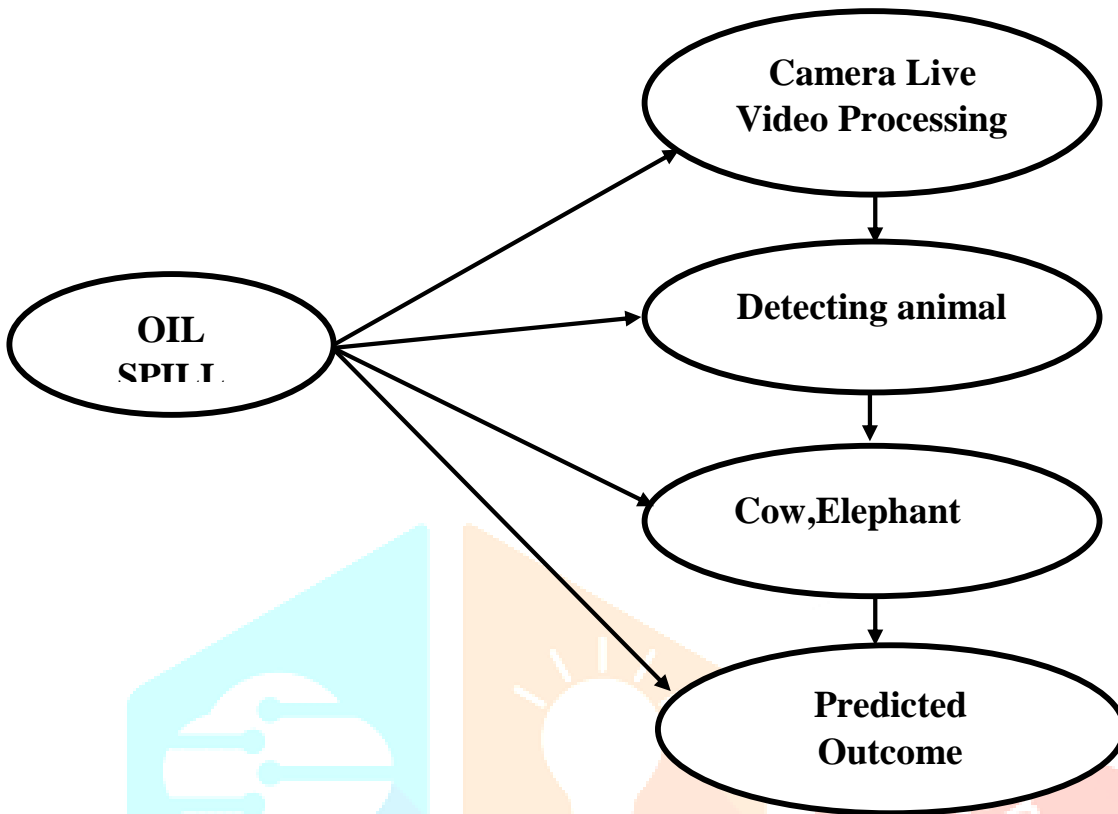
4.4 PROPOSED BLOCK DIGRAM

```
┌─────────────────┐        ┌─────────────────┐
│  INPUT IMAGES   │ ─────▶ │     IMAGE       │
│                 │        │  PROCESSING     │
└─────────────────┘        └─────────────────┘
                                   │
                                   ▼
                           ┌─────────────────┐
                           │     DEEP        │
                           │   LEARNING      │
                           │    MODEL        │
                           └─────────────────┘
                                   │
                                   ▼
                           ┌─────────────────┐
                           │ CLASSIFICATION  │
                           └─────────────────┘
                                   │
                                   ▼
                           ┌─────────────────┐
                           │    ANIMAL       │
                           │   DETECTED      │
