

CAMERA VISION BASED ANIMAL BEAT SYSTEM FOR AGRICULTURE USING MACHINE LEARNING

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Abstract-

Agriculture automation has been on the rise leveraging, among others, Deep Neural Networks (DNN) and IoT for the development and deployment of many controlling, monitoring and tracking applications at a fine-grained level. In this rapidly evolving scenario, managing the relationship with the elements external to the agriculture ecosystem, such as wildlife, is a relevant open issue. One of the main concerns of today's farmers is protecting crops from wild animals' attacks. There are different traditional approaches to address this problem which can be lethal (e.g., shooting, trapping) and non-lethal (e.g., scarecrow, chemical repellents, organic substances, mesh, or electric fences). Nevertheless, some of the traditional methods have environmental pollution effects on both humans and ungulates, while others are very expensive with high maintenance costs, with limited reliability and limited effectiveness. In this project, we develop a system, that combines AI Computer Vision using DCNN for detecting and recognizing animal species, and specific ultrasound emission (i.e., different for each species) for repelling them. The edge computing device activates the camera, then executes its DCNN software to identify the target, and if an animal is detected, it sends back a message to the Animal Repelling Module including the type of ultrasound to be generated according to the category of the animal.

I.INTRODUCTION

Agriculture has seen many revolutions, whether the domestication of animals and plants a few thousand years ago, the systematic use of crop rotations and other improvements in farming practice a few hundred years ago, or the “green revolution” with systematic breeding and the widespread use of man-made fertilizers and pesticides a few decades ago. Agriculture is undergoing a fourth revolution triggered by the exponentially increasing use of information and communication technology (ICT) in agriculture. Autonomous, robotic vehicles have been developed for farming purposes, such as mechanical weeding, application of fertilizer, or harvesting of fruits. The development of unmanned aerial vehicles with autonomous flight control, together with the development of lightweight and powerful hyperspectral snapshot cameras that can be used to calculate biomass development and fertilization status of crops, opens the field for sophisticated farm management advice. Moreover, decision-tree models are available now that allow farmers to differentiate between plant diseases based on optical information. Virtual fence technologies allow cattle herd management based on remote-sensing signals and sensors or actuators attached to the livestock. Taken together, these technical improvements constitute a technical revolution that will generate disruptive changes in agricultural practices. This trend holds for farming not only in developed countries but also in developing countries, where deployments in ICT (e.g., use of mobile phones, access to the Internet) are being adopted at a rapid pace and could become the game-changers in the future (e.g., in the form of seasonal drought forecasts, climate-smart agriculture). Also known as precision agriculture, smart farming is software-managed and sensor-monitored. Smart farming is growing in importance due to the combination of the expanding global population, the increasing demand for higher crop yield, the need to use natural resources efficiently, the rising use and sophistication of information and communication technology and the increasing need for climate-smart agriculture. Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things (IoT) – for tracking, monitoring, automating and analysing operations.

II. SYSTEM TESTING

System testing is a critical aspect of Software Quality Assurance and represents the ultimate review of specification, design and coding. Testing is a process of executing a program with the intent of finding an error. A good test is one that has a probability of finding an as yet undiscovered error. The purpose of testing is to identify and correct bugs in the developed system. Nothing is complete without testing. Testing is the vital to the success of the system. In the code testing the logic of the developed system is tested. For this every module of the program is executed to find an error. To perform specification test, the examination of the specifications stating what the program should do and how it should perform under various conditions. Unit testing focuses first on the modules in the proposed system to locate errors. This enables to detect errors in the coding and logic that are contained within that module alone. Those resulting from the interaction between modules are initially avoided. In unit testing step each module has to be checked separately. System testing does not test the software as a whole, but rather than integration of each module in the system. The primary concern is the compatibility of individual modules. One has to find areas where modules have been designed with different specifications of data lengths, type and data element name. Testing and validation are the most important steps after the implementation of the developed system. The system testing is performed to ensure that there are no errors in the implemented system. The software must be executed several times in order to find out the errors in the different modules of the system. Validation refers to the process of using the new software for the developed system in a live environment i.e., new software inside the organization, in order to find out the errors. The validation phase reveals the failures and the bugs in the developed system. It will be come to know about the practical difficulties the system faces when operated in the true environment. By testing the code of the implemented software, the logic of the program can be examined. A specification test is conducted to check whether the specifications stating the program are performing under various conditions. Apart from these tests, there are some special tests conducted which are given below Peak Load Tests: This determines whether the new system will handle the volume of activities when the system is at the peak of its processing demand. The test has revealed that the new software for the agency is capable of handling the demands at the peak time. Storage Testing's this determines the capacity of the new system to store transaction data on a disk or on other files. The proposed software has the required storage space available, because of the use of a number of hard disks. Performance Time Testing's this test determines the length of the time used by the system to process transaction data.

