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A Project Work Phase-I (17CSP78)
Report on

“Animal Intrusion Detection Using Machine Learning”

**Project Report submitted in partial fulfilment of the requirement for the
award of the degree of**

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

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CERTIFICATE

Certified that the Project Work Phase-I (17CSP78) entitled "**Animal Intrusion Detection Using Machine Learning**" is a bonafide work carried out by:

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in partial fulfilment for VII semester B.E., Project Work in the branch of Computer Science and Engineering prescribed by **Visvesvaraya Technological University, Belagavi** during the period of September 2020 to January 2021. It is certified that all the corrections and suggestions indicated for internal assessment have been incorporated. The Project Work Phase-I Report has been approved as it satisfies the academic requirements in report of project work prescribed for the Bachelor of Engineering degree.

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DECLARATION

We, the undersigned students of 7th semester, Computer Science & Engineering, KSIT, declare that our Project Work Phase-I entitled "**Animal Intrusion Detection Using Machine Learning**", is a bonafide work of ours. Our project is neither a copy nor by means a modification of any other engineering project.

We also declare that this project was not entitled for submission to any other university in the past and shall remain the only submission made and will not be submitted by us to any other university in the future.

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ABSTRACT

The conflict between humans and animals is seen across the country in a variety of forms, including monkey menace in the urban areas, crop raiding by wild pigs and so on. Providing effective solutions for human-animals conflict is now one of the most significant challenges all over the world.

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. Many approaches involving to sense animal entry using IoT, sensing unit, communicating device to take preliminary actions, diversion of animal and sending alert to farmers. Various methods and algorithms have been developed to enhance the safety measure from animal intrusion.

With regard to this problem, we have developed the system which will monitor the field. At first it will detect intrusion around the field using camera system to capture the image if there is an unauthorized entry and classifying them using image processing and then takes suitable action by detecting the type of the intruder. Finally sends notification to farm owner and forest officials using message.

This proposed work with the help of Convolutional Neural Network algorithm to detect the animals. 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.

Keywords: Animal Detection and Classification, , CNN algorithm, Buzzers and Twilio Messenger.

TABLE OF CONTENTS

Chapter No.	Title	Page No.
1.	INTRODUCTION	1-3
1.1	Overview	1
1.2	Purpose of the project	2
1.3	Definitions	2-3
2.	LITERATURE SURVEY	4-5
2.1	Content-based Retrieval and Real Time Detection from Video Sequences Acquired by Surveillance Systems.	4
2.2	Motion Detection for Security Surveillance	4-5
2.3	An Improved Real Time Image Detection System for Elephant Intrusion along the Forest Border Areas	5
3.	PROBLEM IDENTIFICATION	6
3.1	Problem Statement	6
3.2	Project Scope	6
4.	GOALS AND OBJECTIVES	7
4.1	Project Goals	7
4.2	Project Objectives	7
5.	SYSTEM REQUIREMENT SPECIFICATION	8
5.1	Software Requirements	8
5.2	Hardware Requirements (if any)	8
6.	METHODOLOGY	9-12

7.	APPLICATIONS	13
8.	CONTRIBUTION TO SOCIETY AND ENVIRONMENT	14
	REFERENCES	15
	APPENDIX - I CSI PUBLISHED PAPER COPY	
	APPENDIX - II CERTIFICATES OF PAPER PRESENTED	
	APPENDIX - III CERTFICATES OF WINNERS AND RUNNERS-UP (IF ANY)	
	APPENDIX - IV OTHER JOURNALS PUBLISHED PAPERS AND OTHER CONFERENCE ATTENDED CERTIFICATES (IF ANY)	

LIST OF FIGURES

Fig. No.	Figure Name	Page No.
6.1	Layers of CNN	9

LIST OF TABLES

Table No.	Table Name	Page No.
5.1	Software Requirements	8
5.2	Hardware Requirements	8

Chapter 1

INTRODUCTION

1.1 Overview

India is an agricultural country. Agriculture has always been India's most important economic sector. Agriculture is also considered as a foundation of life, since it is the primary source of food and other raw materials. It plays a crucial part in the country's economic development.