                           └─────────────────┘
```
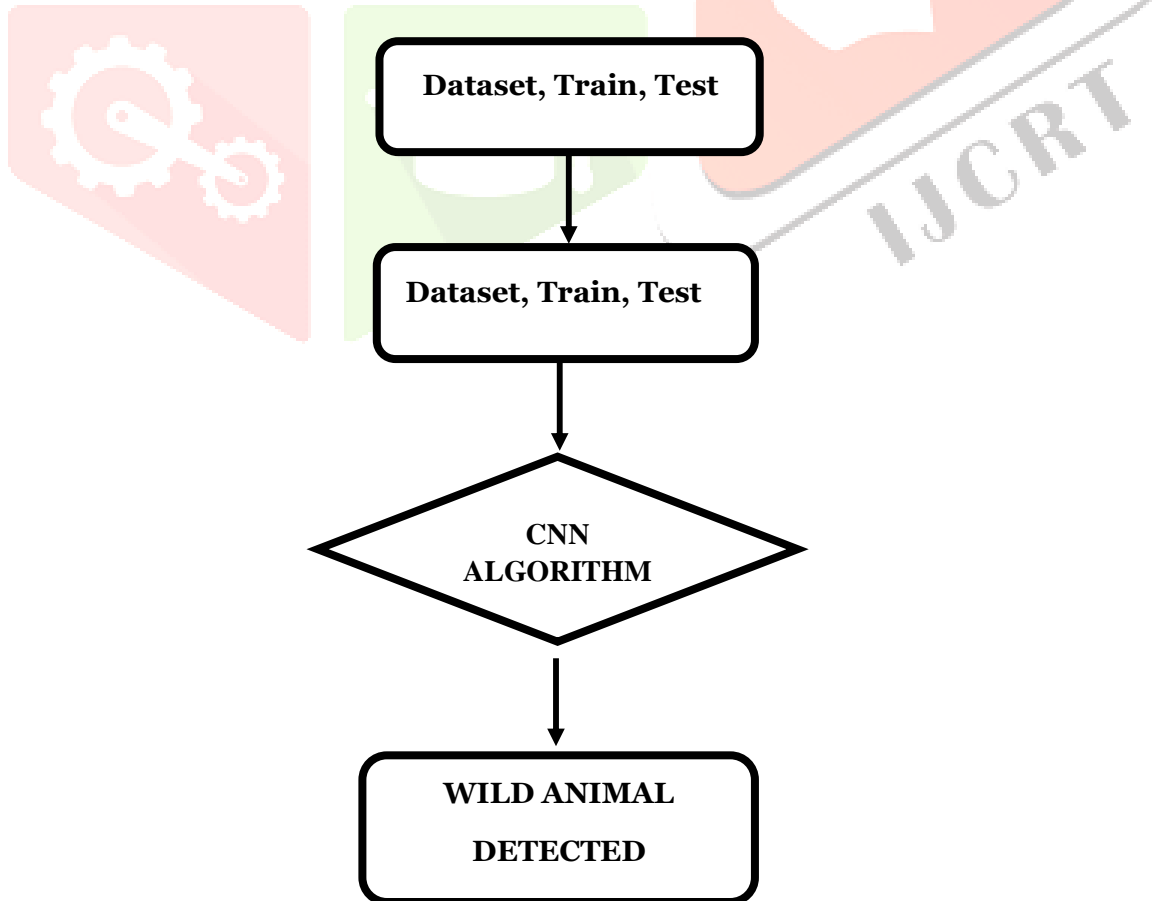
4.5 ARCHITECTURE DIAGRAM

```
┌──────────────┐   ┌──────────────┐   ┌──────────────────┐   ┌──────────────┐
│ Dataset,     │──▶│ Dataset Pre- │──▶│ Maxpool, Conv2D, │──▶│ Faster R-    │
│ Train, Test  │   │ processing   │   │ Dense, Flatten   │   │ CNN Model    │
└──────────────┘   └──────────────┘   └──────────────────┘   └──────────────┘
                                                                     │
                                                                     │
                                              ┌──────────────┐       │
                                              ▼              │       │
┌──────────────┐   ┌──────────────┐   ┌──────────────┐      │
│ Testing with │──▶│ Faster R-    │──▶│ Predicted    │
│ a new input  │   │ CNN Model    │   │ output       │
│ image        │   │              │   │              │
└──────────────┘   └──────────────┘   └──────────────┘
```

