



HOME AUTOMATION USING ML

¹Nighila Ashok, ²Dilshana V S, ³Fariyath M A, ⁴FousiyaMA, ⁵MuhsinaMJ

¹Assistant Professor, ²Student, ³Student, ⁴Student, ⁵Student

¹Department of Computer Science Engineering,
¹Universal Engineering College Vallivattom, Thrissur, India

Abstract: Automatic management of home appliances should be unnaturally intelligent systems that require to form itself rely on human being's action and surroundings. These systems square measure totally examine user needs and conditions of the near so as to estimate future actions and cut back user interactions. Here we tend to bring a brand new Home automatic system supported machine learning. During this system we tend to advance VGG16+LSTM design to will increase accuracy and potency of the system. The system contains 3 modes of operations to regulate home appliances, they are: emotion detection mode, automatic mode and manual mode. This method prominence given to energy consumption and prediction performed by provision regression and additionally confirm frequency occurring set of devices by victimization apriori rule. The another element of this method is that we will examine power consumption of individual devices.

Index Terms – Machine learning, Apriori algorithm, Logistic Regression, VGG16, Association rule

I. INTRODUCTION

Smart Home Systems are inevitable things in our way of life that contains sensible technologies for furnishing comfort, health, safety, security and energy reduction. What is more the standard of life is upgraded by the automatic management of appliance and accessibility services. The most purpose of home automation system is to form our home functions elegant. Our system is to regulate home appliances in numerous modes they are: manual mode, automatic mode and emotion detection mode. Because the system works in emotion detection mode, we've got used a lot of correct design i.e. VGG16+LSTM design. As we all know energy may be an important economic issue because of its high demand and unsustainable provides. This method may be an answer for this issue. Our system ensures energy conservation in home appliances. The system will predict the energy to be employed by every devices in future consistent with the previous information sets. This method will analyze the ability employed by every devices so devices that consumes a lot of energy is decide. Thus the gratuitous usages is avoided.

II. THEORY

2.1 Machine Learning

Machine learning (ML) is that the study of computer algorithms that improve mechanically through expertise and by the utilization of information. It's seen as a district of computing. Machine learning algorithms build a model supported sample knowledge, called "training data", so as to create predictions or choices while not being expressly programmed to try and do thus. Machine learning algorithms are utilized in a large sort of applications, like in medication, email filtering, and computer vision, wherever it's troublesome or impracticable to develop typical algorithms to perform the required tasks.

2.2 VGG16

VGG16 could be a convolutional neural network model projected by K. Simonyan and A. Zisserman from the University of Oxford within the paper "Very Deep Convolutional Networks for Large-Scale Image Recognition". The model achieves 92.7% top-5 take a look at accuracy in ImageNet, that could be a dataset of over fourteen million pictures happiness to one thousand categories. It had been one in every of the known model submitted to ILSVRC-2014. It makes the advance over AlexNet by replacement giant kernel-sized filters (11 and five within the initial and second convolutional layer, respectively) with multiple 3×3 kernel-sized filters one when another. VGG16 was trained for weeks and was mistreatment NVIDIA Titan Black GPU's.

2.3 LSTM

LSTM was planned by Sepp Hochreiter and Jürgen Schmidhuber. By introducing Constant Error Carousel (CEC) units, LSTM deals with the vanishing gradient drawback. A type of perennial neural network is Long STM (LSTM) networks. It is capable of learning order dependence in sequence prediction issues. A standard LSTM unit consists of a cell, an input gate, an output gate and a forget gate. Over discretionary time intervals the cell remembers values and to manage the flow of knowledge use 3 gates and that they are in and out of the cell. LSTM networks are creating predictions supported time and are well-suited to forecasts, process since there will be lags of much length between major events in a very statistic. LSTMs were begin to handle the vanishing gradient drawback that may be run into once coaching ancient RNNs. Relative unconcerned to gap length is AN advantage of LSTM over RNNs, hidden mathematician models and alternative sequence learning strategies in varied applications.

