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A SMART FARMLAND FOR CROP PREVENTION AND ANIMAL INTRUSION DETECTION AND PREVENTION USING CNN

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1. Abstract:
From the reviewed studies, it is evident that smart farmland technology has the potential to enhance crop protection by accurately detecting animal intrusion and notifying the farmer in real-time. In this way, farmers can take immediate actions to prevent further damage to crops and avoid financial losses. With the use of machine learning algorithms such as CNN, the accuracy and reliability of these detection systems can be significantly improved, reducing the incidence of false positives and false negatives.

Keywords: CNN, Arduino, Smart Farmland, IOT

2. Introduction:
Normal and Smart farmlands differ in terms of animal detection and prevention capabilities. In normal farms, animal detection and prevention are generally done manually, which is time-consuming and can result in errors. Implementation of technology on farmlands to prevent animal intrusion and detection using CNN can revolutionize agriculture and address many of the challenges that farmers face today. Through the use of IoT, detectors, and machine learning algorithms, farmers can monitor and protect their crops more efficiently and effectively. This technology can help in decreasing crop damage, reducing losses, and getting a better overall yield. The real-time monitoring capabilities of these systems also help to ensure that any implicit pitfalls to the crop can be linked and addressed as it arrives.

It's also important to note that the use of smart farmland technology isn't limited to crop protection only. These systems can also be used for other operations, such as optimizing irrigation, perfecting soil quality, and covering rainfall conditions. By assessing the data collected from these systems, farmers can make data-driven decisions to optimize resource application, minimize input costs, and maximize yield.

Several detection algorithms are in use for animal intrusion detection in smart farmlands:

a) Convolutional Neural Networks (CNNs): CNNs are extensively used for object detection in smart farmlands. They are particularly useful for detecting creatures based on their visual features, such as their size, shape, and color.
b) Support Vector Machines (SVMs): SVMs are generally used for classification in smart farmlands. They can be used to classify creatures based on their visual features, such as color and texture.
c) Random Forests: Random Forests are machine-learning algorithms that can be used for classification. They work by developing a large number of decision trees and combining their results to make a final prediction.
d) Deep Belief Networks (DBNs): DBNs are deep learning algorithms that can be used for detection tasks in smart farmlands. They are particularly useful for detecting animals based on their visual features, such as size and shape.

e) Hidden Markov Models (HMMs): HMMs are statistical models that can be used for detecting animal intrusion in smart farmlands. They work by modeling the probability of an animal being present in a particular area based on the observed data.
f) Gaussian Mixture Models (GMMs): GMMs are statistical models that can be used for detecting animal intrusion in smart farmlands. They work by modeling the probability distribution of the data and detecting anomalies in the data that may indicate the presence of an animal.

The choice of algorithm depends on several factors, such as type of animal being detected, the visual features of the animal, and the size and complexity of the farmland.

3. Literature Survey:

Ms. Netra V. Deshmukh et al [1] Here, they proposed a method that protects the farm from wild animals, through electronic devices used in agriculture to improve prevention through routine procedures. Operational amplifier circuits are often used to detect invasive species from outside the farm. The purpose of the monitoring application is to provide early warning of possible wildlife encroachment & damage. They propose an IoT approach to smart agriculture based on low power and open source technology. The main purpose is to prevent crop loss and protect the area from intruders and wild animals that threaten the agricultural area. It will also save them from huge financial losses and from having to use force to protect their territory. This will also help them get better crops and thus improve their financial situation.

Oltean Andrei et al [2] The aim here is to design as well as build a low-cost electronic device for electronic monitoring using Arduino and IoT. The main task is to measure, collect & send all important electricity in a web-based application using a wi-fi connection. The electrical parameters include: voltage, current, voltage, phase angle, power and energy. The design is more suitable for many types of low-voltage installations, primarily for household appliances. Measurement results are sent remotely in an online database and data can be stored and analyzed in real time.
The solutions are stable for easy access to past and present data. The low cost of the equipment makes it possible for a Market approach.

N.Penchalaiah et al [3] In this paper, an automatic system is aimed to assist farmers in irrigation. Here they use IR sensors to detect wild animals, soil moisture sensors to control humidity in the fields, some loudspeakers to let animals enter the fields, and microcontrollers to collect sensor data. The microcontroller analyzes the data and accordingly sends a signal to a loud speaker that prevents animals from reaching the area and sends safety instructions to neighbors, especially farmers and forestry workers. This also signals the motor to turn and outputs according to the soil moisture data of the soil moisture sensor.