4.6 FLOW CHART

4.7 USECASE DIAGRAM

4.8 ACTIVITY DIAGRAM

4.9 CLASS DIAGRAM

```
┌─────────────────────────────┐
│          DATASET            │
├─────────────────────────────┤
│         TRAINING            │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│       CNN ALGORITHM         │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     PREDICTED OUTCOME       │
└─────────────────────────────┘
```

4.10 SEQUENCE DIAGRAM

| ANIMAL | DATABASE RECORD | CNN ALGORITHM | PREDICTING OUTCOME |

Camera processing   Classifying each Frame   CNN Working

OUTPUT

<div align="center">
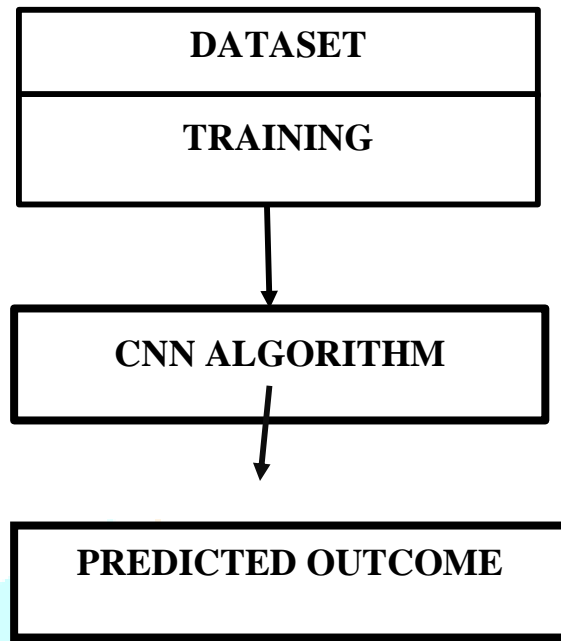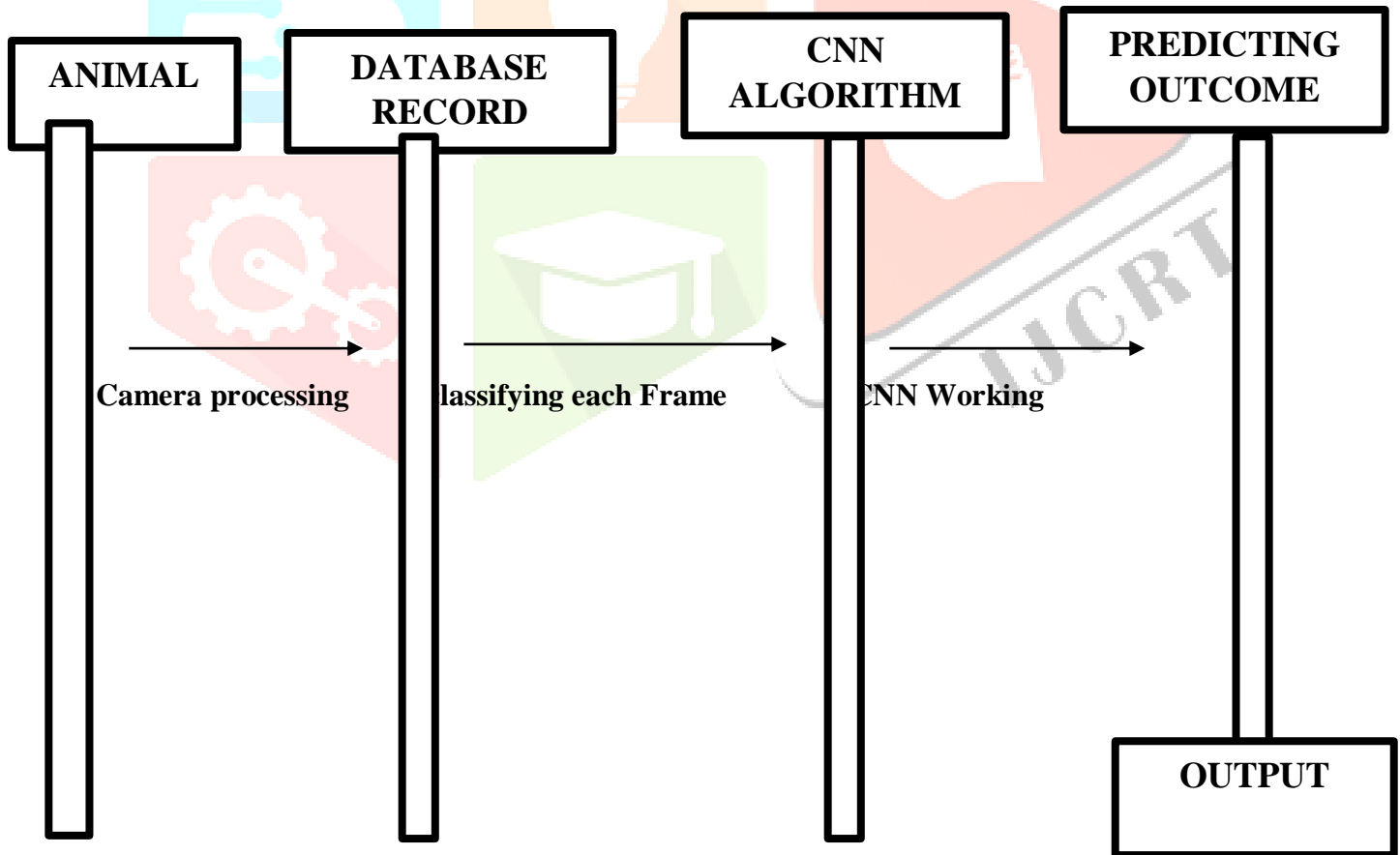
CHAPTER 5

MODULES DESCRIPTION

</div>

1. IMAGE DATASET COLLECTION

2. IMAGE PREPROCESSING

3. IMPORTING MODULES

4. CAPUTURING THE IMAGES OF ANIMALS

5. CAMERA INTERFACING

1. IMAGE DATASET COLLECTION

For this project, we must gather every image that makes a car appear to be animal image data. This is the project's most crucial step. Therefore, all of the visuals that we see come from real-time or recorded CCTV footage. The following procedures can be taken after we get the data.

