Animal monitoring based on IoT technologies

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Abstract- Placing grazing animals in the vineyards needs more assistance for the animal husbandry activities**.** These assistance must include tracking and conditioning the position and actions of animals in particular their feeding posture. Sheep may grass in agricultural areas and in vineyards without endangering them by this scheme.

This paper suggests a framework for tracking animal behavior based on iot technologies this involves a local IoT network to capture animal data and a cloud platform to autonomously shepherd ovine within vineyard areas with processing and storage capabilities. This paper suggests a framework for tracking animal behavior based on the iot technologies. The network contains a local iot network for the data collection of animals and a cloud platform for the autonomous management of other cloud platforms the equipment allows relevant data obtained by the iot network to be retrieved. Therefore besides the definition of the platform some findings concerning the platform for machine learning are discussed vine within vineyard areas with processing and storage capabilities. Namely this framework was evaluated with encouraging preliminary results for detecting and identifying conditions that value the posture of the animal this paper provides a summary of those algorithms as several algorithms have been evaluated.

Keywords — Posture management, big data, animal tracking, Machine Learning, IoT.

I. INTRODUCTION

The viticulture industry is a large scale agricultural enterprise across Mediterranean Sea. One important example is the Portuguese one which is considered to be about 191000 hectares the 4th largest area of Portuguese vineyards in Europe [1]. Furthermore Mediterranean wine's rising export volume is transforming the wine industry owing in particular to its important role in the countries ' economies.

This procedure is famous for being extremely hard to work particularly during the spring of the year when the wildlife weeds have to be removed continuously so that they are not in competition with wines and nutrients from the sun which is the task of weed removal and where possible it was started by hand with grass sheep. During the wine making specialization weeding of animals was discontinued over the last 50 years.
The methods are burdensome rather than herbicides and while Mechanical processes are causing earth erosion and are source of greenhouse gases chemical substances that contaminate the soils with fruit and water this technique has been carried out mechanically in areas between rivers and chemically in areas under ranges below. Engineering is strong and while mechanical processes cause soil erosion chemicals can contaminate the soils with fruits and rivers. As part of the sheep it project [2] solutions are being established to allow ovine to weed vineyards and other similar crops ensuring that wine production is not compromised while contributing to soil fertilization and livestock sector sustainability.

The project incorporates an iot sensor network responsible for tracking and conditioning the role and location of animals within vineyards to reduce animal impact within agro businesses specializing in plant handling it. It also provides a cloud platform for processing the collected data and producing meaningful information for end users. The Project incorporates an iot sensor network responsible for tracking and conditioning the role and location of animals within vineyards to reduce animal impact within agro businesses specializing in plant handling. The processing power of today's cloud providers allows data mining dam integration and machine learning to use ml techniques that can collect additional relevant information for which winegrowers and/or shepherds are processed.

This document discusses the sheep cloud platform that collects data from animal sensors for analysis of data and g regulation management enables farm managers to access information about animals and to set alarms on the grounds of real time when certain conditions are detected. The paper further explains some preliminary results of a case in which several machine learning algorithms were checked for animal posture control.

The majority of the paper is organized accordingly part ii addresses the work involved in agricultural big data and part iii explains the overall device architecture and concentrates on one link with the cloud's local IoT network the Ml learning algorithms used to predict animal behavior are given by section iv section v ends the post.

II. RELATED WORK ANIMAL MONITORING

There is an enormous diversity of reported animal surveillance research with diverse goals sources Include the study of Include the study of wild animal migratory behavior[3] the behavioral analysis of grazing animals[4][5][6] the study of grazing site profiles animal posture behavior[7] or the animal estrus[8][9].

Within the GPS track gathered over 4 months Williams et al [5] used machine learning techniques from 4 cows our study uses week data mining traits and the use of four ml algorithms we can recognize three stages in eating rest and walking.

The results are relatively poor because of the use of a single sensor that records the animal position, in particular in pasture and rest conditions. The paper describes the adequacy for the other applications in the control and management of animal diseases, including problems associated with the high energy use of the system through the se of the GPS receivers. The papers describe the animal tracking method.

The identification of strus [8] is one of the most commonly reported cases of animal testing use possibly because of the economic benefit of effective insemination management these studies usually include the use of accelerometer sensors attached to The nears or legs of the animals to assess animal behavior.

In addition to research, some commercial products[9] provide monitoring of the wireless network information that permits a remote study of feed rumination and of the level of animal a ctivities that promote animal management.

Columns monitored in cows in the research established by D utta et al[6] are evaluated by a series of ml algorithms to eval uate thresholds which are then used to distinguish competenc es by means of a "binary tree" or a group of such classificers. The measurements are reminder of the triaX accelerometry a nd magnetometry Precision and responsiveness are more than 90% even for simpler individual classification systems such as "binary tree" in certain classified behaviours.