Md. Wahidur Rahman et al [4] This article introduces the use of IoT to support agriculture, especially for those who need a smart farming method. The aim of this study is to perform real-time monitoring using the most affordable security systems. Features of this work include: i) monitoring of sensor data using soil moisture sensor ii) real-time monitoring of sensor values using cloud and dashboard iii) responding to app-related security concerns using Wi-Fi, laser shield on Android for Agriculture, and IP cameras.

Anjana M et al [5] In this article, they introduce smart farming equipment using IoT, which includes many features such as solar power generation and advances in modern agriculture, crop protection using greenhouses/multi-rooms, to increase the efficiency and reduce the costs of agriculture. It uses GSM technology to inform the growers about various environmental factors via SMS. Since the sensors are not controlled using a remote control or via internet service, they are placed in different places on the farm and connected to the sensor and work is done with the microcontroller.

Vidhya S et al [6] In this project they are using Raspberry pi to protect the land from animals. PIR sensor is used to detect intruders and a Pi camera to take pictures. Images taken using a convolutional neural network classify animals as domestic or wild. CNN is a neural network design with special features, especially used for image classification. When deployed, use the sound to protect the animal and send an SMS about the wild animal to the land owner.

Amit Kumar Pandey et al [7] In this paper, CNNs for classification of natural images are investigated, a deep learning model is developed for classification of images that uses CNN, a model for custom treatment. The

performance of the network architecture proposed using hyperparameters such as filter size, step, zero padding, activation function, pooling layer and periods.

Stefano Giordano et al [8] The development of IoT applications is presented in this paper. Crop protection to prevent animal invasion in crops. Protection and care is provided so that agriculture is not damaged by wild animals and weather conditions.

S.Santhiya et al [9] This article covers the land, it uses Raspberry pi to protect it from animals like wild boar, elephant, monkey, etc. Authorized personnel are informed by sending a message using RFID (Radio Frequency Identification Device) modules and GSM (Global System for Mobile) modems in their projects. Animals can be detected using RFID. Send SMS after detection. This project works through three main steps to prevent the entry of animals: warnings from fog machines, making noise and emitting smoke. It has been shown that the proposed system that is based on Raspberry pi is more promising, easy to use and not difficult and can be easily used by using it. There are many boring and repetitive tasks. In this project, the process is fully automatic and animals are not harmed during protection.

Joseph Redmon et al [10] Introducing YOLO, a new way to search for objects. Previous work on object detection uses repeated objects to make objects visible. Instead, they create discovery objects as the problem returns from separate and related class boxes. In one test, a single neural network predicts bounding boxes and class probabilities directly from the entire image. Since the entire detection pipeline is a single connection, the end-to-end search process can be optimized directly. Integration architectures are very fast. The basic YOLO model processes images in real time at 45 frames per second. Fast YOLO, a smaller version of the network, handles an astonishing 155 frames per second, achieving twice the mAP at other times tested. It produces a higher error than state-of-the-art detection in the field, but is also able to predict false background. YOLO learns general object representation and outperforms other detection methods including DPM and R-CNN when expanding from natural images to other sources such as artwork.

R. Radha et al [11] In this paper, research with a wireless sensor network connected to an ultrasonic generator is proposed to protect monkeys. Sensor nodes recognize the monkey's movement on the ground and use our application-specific flood algorithm to alert the sinker by emitting a sound. The sink node connects the generator to Ultrasonic, which generates ultrasonic waves above 20 kHz, discouraging the monkeys and forcing them to leave the area. They evaluated the performance of their security methods using the ns2.35 simulator and found that our algorithm outperformed the sensor nodes in terms of radio transmission, end-to-end latency, and battery life.

4. Existing Models:

The use of AI based animal detection systems in smart farming help in prevention of animal intrusions by using real-time alert system to alert the farmers, enabling them to take proper measures to cover their crops. Some existing solutions of animal intrusion in farms using AI detection and CNN are

Agri-Pal: Agri-Pal is an AI-based animal detection system that uses machine learning algorithms and cameras to detect animal intrusion in farms. It's a plug-and-play device that provides real-time cautions to farmers, enabling them to take prompt action to prevent damage to crops and live stock animals. Agri-Pal also includes complaint detection features to help farmers identify sick creatures in their flock .

Intelligent AI drones can be used to overlook large areas of cropland to detect animal intrusion. These drones can cover up to 50 acres of land in just a few minutes and give data receptivity with up to 95% accuracy. The use of drones can significantly reduce the time and cost associated with monitoring the cropland, making it a cost-effective result for farmers.

Smart farm monitoring results, similar to IBM's IoT- based platform, can be used to cover cropland for animal intrusion. These results use IoT detectors to collect data on soil humidity, temperature, and other environmental factors that can help detect animal intrusion. The data collected can be processed and analyzed using machine learning algorithms to identify patterns and anomalies that may indicate animal intrusion.