2.IMAGE PREPROCESSING

After gathering all the images, pre-processing is required. Thus not all images can convey information clearly. So that we may prepare the images by renaming, resizing, and labelling them. Once the procedure is complete, we can use the photos to train our deep learning model.

3.IMPORTING MODULES

Following that, we must import all of the required library files. Library files are collections of functions and small execution codes. This library files will assist us in performing all of the necessary steps of object detection and image processing. We use important library files such as Tensor Flow, opencv, keras, and others in this project. These libraries will aid in making our deep learning model more efficient and adaptable for processing real-time images or videos.

4. CAPTURING THE IMAGES OF ANIMALS

For this project, we must gather every image that makes an animal crop. This is the project's most crucial step. Therefore, all of the visuals that we see come from real-time or recorded CCTV footage. The following procedures can be taken after we get the three animal datasets.
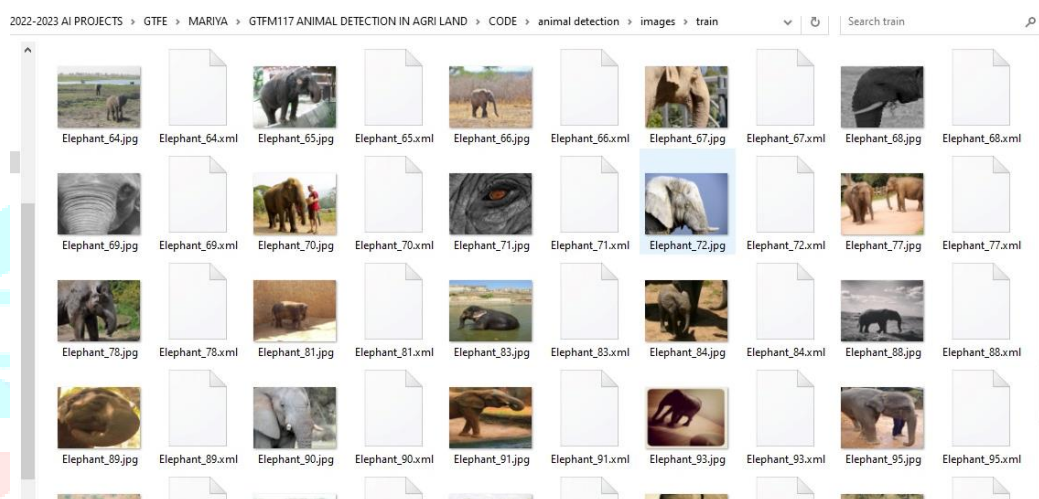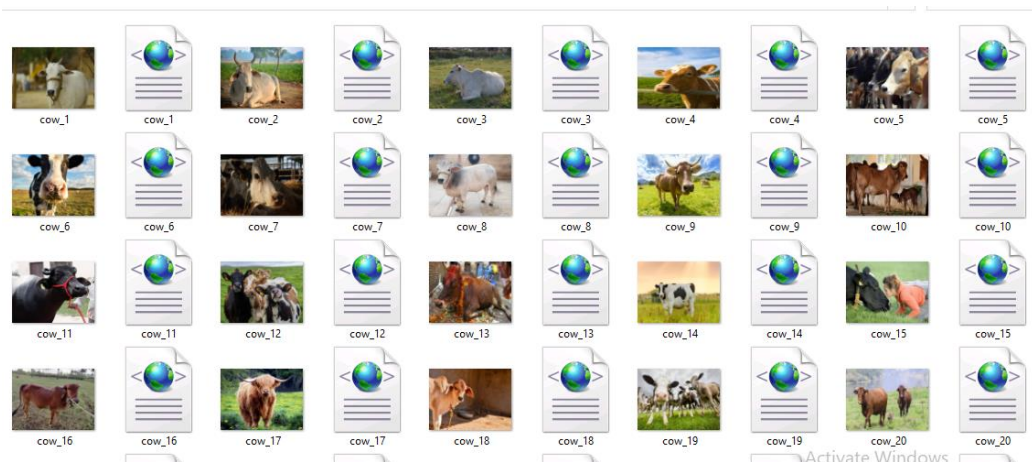
5. CAMERA INTERFACING

One of the most important steps in image processing is computer vision. As a result, we must connect the camera to our deep learning model. Because the computer will see all real-world objects through the camera. Motoring of all kinds of medium can be done using camera. The captured animal detecting can be produced as main source of proof if needed.

CHAPTER 6

SOFTWARE DESCRIPTION

PYTHON

OPENCV

PILLOW

6.1 PYTHON

Python is a popular programming language. It was created by Guido vanRossum, and released in 1991. It is used for:

- Web development (server-side),

- Software development,

- Mathematics,

- System scripting.

6.1.1 PYTHON WORK

- Python can be used on a server to create web applications.

- Python can be used alongside software to create workflows.

- Python can connect to database systems. It can also read and modify files.