In recent years, wild animals are special challenge for the farmers throughout the world, Animals cause serious damage to crop by animals running over the field and trampling over the crops. It causes the financial problem to the farmers.

Agricultural fields near forest zone, humans and animal conflict are a major problem where large number of crops is lost and farmers life is in danger. Because of this farmer lose their crops, farm equipment, and sometimes farmers live. So, this zone is to be watched continuously to protect the agricultural field from the entry of wild animals. Regarding this problem, we have developed the system which will monitor the field.

Efficient and reliable monitoring of wild animals in their natural habitat is essential. This project is used to protect the farmland from animals by using Raspberry pi. 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 Machine Learning to detect the movement of the animal and send signal to the controller. It diverts the animal by producing sound and signal further, and Twilio messenger is used which gives an alert to farmers and forest department immediately. This system helps to develop a security system for the protection of farm and prohibit the entry of animal to the farm.

1.2 Purpose of the project

Human Wildlife Conflicts have caused a stream of major changes in the agricultural patterns and practices nationwide. To protect their crops from getting damaged because of animal intrusions, farmers have been using electric fences around their fields and areas where the fencing don't prove efficient, farmers prefer to stay up all night and guard their fields from animal intrusions. Practices like these have done more harm than good for us and in extreme cases, it has even costed lives of both man and animals.

Animal intrusion system helps to develop a security system for the protection of farm and prohibit the entry of animal to the farm, system use Twilio for alerting the farmer. It also helps in Protecting crops from Wild Animals. The system ensures that the alarm is not triggered by the presence of a human in the field, or via any random motion.

1.3 Definitions

- **Machine Learning:**

Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

- **Python:**

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of . Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-

oriented and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library.

- **Open CV:**

OpenCV abbreviated as open-source computer version is a library with functions that mainly aim real-time computer vision. With OpenCV one can perform face detection using pre-trained deep learning face detection model which is shipped with the library. OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. There are bindings in Python, Java and MATLAB/OCTAVE. OpenCV runs on the following desktop operating systems: Windows, Linux, macOS, FreeBSD, NetBSD, OpenBSD. OpenCV runs on the following mobile operating systems: Android, iOS, Maemo, BlackBerry 10.

Chapter 2

LITERATURE SURVEY

2.1 Content-based Retrieval and Real Time Detection from Video Sequences Acquired by Surveillance Systems.

Authors: Lin jang

Published: IEEE 2014

In this paper, a surveillance system devoted to detect abandoned objects in unattended environments is presented to which image processing content based retrieval capabilities have been added for making easier inspection task from operators.

Video-based surveillance systems generally employ one or more cameras connected to a set of monitors. This kind of systems needs the presence of a human operator, who interprets the acquired information and controls the evolution of the events in a surveyed environment. During the last years efforts have been performed to develop systems supporting human operators in their surveillance task, in order to focus the attention of operators when unusual situations are detected. Image sequences databases are also managed by the proposed surveillance system in order to provide operators with the possibility of retrieving in a second time the interesting sequences that may contain useful information for discovering causes of an alarm.

Experimental results are shown in terms of the probability of correct detection of abandoned objects and examples about the retrieval sequences.

2.2 Motion Detection for Security Surveillance

Authors: yin lang

Published in: IEEE 2015

This paper deals with the design and Implementation of Smart surveillance monitoring system using Raspberry pi and CCTV camera. This design is a small portable monitoring system for home and college security. This system will monitor when motion detected, the Raspberry Pi will control the Raspberry Pi camera to take a picture and sent out image to the user according to the program written in python environment. The proposed home security

system captures information and transmits it via a Raspberry towards pc. Raspberry pi operates and controls motion detectors and CCTV camera for remote sensing and surveillance, streams live record it for Future playback. Python software plays an important role in this project. Motion detection systems are a necessity in the modern times. Although some people object the idea of being watched, surveillance systems actually improve the level of public security, allowing the system operators to detect threats and the security forces to react in time. Surveillance systems evolved in the recent years from simple CCTV systems into complex structures, containing numerous cameras and advanced monitoring centres, equipped with sophisticated hardware and software. However, the future of surveillance systems belongs to automatic tools that assist the system operator and notice him on the detected security threats. This is important, because incomplex systems consisting of tens or hundreds of cameras, the operator is not able to notice all the events.