Intrusion detection and prevention systems, similar to Snort, can be used to monitor network traffic in cropland and prevent intrusion by

creatures. These systems use machine learning algorithms to assess data packets and detect anomalies that may indicate an intrusion attempt. Intrusion detection and prevention systems can help farmers secure their networks and help prevent animal intrusion.

Fig. 4.1.
Example of Animal Dataset (Tibor TRNOVSZKY 2017)

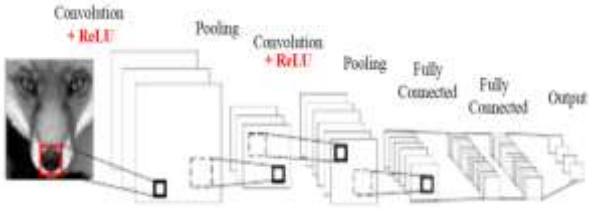

Fig. 4.2.
Example of Convolutional Neural Network (Tibor TRNOVSZKY 2017)

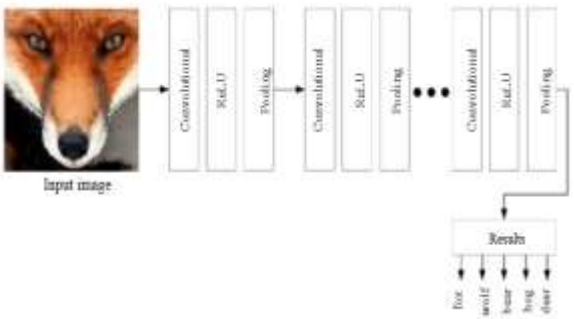

Fig. 4.3.
Example of Layers of CNN (Tibor TRNOVSZKY 2017)

5. Methodology:

The methodology used for this review paper on animal intrusion prevention using Convolutional Neural Networks (CNNs) involves the following steps:

Research Objective: Clearly defining the objective of the review paper, such as evaluating the effectiveness of CNNs in preventing animal intrusion in various contexts, such as agricultural fields, or urban environments.

Literature Search: Conducting a comprehensive literature search using relevant databases, scientific journals, conference proceedings, and specialized websites using keywords such as "animal intrusion prevention," "CNN," "wildlife conservation," and "agricultural protection" to identify relevant studies.

Selection Criteria: Establishing a specific criteria for study inclusion, such as focusing on studies that utilize CNNs for animal intrusion prevention, published within a certain timeframe, and written in English. Considering the context of the study, target species, detection accuracy, and other relevant factors.

Study Selection: Screening the identified studies based on the established criteria. Initial: review titles and abstracts to identify potentially relevant studies. Then, obtaining full-text articles of these studies and further assessing their suitability for inclusion. Maintaining a record of the reasons for inclusion or exclusion at each stage.

Data Extraction: Developing a standardized data extraction form to systematically collected key information from the selected studies. This may include study details (author, year, location), study design, CNN architecture, dataset used, animal species targeted, performance metrics (e.g., accuracy, sensitivity), and notable findings. Ensure consistency in data extraction.

Quality Assessment: Evaluating the quality of the included studies, considering factors such as study design, sample size, dataset representativeness, and the validity of the results. Utilizing appropriate quality assessment tools or checklists to assess the methodological rigor of each study.

Data Synthesis: Analyzing and synthesizing the extracted data to identify common trends, methodologies, and outcomes across the selected studies. Examining the effectiveness of CNNs in different animal intrusion scenarios,

their limitations, and areas for improvement. Summarizing the findings using tables, figures, or visual aids to enhance clarity.

Discussion and Conclusion: Interpreting the synthesized findings and discussing the strengths and weaknesses of using CNNs for animal intrusion prevention. Considering the suitability of CNNs for different animal species, environmental conditions, and the potential impact on human-animal interactions. Draw conclusions regarding the current state of research, identifying research gaps, and proposing future directions.

By following these steps, the methodology for this review paper on animal intrusion prevention using CNNs we provide a systematic and thorough analysis of the literature, providing valuable insights into the effectiveness and potential applications of CNNs in mitigating animal intrusion in various contexts.

6. Conclusion:

In conclusion, using smart farmland that uses CNNs to prevent and detect animal attacks has the potential to transform agriculture and solve the problems of many farmers today. Farmers can better monitor their crops and livestock using IoT, sensors and machine learning algorithms. The machine helps to reduce crop damage, reduce losses and increase overall yield. The real-time monitoring capabilities of these systems also help ensure that any threats to the crop are detected and addressed immediately. It is clear from the Research review that smart farming equipment can improve crop protection by identifying invasive species and alerting farmers in a timely manner.

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