In order to differentiate healthy and slow eating walking habits umstätter et al [7] applied controlled comportment classification in 10 goats bring GPS trackers with pitch and roll tilt sensors and experienced different local conditions such as hills and sheds The classification data sets included minimum and average roll and pitch tilts for 30 seconds. Those methods used for the classification of active and inactive behavior with a precision of over 92 percent were linear discriminant analytical methods; Classification tree with only the maximum pitch tilting accuracy and comparable accuracy to the preceding one while position sensitive external conditions decreased overall accuracy by 5 percent and the pre calibration method needed for each place. This final approach reduced fake outdoor classifications to 20% and proved the most reliable A decision tree manually developed based upon frequency analysis and custom data sets measurement of behavioral consistency and moving total of variations from minimum to maximum inclination values.

II. AN ANIMAL MONITORING PLATFORM

The project sheep it aims to provide solution for tracking of an Iot based controlling and handling sheep weeding vineyard herds to accomplish such a target The system consists of a number of separate blocks and interactions each of which may include the processing and representation of data analytics in relation to data collection for specific tasks.

Fig 1 shows the overall design of the framework being introduced the devices which compound the iot network architecture implemented for running local tasks are illustrated in the left part this Local infrastructure cloud platform effect is interconnected right of fig 1 part is described via a wide band link e g (3 g 4 g and LTE). In the following sections these two large blocks are highlighted.

A. IoT network

Collection of sensor data and tracking of the position and location of the animals are the main data collection tool. Considering that the sensor data and the use of corrective stimuli is process able due to the retarded posture management algorithm because the decision cannot be made or a central node that has more processing power is transmitted. The related user data is then transferred to a fixed communication network to Order to evaluate location by RSSI based tracking techniques the collar collects additionally include routine synced signal emissions across a network and allows the network to track animals ' position accordingly In addition they include the device implements an access multiple time division process to preserve its energy consumption as low as possible and provides specifics of the proposed solution in [10].

The gateways serve as an aggregate connector for the local internet network which implements a lamp with higher processing power which communicates with the remaining lamps and links the LAN via a broadband connection with the internet as well as incorporate a local warning generator for critical cases e g (fence breach panic detection).

This gateway also contains a module that maps data collected in the java script. Information structures for object notation easily understand by top layer applications. So that NON IP network can be connected with the IP based internet in a seamless way This infrastructure can be replicated by different owners all powered by the listed cloud platform.

B. Server Cloud

Within figure 1 the cloud platform includes five separate interconnected modules merging and saving stream data.