2.3 An Improved Real Time Image Detection System for Elephant Intrusion along the Forest Border Areas

Authors: S. J. Sugumar and R. Jayaparvathy

Published in: Hindawi Publishing Corporation Scientific World Journal 2017

Human-elephant conflict is a major problem leading to crop damage, human death and injuries caused by elephants, and elephants being killed by humans. In this paper, we propose an automated unsupervised elephant image detection system(EIDS) as a solution to human-elephant conflict in the context of elephant conservation. The elephant's image is captured in the forest border areas and is sent to a base station via an RF network. The received image is decomposed using Haar wavelet to obtain multilevel wavelet coefficients, with which we perform image feature extraction and similarity match between the elephant query image and the database image using image vision algorithms. A GSM message is sent to the forest officials indicating that an elephant has been detected in the forest border and is approaching human habitat. We propose an optimized distance metric to improve the image retrieval time from the database. We compare the optimized distance metric with the popular Euclidean and Manhattan distance methods. The proposed optimized distance metric retrieves more images with lesser retrieval time than the other distance metrics which makes the optimized distance method more efficient and reliable.

Chapter 3

PROBLEM IDENTIFICATION

3.1 Problem Statement

In forest borders, there is a conflict between human and animals continuously increasing as animals tend to stray into areas of human habitation. It is extremely difficult to monitor and track animals.

Traditional methods followed by farmers are not that effective and neither it is feasible to hire guards nor electric fences 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,

In this project, we will monitor the entire farm through a camera which will be recording the surrounding throughout the day. With the help of this proposed system, we detect the entry of animals and we play appropriate sounds to drive the animal away.

3.2 Problem Scope

- To design a security system for farm protection
 - Prohibit the entry of animal into the farm
 - Design a system that sounds when animal tries to enter into the farm
 - The camera continuously monitors the fields and provides the video feed to the farmer at home 24x7 for the whole day.
 - The system ensures that the alarm is not triggered by the presence of a human in the field, or via any random motion.
 - The system is capable monitoring and warding of animals thus protecting the fields from any damage also we can setup a Timer as per farmer's requirement
-

Chapter 4

GOALS AND OBJECTIVES

4.1 Project Goals

- To capture the image of the intruder and classify them.
- To provide protection from the attacks of the wild animals and thus minimizing the probable loss to the farmer.
- Taking suitable action based on the type of the intruder. To send notification to farm owner and forest officials.
- To protect human life from the attacks of wild animals and vice-versa

4.2 Project Objectives

Crop protection and animal intrusion system helps to develop a security system for the protection of farm and prohibit the entry of animal to the farm, system use ml module for alerting the farmer. It also helps in Protecting crops from Wild Animals.

The system ensures that the alarm is not triggered by the presence of a human in the field, or via any random motion. The system is capable of turning on/Off automatically and warding off the animals thus protecting the fields from any damage. Also, we can setup a timer as per farmer's requirement.

Chapter 5

SYSTEM REQUIREMENTS SPECIFICATIONS

A software requirements specification (SRS) is a comprehensive description of the intended purpose and environment for software under development. The SRS fully describes what the software will do and how it will be expected to perform. Software requirements specification permits a rigorous assessment of requirements before design can begin and reduces later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules

5.1 Software Requirements

The software requirements for the proposed project are depicted in the table below:

Sl.No	Software	Specification
01	Browser	Google Chrome
02	Libraries	Open CV, Twilio
03	Tool Box	Image Processing Tool-box

Fig 5.1 Software Requirements

5.2 Hardware Requirements

The hardware requirements for the proposed project are depicted in the table below:

SL.No	Software	Specification
01	Processor	Raspberry -pi 3 B+
02	Camera	
03	Buzzer	2-5V buzzer

Fig 5.2 Hardware Requirements

Chapter 6

METHODOLOGY

To detect intrusion in the farm land:

This step includes detection of motion in the live video. The motion detection is done by the process of comparing sequential images and determining whether the differences between them represent motion. If there are significant differences between two consecutive images, the cameras "conclude" that there has been motion within the camera view.