- Python can be used to handle big data and perform complex mathematics.

- Python can be used for rapid prototyping, or for production-read There are two attributes that make development time in Python faster thanin other programming languages:

1. Python is an interpreted language, which precludes the need to compilecode before executing a program because Python does the compilation in the background. Because Python is a high-level programming language, itabstracts many sophisticated details from the programming code. Python focuses so much on this abstraction that its code can be understood by mostnovice programmers.

2. Python code tends to be shorter than comparable codes. Although Python offers fast development times, it lags slightly in terms of executiontime. Compared to fully compiling languages like C and C++, Python programs execute slower. Of course, with the processing speeds of computers these days, the speed differences are usually only observed in benchmarking tests, not in real-world operations. In most cases, Python isalready included in Linux distributions and Mac OS X machines.

3. Python is a dynamic, high level, free open source and interpreted programming language. It supports object –oriented programming as wellas procedural oriented programming. Python is a very easy to code as compared to other language like c , c ++, java etc.. It is also a developer- friendly language. Python is also an Integrated language because we can easily integrated python with other language like c, c ++, etc..

6.1.2 SETTING UP THE PYTHON IDLE

Step 1 –Download the python IDLE software

Open your web browser and navigate to the Downloads for Windows section ofthe official python website.
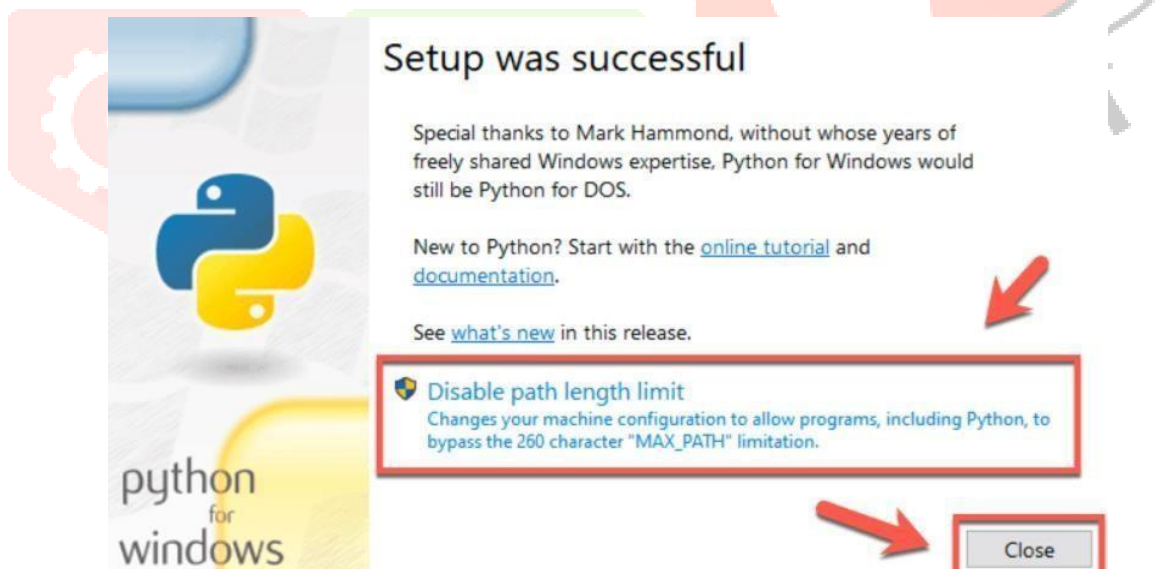
6.1.3 TESSERACT OCR

Tesseract is an open source text recognition (OCR) Engine, available under the Apache 2.0 license. It can be used directly, or (for programmers) using an API to extract printed text from images. It supports a wide variety of languages. Tesseract doesn't have a built-in GUI, but there are several available from the 3rdParty page. Tesseract is compatible with many programming languages and frame

works through wrappers that can be found <u>here</u>.

6.1.4 PYTHON NUMPY

Our Python NumPy Tutorial provides the basic and advanced concepts of the NumPy. Our NumPy tutorial is designed for beginners and professionals.

NumPy stands for numeric python which is a python package for the computation and processing of the multidimensional and single dimensional array elements.

6.1.5 What is NumPy

NumPy stands for numeric python which is a python package for the computation and processing of the multidimensional and single dimensional array elements.Travis Oliphant created NumPy package in 2005 by injecting the features of the ancestor module Numeric into another module Numarray. It is an extension module of Python which is mostly written in C. It provides various functions which are capable of performing the numeric computations with a high speed. NumPy provides various powerful data structures, implementing multi-dimensional arrays and matrices. These data structures are used for the optimal computations regarding arrays and matrices. In this tutorial, we will go through the numeric python library NumPy.