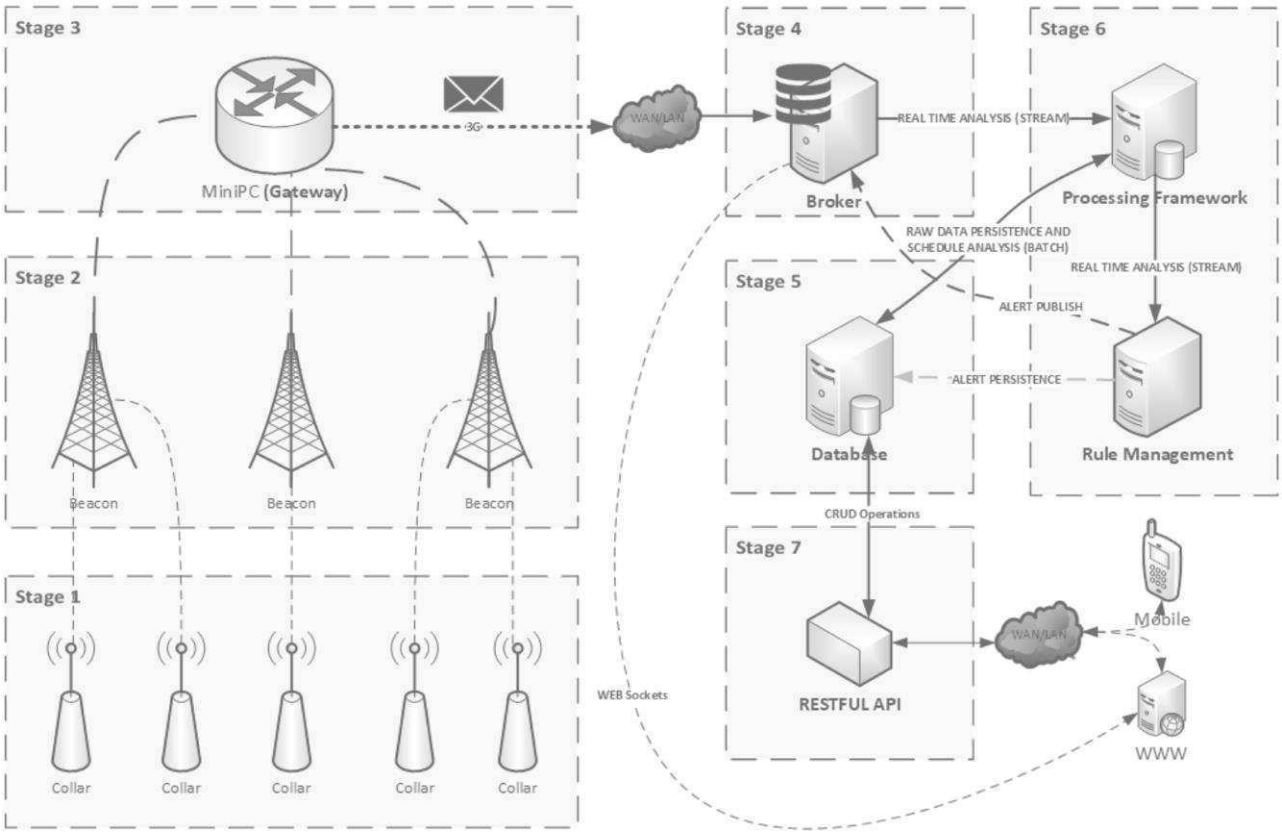

Fig. 1: Overall architecture

Middleware for messaging is one of the first steps in sending messages the manufacturers and customers gathering and transmitting JSON messages to a data processing engine from the gateway. It supports multiple message protocols like AMQP [12] and MQTT [13] based on the asynchronous publishing / subscription architecture rabbit MQ also intermediaries all messages that the gateway got from the FIFO queue between the gateway and the remaining network. Apache spark [14] is the only one queue subscriber generated in the RabbitMQ at the time apache spark [14] and the only one queue subscriber generated in the RabbitMQ at this moment. Amongst these are JSON data translation alarm formation data processing and data persistence in database DB including DM and ML techniques.

This involves two large stream processes dealing with real time traffic and a function dealing primarily with non-journal traffic using network processing tasks in addition a rules management module drools [15] has been appended to the processing System and the two processes have to continue to feed it with new data on a regular basis furthermore a rules management module (Drools) [15] has been added to this processing system allowing the description of complex event processes (CEPS).

Briefly they allow prediction generation pattern detection and Other related actions including real time user notifications that can cause actions such as alarms.

Another critical platform element is the DB for easy access by upper layer applications the data obtained directly from collar sensors and the data obtained from them user inserted static data or other device operating information should be stored conveniently. A relationship database model looks more promising than a sheep model IT network of several entities in fact the payload of the planned messages does not warrant using this model in this architecture despite all of the advantages of the NoSQL model. PostgreSQL has been selected from the various solutions available since it is suitable neither for the protection nor the integrity mechanisms it provides for environments with high volume of data. Eventually a web development system for the REST API is included on the platform it allows the consumer and other related channels to interact directly for example animal information may be incorporated directly into legal animal registry databases.

III. ANIMAL BEHAVIOR MONITORING

Collars are the main source of information within the provided network we are responsible for gathering information on the posture location and offenses of the animals.

The sensor information collected can be used to turn the farmer into useful information such as hours of work time of travel favorite pasture areas disturbance (e.g. panic, illness) fencing and posturing offenses among others.

However many of these details cannot be collected directly from sensors as device architectures are more demanding are available the use of DM and ML technologies that have become increasingly popular and efficient is an interesting possibility in View of the integration of context we focused the ml module on one single yet important application event namely the detection of the posture of sheep.

A. ML use case – detecting sheep's posture infractions

It is not easy to determine if a sheep feeds on a vine or a plant to avoid bad decisions more than one sensor needs to be measured. Therefore, ML has been chosen to help the method i.e., to use supervised algorithms so that the learn algorithm can learn from a set of workouts and applies the learning model to an evaluated test set. The data from an accelerometer with 3 axes and an ultrasonic transceiver on columns are obtained for this particular application which results in measurements of the pitch of the necked and the ground's width. Sheep have been released on a plain field for about three hours and their video behavior recorded at the same time collars were constantly time consuming and transmitted raw sensor data to the network to be categorized manually. Selection of protocol is a difficult task [10].The videos collected were analyzed and each inspection item classified as one of the other categories. i.e. the head facing off the ground and head down in the middle of fig 2 out of the grass, the pet is feeding. Stand and go on the right fig 2 for food walk and ride it has only been seen as an infraction of cases previously defined as "standing and reaching for food" all other cases have been re classified as "not infraction ". We were therefore faced with a problem of binary classification while not used in this paper the broader ranking initially obtained would allow the reuse of the same data set by more advanced activity ratings.