The camera takes the video when the motion is detected gives it to the raspberry pi . the obtained video streaming data is analysed using Open CV platform. Using Open CV the data is classified with the help of machine learning algorithm to check whether any intruder has entered the farm land.

Capture the image and classify using CNN:

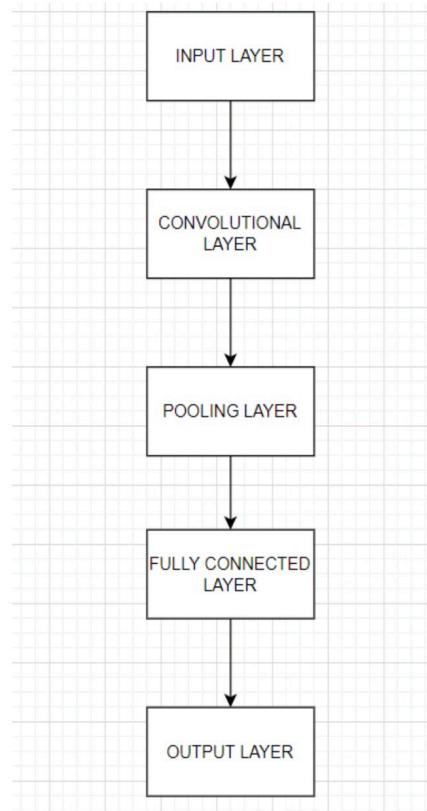


Figure 6.1 :Layers of CNN

When the intrusion is detected the image is captured and taken as a input to input layer in CNN algorithm. the input is broken down into pixels. Then output of the input layer is fed into the convolution layer.

The main purpose of the convolution step is to extract features from the input image. Input image is , a feature detector, and a feature map. take the filter and apply it pixel block by pixel block to the input image. This can be done through the multiplication of the matrices. The result of this is the convolved feature map. It's smaller than the original input image the purpose of the feature detector is to detect features.

Feature detectors can be set up with different values to get different results. For example, a filter can be applied that can sharpen and focus an image or blur an image. That would give equal importance to all the values. You can do edge enhancement, edge detection, and more.

The primary purpose here is to find features in your image, put them into a feature map, and still preserve the spatial relationship between pixels. That's important so that the pixels don't get all jumbled up.

We can visualize the output of a convolutional layer before a ReLu activation function is applied

The ReLU Layer:

The ReLU (rectified linear unit) function is next step to convolution layer which turns all of the negative pixel values black. Here we are applying an activation function onto feature maps to increase non-linearity in the network because images themselves are highly non-linear. It removes negative values from an activation map by setting them to zero.

It has become the default activation function because it is easier to train and often achieves better performance.

Pooling Layer:

The pooling layer takes the feature maps as input and reduces the dimensionality of maps. It does this by constructing a new, smaller image of only the maximum (brightest) values in a given kernel area. Pooling layer would lessen the number of parameters when a large image is given as input.

Pooling progressively reduces the size of the input representation. It makes it possible to detect objects in an image. Pooling helps to reduce the number of required parameters and the amount of computation required. It also helps control over fitting

Flattening:

This is a pretty simple step. flatten the pooled feature map into a sequential column of numbers (a long vector). This allows that information to become the input layer of an artificial neural network for further processing.

Fully connected layer:

A fully connected layer that takes the output of pooling and predicts the best label to describe the image.

At this step, the error is calculated and then back propagated. The weights and feature detectors are adjusted to help optimize the performance of the model. Then the process happens again and again Once the network has been trained. Passes the image and the neural network will be able to determine the image class probability for that image with a great deal of certainty. The fully connected layer is a traditional Multi-Layer Perceptron. It uses a classifier in the output layer.

The objective of a fully connected layer is to take the results of the convolution/pooling process and use them to classify the image into a label and have a count of it.

At this point, everything is trained through forward- and backward propagation. We wind up with a very well defined neural network where all the weights and features are trained. Now we have classified image divided into its respective groups.