The need of NumPy

With the revolution of data science, data analysis libraries like NumPy, SciPy, Pandas, etc. have seen a lot of growth. With a much easier syntax than other programming languages, python is the first choice language for the data scientist.

NumPy provides a convenient and efficient way to handle the vast amount of data. NumPy is also very convenient with Matrix multiplication and data reshaping. NumPy is fast which makes it reasonable to work with a large set of data.

There are the following advantages of using NumPy for data analysis.

1. NumPy performs array-oriented computing.
2. It efficiently implements the multidimensional arrays.
3. It performs scientific computations.
4. NumPy provides the in-built functions for linear algebra and random number generation.

Nowadays, NumPy in combination with SciPy and Mat-plotlib is used as the replacement to MATLAB as Python is more complete and easier programming language than MATLAB.

Prerequisite

Before learning Python Numpy, you must have the basic knowledge of Python concepts.

6.2 OPEN CV

OpenCV tutorial provides basic and advanced concepts of OpenCV. Our OpenCV tutorial is designed for beginners and professionals.

OpenCV is an open-source library for the computer vision. It provides the facility to the machine to recognize the faces or objects. In this tutorial we will learn the concept of OpenCV using the Python programming language.

Our OpenCV tutorial includes all topics of Read and Save Image, Canny Edge Detection, Template matching, Blob Detection, Contour, Mouse Event, Gaussian blur and so on.

6.2.1 What is OpenCV?

OpenCV is a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc.

In OpenCV, the CV is an abbreviation form of a computer vision, which is defined as a field of study that helps computers to understand the content of the digital images such as photographs and videos.

The purpose of computer vision is to understand the content of the images. It extracts the description from the pictures, which may be an object, a text description, and three-dimension model, and so on. For example, cars can be facilitated with computer vision, which will be able to identify and different objects around the road, such as traffic lights, pedestrians, traffic signs, and so on, and acts accordingly.

Computer vision allows the computer to perform the same kind of tasks as humans with the same efficiency. There are a two main task which are defined below:

o **Object Classification -** In the object classification, we train a model on a dataset of particular objects, and the model classifies new objects as belonging to one or more of your training categories.

o **Object Identification -** In the object identification, our model will identify a particular instance of an object - for example, parsing two faces in an image and tagging one as Virat Kohli and other one as Rohit Sharma.

6.2.2 History

OpenCV stands for Open Source Computer Vision Library, which is widely used for image recognition or identification. It was officially launched in 1999 by Intel. It was written in C/C++ in the early stage, but now it is commonly used in Python for the computer vision as well.

The first alpha version of OpenCV was released for the common use at the IEEE Conference on Computer Vision and Pattern Recognition in 2000, and between 2001 and 2005, five betas were released. The first 1.0 version was released in 2006.

The second version of the OpenCV was released in October 2009 with the significant changes. The second version contains a major change to the C++ interface, aiming at easier, more type-safe, pattern, and better implementations. Currently, the development is done by an independent Russian team and releases its newer version in every six months.

How OpenCV Works

In this tutorial, we will learn how computers perform image recognition.

How does computer recognize the image?

Human eyes provide lots of information based on what they see. Machines are facilitated with seeing everything, convert the vision into numbers and store in the memory. Here the question arises how computer convert images into numbers. So the answer is that the pixel value is used to convert images into numbers. A pixel is the smallest unit of a digital image or graphics that can be displayed and represented ona digital display device.
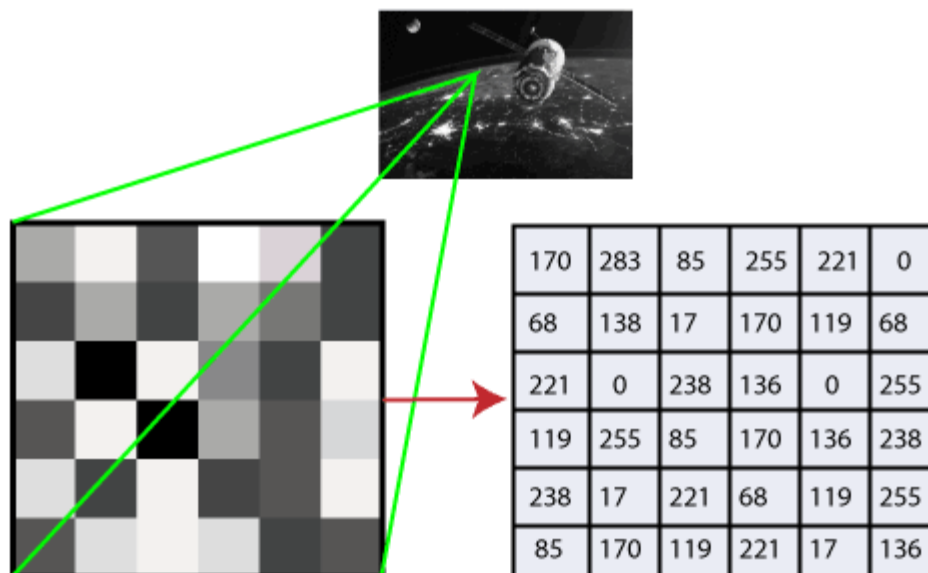
The picture intensity at the particular location is represented by the numbers. In the above image, we have shown the pixel values for a grayscale image consist of only one value, the intensity of the black color at that location.