The ML techniques were applied to r a certain amount of preprocessing was performed in particular to delete redundant and duplicate data by entry time and sequence number the Resulting 20555 data was then divided into 2 sub sets with a ratio of 75 percent to 25 percent for a training set of 15416 entries and a test set of 5139 entries i e Algorithms can be properly categorized from a data set and later by evaluating models which have been learned.

Fig.2: rest (left), pasture (middle) and look for examples of food

B. Machine Learning Algorithms comparison

Diverse ml algorithms were tested to detect sheep's posture infringements using the ml module which is embedded in the Sheep IT computational framework.

A random forest decision trees (DT), for use with the c50 and rpart XGBoost KNN system vector support SVM and naïved Bayes DT, for c50 packages, were tested for many algorithms, especially the most prevalent of classification problems. The findings were evaluated by using the following criteria oft en used in classification problems, I accuracy (accuracy) repre senting the efficacy of the prediction within the population as a whole, ii) true positive rating (TPR), (iii) true negative (TNR) accuracy or positive predictive value (PTV).

Table 1 - COMPARISON OF MACHINE LEARNING ALGORITHMS

	Metric				
Algorithm	*ACC*	*TPR*	*TNR*	*PPV*	*AUC*
Random Forest	0.9696	0.8267	0.9861	0.8728	0.987
DT (C50)	0.9693	0.8475	0.9833	0.8539	0.986
XGBoost	0.9685	0.82674	0.9848	0.8625	0.988
KNN	0.9622	0.7702	0.9844	0.85.03	0.977
SVM	0.9642	0.7590	0.9879	0.8778	0.972
DT (rpart)	0.9591	0.8211	0.9750	0.8728	0.970
Naïve Bayes	0.9527	0.8795	0.9612	0.7230	0.979

This is based on the uncertainty matrix which can be built into a tested data set during a ml model test while we are skipping the representation of all matrices for convenience The results of each algorithm do not improve as random DT forests are the best results in accuracy and AUCS with kit c50 and XGBoost. The findings can also be verified athwart Fig. This similarity.3, on which we can see the curves overlapping often.

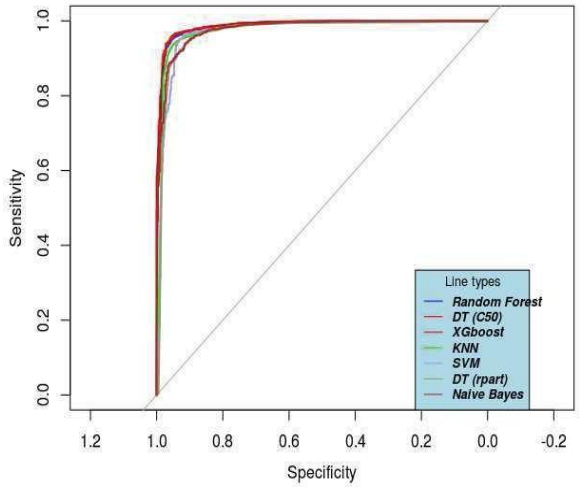

Fig. 3: The ML algorithms Tested ROC curves

The time needed for computing the model is quite different and the relationship between the attributes and the classifier (in this case, infringement or not) is easy to interpret. DT's features the most suitable, because they allow, in addition to creating fast models, to represent the model in terms of a collection of whether or not they are, and form a tree that is easy to interpret. A label of classification represents any terminal node (leaf) in a branch. That route therefore defines a rating law since the terminal leaf's root node can be easily transferred to and if. This is very important to the Sheep IT project because it is a very useful method for the correct conditions in which a system of posture regulation based on a simple microcontroller is put into place in the cattle neck.

IV. CONCLUSION

The management of weeds in vineyards is a notable problem. It requires considerable economic and labor efforts from winemakers. More than that, manufacturers are planning to resist methods commonly used, whether mechanical or chemical, to improve the quality of their products. While sheep are regarded as an alternative and environmentally friendly approach to feed their ability from weeds. The Sheep IT project however proposes a scheme to maintain the disposition and position of the sheep when pasturing in winegrowing regions to protect cultures.

In addition to local activities, the system includes a computing application that operates on the cloud to gather locally collected data and search it for additional information. A further solution is to master the paper and describe the entire network infrastructure from shirt mobile nodes to the cloud platform with various features including data treatment and data storage.

One important case of the Sheep IT project is to recognize opportunities when sheep pose a risk to grapes and wine. The value of this application is shown. A set of data was generated and processed using the existing platform, consisting of collared sensor data, each object being manually categorized. Various ml algorithms were then evaluated for the evaluation of platform power our results are especially relevant because our simple understanding helps to explain the algorithm for posture regulation on collars the DT algorithms were equally accurate.

Future work will include the evaluation of the application actions with a higher level of scalability and consistency as well as the evaluation of other cases of ML, such as disease detection, panic attacks, motion patterns, food preferences.

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