Sheep Identification

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About the Project

Mike Milne the owner of Kauricone, an New Zealand company that develops business technology solutions that includes various servers and softwares that are available for businesses. Kauricone's IOT (Internet of Things) device serves as an applications, database and edge/cluster server. The server has various functional uses from emails, websites, file management and manipulations as well as machine learning. Kauricone designed this project in order to explore the field of machine learning, deep learning, and artificial intelligence, in order to test the capabilities of their servers in New Zealand agricultural sector. The project outcomes from tinkering with the servers performances will led to possible opportunities to expand or improve the functions and capacity of the device capabilities.

Project Rationale

New Zealand has roughly twenty-seven million sheep in New Zealand, the New Zealand farming industry contributes five million dollar to the country economy. Through this research and development project of testing the capability of machine learning on Kauricone IOT server that will led to the IOT server being placed into rural setting in New Zealand, will assist in farming management. The Sheep Identification project provides an opportunity to identify a living sheep through machine learning, it enables recognition and detection functionalities for sheep in a paddock of a farm. The project has the opportunity to have an dramatically large impact on the New Zealand agriculture section through the innovation and improvement of automated systems for farming management that will be reduce the time and labour spent by farmers worldwide.

Project Objectives

The objectives for the R&D Sheep Identification Project were:

- Confirm provided technology of hardware/software from Kauricone, works as specified by Kauricone.
- Provide a report on the number of sheep and the individual identities of each subject.
- Implement and apply classification models to image processing.

Project Product and Methodology

Project Product

The Sheep Identification Project was supplied with one of Kauricone IOT (Internet of Thing) device which is an data collection server that capable of retrieving information from other device such as cameras. This little black box device is fitted with various ports and software for graphics, video, cameras, audio, PCIe, SIM, IR and networking functionalities. The project focused on the software's:

- Ubuntu OS 18.04
- Python 2.7
- OpenCV
- Tensorflow 1.14
- Darknet
  - YOLO

Project Approach

The project was section into three stages for product deliverables and reports from classification and detection of sheep within an image as well as counting sheep, individual identify and recognizing sheep in the image, then finally detection of grass level and send a notification to the farmer of the grass level.

Stage One

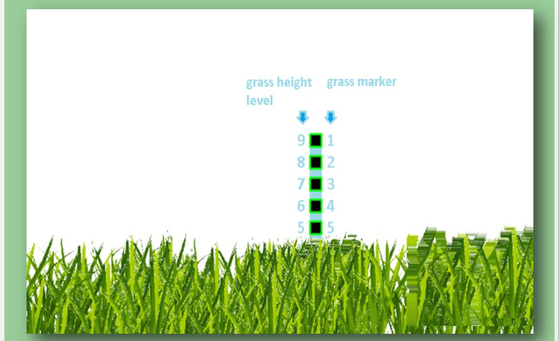
For stage one, the team successfully implemented YOLOV4 which was based on Darknet onto the Kauricone IOT device that was provided, and deployed onto the Kauricone server. The team was unable to implement the original software requirement of TensorFlow because of the server's CPU limitations. The CPU is ARM based, which resulted in various libraries missing or disabled when updating the existing software on the IOT device. It was decided to use the Darknet implementation with OpenCV, because it had the required libraries to deploy YOLOV4 on the server. An custom Python script was compiled, so that an classification model could process image inputs of sheep, then produce and store both and image and text output into an folder. The image output consists of the original image, including all bounding boxes, and the text output, which represents the coordinates for the bounding boxes and their names.

Stage Two

For stage two the team ran into some challenges, the original requirements in the given project description were to identify each sheep individually using a 3-camera setup, but due to external factors (coronavirus), was beyond the project management planning control, the team never managed to visit an farm site to execute any physical setup of cameras and devices in a rural setting. With the lack of consistent data, the limitation resulted in the team to research on solution, on an hypothetical approach supported by current and theorized research and studies. This included sheep facial recognition as well as body size or shape and coloured tag solutions. Without the large amounts of consistent data this solution would only stay researched and never make it into development. This staged proved improbable however, it provided research and concepts to the client.

Stage Three

For stage three, the clients original plan of having the grass level control when the gates open have been requested to be removed. This decreased the scope of stage three leaving only the task of detecting the grass level to be done. With the previous implication of not being able to visit the farm physically, there was no other way in which the team could have detected the grass level from its texture/colour. Instead, the team have decided on developing a horizontal camera angle solution which was done digitally to simulate the feature. This was done by initially setting up a marker in an area of grass which is captured by a camera. The marker consists of multiple square boxes that will then be processed by the IOT device. Depending on how many squares are not detected will determine the height of the surrounding grass.



Project Challenge/Difficulties

An difficulty faced during the project was setting up a stable network connection and getting the system running offsite. The challenges the project presented were working around out-dated software version and finding solutions that does not risk the stability of the IOT (Internet of Things) device as well as the time and skills required to provide a solution to identifying individual sheep and also the detection of grass level through images taken from a specific angle and distance.

Project Improvement/Reflection

With more time, the sheep identification project can be improved and further developed in training and testing classification models as well as having more variety of data that can support and increase the accuracy rate of detection. More research will be required for individual sheep recognition and study on unique sheep features. It is clear to distinguish various specimen from one another through machine learning in computer vison intelligence.

References Links

https://www.kauricone.com/
https://www.python.org/
https://www.tensorflow.org/
https://pjreddie.com/darknet/yolo/