Taking Suitable Action Based on Intruder:

Once the image is classified into the respective groups, the suitable action is taken based on what type intruder. With help of buzzer, the animals are driven away or diverted from the farm land . Buzzer which is an audio signaling device which also includes alarm devices, timers and confirmation of user input. Here we are using buzzer of 2khz to 4khz for diverting the animals.

Simultaneously ,The intimation message is sent when the intrusion is detected using twilio messenger tool. Twilio is two-way process where SMS and MMS messages allow you to carry on a conversation by both sending and receiving text and multimedia messages.

Twilio uses Amazon Web Services to host telephony infrastructure and provide connectivity between HTTP and the public switched telephone network (PSTN) through its APIs .Twilio allows software developers to programmatically make and receive phone calls, send and receive text messages, and perform other communication functions using its web service APIs.The framers and forest officials take their measures after receiving the alert messages.

Chapter 7

APPLICATION

By this system need of human can be eliminated and hence saves lot of time and cost included in it.

- The farmer can monitor the field remotely. It works in real time to detect animal's intrusion.
- Type of animal and also the count can be given
- This system is ecofriendly which does not cause any harm to human or animals. It requires very low voltage to operate. There is no risk of electric shock.
- This system is a flexible system it can also be used in the places where continuous monitoring is required.
- The cost included in development of this system is minimal compared to the application it has to offer. It provides accurate information about the field. This system even can be trained to detect various kinds of animals. This system can also be trained to detect owner and labor, so that unwanted alerts can be reduced
- User can monitor their Large fields, forests, gardens from anywhere, this can be used in agricultural fields which is very helpful and useful for the farmers. •Saves Rain water and promotes Rain water harvesting
- Crop Losses Can be Avoided Easily
- It optimizes the power usage through water resource management and also saving government's free subsidiary electricity and this proves an efficient and economy way of irrigation and this will automate the agricultural sector.

Chapter 8

CONTRIBUTION TO SOCIETY AND ENVIRONMENT

The problem of crop vandalism by wild animals has become a major social problem in the current time. It requires urgent attention and an effective solution. Thus, this project carries a great social relevance as it aims to address this problem. Hence, we have designed a smart embedded farmland protection and surveillance-based system which is low cost, and also consumes less energy.

This system is totally harmless and doesn't injure animals in any way. It also doesn't cause any harm to humans. Also, this system has a very low power requirement thus reducing the hazards of electric shocks.

The main aim is to prevent the loss of crops and to protect the area from intruders and wild animals which pose a major threat to the agricultural areas. Such a system will be helpful to the farmers in protecting their orchards and fields and save them from significant financial losses and also saves them from unproductive efforts that they endure for the protection of their fields. This system will also help them in achieving better crop yields thus leading to their economic wellbeing

REFERENCES

”Real-Time Monitoring of Agricultural Land with Crop Prediction and Animal Intrusion Prevention using Internet of Things and Machine Learning at Edge” by R Nikhil, B S Anisha and P Ramakanth Kumar,2020

“Internet of Things based Wild Animal Infringement Identification, Diversion and Alert System” by Muneera Begum H,Janeera.D.A,Aneesh Kumar.A.G,2020

”Survey of Intrusion Detection Techniques and Architectures in Wireless Sensor Networks.” by Sharma, Rakesh, and Vijay Anant Athavale, International Journal of Advanced Networking and Applications 10, no. 4 ,2019

“A Smart Farmland Using Raspberry Pi Crop Prevention and Animal Intrusion Detection System” by Santhiya S, Dhamodharan Y, Kavi Priya NE., Santhosh CS and Surekha M, International Research Journal of Engineering and Technology (IRJET), 2018

“IoT based wireless sensor networks for prevention of crop from wild animals ,IETE Zonal Seminar” by S.R.Choury P.A.Amale, N.B. Bhawar, Recent Trends in Engineering & Technology” ,2017

”WSN application for crop protection to divert animal intrusions in the agricultural land.” By Bapat, Varsha, Prasad Kale, Vijaykumar Shinde, Neha Deshpande, and Arvind Shaligra, Computers and Electronics in Agriculture 133,2017