There are two common ways to identify the images:

1. **Grayscale**

Grayscale images are those images which contain only two colors black and white. The contrast measurement of intensity is black treated as the weakest intensity, and white as the strongest intensity. When we use the grayscale image, the computer assigns each pixel value based on its level of darkness.

2. **RGB**

A RGB is a combination of the red, green, blue color which together makes a new color. The computer retrieves that value from each pixel and puts the results in an array to be interpreted.

Pixel values of R,G,B
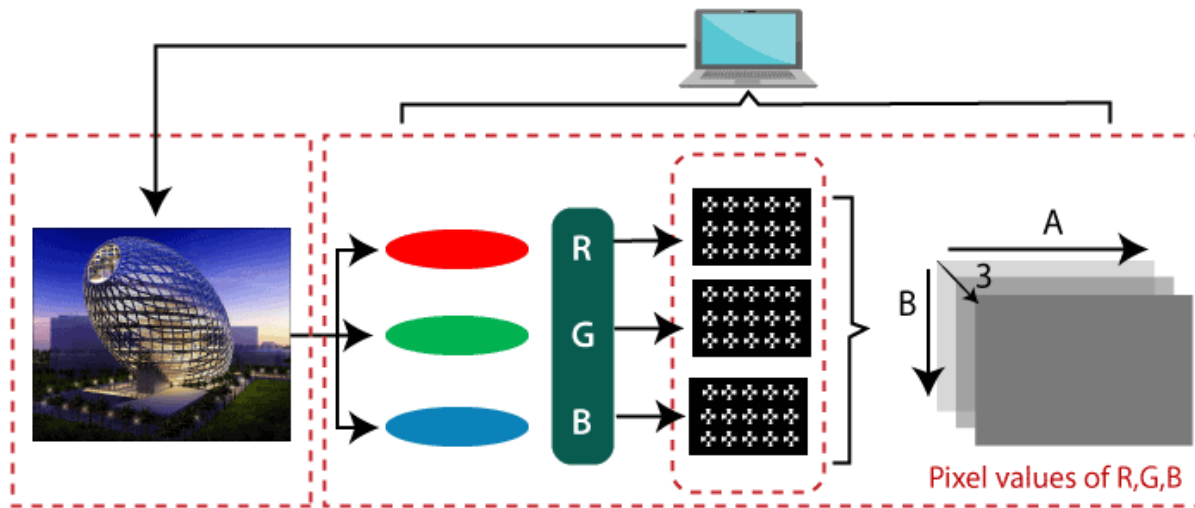
Why OpenCV is used for Computer Vision?

o   OpenCV is available for free of cost.

o   Since the OpenCV library is written in C/C++, so it is quit fast. Now it can be used with Python.

o   It require less RAM to usage, it maybe of 60-70 MB.

o   Computer Vision is portable as OpenCV and can run on any device that can run on C.

6.2.3 Installation of the OpenCV

- **Install OpenCV using Anaconda**

    The first step is to download the latest Anaconda graphic installer for Windows from it <u>official site</u>. Choose your bit graphical installer. You are suggested to install 3.7 working with Python 3.

- **Install OpenCV in the Windows via pip**

    OpenCV is a Python library so it is necessary to install Python in the system and install OpenCV using pip command:

    1.pip install opencv-python

Open the command prompt and type the following code to check if the OpenCV is installed or not.

```
C:\Users\DEVANSH SHARMA\PycharmProjects\myproject\venv\Scripts>python
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul  8 2019, 20:34:20) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> print(cv2.__version__)
4.1.1
>>>
```

6.2.4 OpenCV Read and Save Image

- **OpenCV Reading Images**

    OpenCV allows us to perform multiple operations on the image, but to do that it is necessary to read an image file as input, and then we can perform the various operations on it. OpenCV provides following functions which are used to read and write the images.

- **OpenCV imread function**

    The imread() function loads image from the specified file and returns it.

    The syntax is:

    cv2.imread(filename[,flag])

6.3 PYTHON PILLOW — OVERVIEW

1. In today's digital world, we come across lots of digital images. In case, we are working with Python programming language, it provides lot of image processing libraries to add image processing capabilities to digital images.

2. Some of the most common image processing libraries are: OpenCV, Python Imaging Library (PIL), Scikit-image, Pillow. However, in this tutorial, we are only focusing on Pillow module and will try to explore various capabilities of this module.