III. LITERATURE SURVEY

Wild animals are a special challenge for farmers throughout the world. Animals such as deer, wild boars, rabbits, moles, elephants, monkeys, and many others may cause serious damage to crops. They can damage the plants by feeding on plant parts or simply by running over the field and trampling over the crops. Therefore, wild animals may easily cause significant yield losses and provoke additional financial problems. Another aspect to consider is that wild animal crop protection requires a particularly cautious approach. In other words, while utilizing his crop production, every farmer should be aware and take into consideration the fact that animals are living beings and need to be protected from any potential suffering. There are different existing approaches to address this problem which can be lethal (e.g., shooting, trapping) and non-lethal (e.g., scarecrow, chemical repellents, organic substances, mesh, or electric fences), firecrackers, bright lights, fire, beating drums, and dogs. Non-chemical control of pocket gophers. 22 rimfire rifle or a shotgun can be used to dispatch woodchucks. Some motion-activated water sprayers have been developed that spray birds when they break the motion-detecting. AI Computer Vision based DCNN for detecting animal species, and specific ultrasound emission (i.e., different for each species) for repelling them. design, deployment and assessment of an intelligent smart agriculture repelling and monitoring IoT system based on embedded edge AI, to detect and recognize the different kinds of animal, as well as generate ultrasonic signals tailored to each species of the animal. This combined technology used can help farmers and agronomists in their decision making and management process.

Deep learning in the form of Convolutional Neural Networks (CNNs) to perform the animal recognition.

IV. SOFTWARE DESCRIPTION

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under

the GNU General Public License (GPL). This tutorial gives enough understanding on Python programming language. Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages. Python is a MUST for students and working professionals to become a great Software Engineer specially when they are working in Web Development Domain. Pandas is mainly used for data analysis and associated manipulation of tabular data in Data frames. Pandas allows importing data from various file formats such as comma-separated values, JSON, Parquet, SQL database tables or queries, and Microsoft Excel. Pandas allows various data manipulation operations such as merging, reshaping, selecting, as well as data cleaning, and data wrangling features. The development of pandas introduced into Python many comparable features of working with Data frames that were established in the R programming language. The panda's library is built upon another library NumPy, which is oriented to efficiently working with arrays instead of the features of working on Data frames. NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays. Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits like Tkinter, wxPython, Qt, or GTK.

V.CONCLUSION

Agricultural farm security is widely needed technology nowadays. In order to accomplish this, a vision-based system is proposed and implemented using Python and OpenCV and developed an Animal Repellent System to blow out the animals. The implementation of the application required the design and development of a complex system for intelligent animal repulsion, which integrates newly developed software components and allows to recognize the presence and species of animals in real time and also to avoid crop damages caused by the animals. Based on the category of the animal detected, the edge computing device executes its DCNN Animal Recognition model to identify the target, and if an animal is detected, it sends back a message to the Animal Repelling Module including the type of ultrasound to be generated according to the category of the animal. The proposed CNN was evaluated on the created animal database. The overall performances were obtained using different number of training images and test images. The obtained experimental results of the performed experiments show that the proposed CNN gives the best recognition rate for a greater number of input training images (accuracy of about 98 %). This project presented a real-time monitoring solution based on AI technology to address the problems of crop damages against animals. This technology used can help farmers and agronomists in their decision making and management process.

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