3. Pillow is built on top of PIL (Python Image Library). PIL is one of the important modules for image processing in Python. However, the PIL module is not supported since 2011 and doesn't support python 3.

4. Pillow module gives more functionalities, runs on all major operating system and support for python 3. It supports wide variety of images such as "jpeg", "png", "bmp", "gif", "ppm", "tiff". You can do almost anything on digital images using pillow module. Apart from basic image processing functionality, including point operations, filtering images using built-in convolution kernels, and color space conversions.

- **IMAGE ARCHIVES**

5. The Python Imaging Library is best suited for image archival and batch processing applications. Python pillow package can be used for creating thumbnails, converting from one format to another and print images, etc.

- **IMAGE DISPLAY**

6. You can display images using Tk PhotoImage, BitmapImage and Windows DIB interface, which can be used with PythonWin and other Windows-based toolkits and many other Graphical User Interface (GUI) toolkits.

7. For debugging purposes, there is a show () method to save the image to disk which calls the external display utility.

- **IMAGE PROCESSING**

8. The Pillow library contains all the basic image processing functionality. You can do image resizing, rotation and transformation.

9. Pillow module allows you to pull some statistics data out of image using histogram method, which later can be used for statistical analysis and automatic contrast enhancement.

- **PYTHON PILLOW — ENVIRONMENT SETUP**

10. This chapter discusses how to install pillow package in your computer.

11. Installing pillow package is very easy, especially if you're installing it using pip.

12. Installing Pillow using pip

13. To install pillow using pip, just run the below command in your command prompt:

14. python -m pip install pip

15. python -m pip install pillow

16. In case, if pip and pillow are already installed in your computer, above commands will simply mention the 'requirement already satisfied' as shown below:

```
C:\Users\yadur>python -m pip install pip
Requirement already satisfied: pip in c:\python381\lib\site-packages (19.3.1)

C:\Users\yadur>python -m pip install pillow
Requirement already satisfied: pillow in c:\python381\lib\site-packages (7.0.0)
```

- **PYTHON PILLOW — USING IMAGE MODULE**

17. To display the image, pillow library is using an image class within it. The image module inside pillow package contains some important inbuilt functions like, load images or create new images, etc.

18. Opening, rotating and displaying an image

19. To load the image, we simply import the image module from the pillow and call the Image.open(), passing the image filename.

20. Instead of calling the Pillow module, we will call the PIL module as to make it backward compatible with an older module called Python Imaging Library (PIL). That's why our code starts with "from PIL import Image" instead of "from Pillow import Image".

21. Next, we're going to load the image by calling the Image.open() function, which returns a value of the Image object data type. Any modification we make to the image object can be saved to an image file with the save() method. The image object we received using Image.open(), later can be used to resize, crop, draw or other image manipulation method calls on this Image object.

- **Example**

Following example demonstrates the rotation of an image using python pillow:

from PIL import Image

#Open image using Image module

im = Image.open("images/cuba.jpg")

#Show actual Image im.show()

#Show rotated Image

im = im.rotate(45) im.show()

CHAPTER 7

SOFTWARE REQUIREMETS

7.1 HARDWARE SPECIFICATION

System	:	PC OR LAPTOP
Processor	:	INTEL / AMD
RAM	:	4 GB Recommended
ROM	:	2 GB

7.2 SOFTWARE SPECIFICATION

OPERATING SYSTEM	:	WINDOWS 10/11
LANGUAGE USED	:	PYTHON
BACKEND	:	PYTHON IDEL

FRONTEND : PYTHON SHEL

7.3 ADVANTAGE

- The detecting animals that may be grazing or feeding on crops, farmers can take proactive measures to prevent crop damage, such as using scare devices or relocating the animals to other areas.

- Animal detection can help farmers more efficiently monitor their land for potential threats or problems, allowing them to take action quickly and prevent potential losses.

- Crop damage and improving efficiency, animal detection can help farmers save money in the long term by avoiding the costs associated with lost crops or wasted resources.

7.4 DISADVANTAGE

- Wild animals, such a can cause significant damage to crops, which can lead to yield loss and reduced profitability for farmers.
- Strategy is to implement animal monitoring measures, such as cameras or sensors, to detect animal activity early. By doing so, farmers can take preventive measures to protect their crops or livestock from damage or disease transmission.
- Farmers can also work with local conservation organizations or government agencies to develop wildlife management plans that balance the needs of wildlife with the needs of farmers.

7.5 APPLICATION

•The agriland animal of Cow, Elephant and tiger are commonly raised on agricultural land for their meat, milk, and eggs.

•Animals such as cows, pigs, and chickens produce manure, which can be used as fertilizer to improve soil fertility. can help to control pests like rodents and insects on agricultural land.

•Bees are important for pollinating crops, and many farmers keep bees on their agricultural land to improve crop yields.

CHAPTER 8

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