2.4 Apriori Algorithm

Apriori algorithmic rule is planned by R. Agrawal and R. Srikant in 1994. The aim of the algorithmic rule is to seek out frequent itemsets during a dataset. Since it uses previous information of frequent itemset the name apriori is given. It's in the main used for forming association rules during an on-line database. The algorithmic rule uses Associate in Nursing reiterative approach and uses k-frequent itemsets for locating k+1 itemsets. Apriori algorithmic rule uses a crucial property known as Apriori property that helps to enhance capability of level wise generation of frequent itemsets. Apriori Property states that each one non-empty set of frequent itemset should be frequent, if any itemset is found to be rare, then all its supersets are rare. Apriori algorithmic rule uses 2 parameters they are: support and confidence. Support indicates the frequency of occurrence of the item and confidence refers contingent probability.

2.5 Logistic Regression

Logistic regression may be a applied math model that in its basic type uses a supplying perform to model a binary variable, though more advanced extensions exist. In multivariate analysis, supplying regression (or logit regression) is estimating the parameters of a supplying model (a style of binary regression). Mathematically, a binary supplying model encompasses a variable with 2 potential values, like pass/fail that is delineate by an indicator variable, wherever the 2 values square measure tagged "0" and "1". Within the supplying model, the log-odds (the power of the odds) for the worth tagged "1" may be a linear combination of 1 or additional freelance variables ("predictors"); the freelance variables will every be a binary variable (two categories, coded by AN indicator variable) or endless variable (any real value). The corresponding likelihood of the worth tagged "1" will vary between zero (certainly the worth "0") and one (certainly the worth "1"), therefore the labeling; the perform that converts log-odds to likelihood is that the supplying perform, therefore the name. The unit of activity for the log-odds scale is termed a logit, from supplying unit, therefore the choice names.

2.6 Raspberry Pi

Raspberry Pi is that the low price, little sized laptop which may be connected to host controller Arduino Nano. The host controller collect all data's from the sensing element and send it to Raspberry Pi controller via serial interfacing. Raspberry Pi is another controller utilized in this technique. Arduino Nano is serially interfaced with RPi American state, RX pins of controller board. Raspberry Pi collect the info send by the host controller. household appliance area unit controlled by Raspberry Pi. it'll be running as MQTT consumer, which can send collected knowledge from Arduino to MQTT server. 5V. relays area unit interfaced to Raspberry Pi, collected knowledge from host controller is employed to activate every of the relays.

III. RELATED WORK

In this paper [1] Cohn-Kanade (CK) info was used for sleuthing individual facial expressions. one of the foremost wide used test-beds for rule voluntary and analysis is CK info. However it's some degradations. Then introduces the Extended Cohn-Kanade (CK+) info. During this range the amount the quantity of subjects escalated by twenty seventh and number of sequences is redoubled by twenty second. It concern laptop vision, machine learning and activity sciences. In the extended system here additional 107 sequences and twenty six subjects. The height auditory communication for every sequence is absolutely FACS coded. By feeling researchers feeling labels area unit reviews and valid with relevancy the FACS Investigators. Here patient's face copied by estimating the form and presence AAM parameters. Then SPTS and CAPP characters area unit carried. Thanks to the favour and luxury of access for the first Cohn-Kanade dataset seen as a really premium addition to the already existing corpora that's already in subsistence. For a completely automatic system to be bouncing for all expression during a myriad of realistic situations additional information is needed. For this to occur terribly giant dependably coded datasets. This can need a united endeavour from a good array of analysis establishments thanks to the value related to capturing, coding, storing and distributing such information.

In this paper [2] facial expression recognition task is build up by victimization Convolutional Neural Network (CNN) approach. Emotion Recognition could be a wide space there are a unit so many researches. Automatic facial features recognition is one in all the analysis during this space. Facial features recognition task is recognizing prevalence of facial Action Units (AUs). This analysis hold dataset of extended phytologist Kanade (CK+) that is accumulated for facial expression recognition experiment. We more contempt and neutral categories to the initial CK dataset to extend the performance. The CNN contains fully-connected layers therefore to cut back over fitting we have a tendency to engage a regularization methodology referred to as "dropout". The system contains eight basic feeling categories and victimization totally different numbers of testing and coaching knowledge that the average accuracy rate of the system is reaches ninety two.81%. From this experiment we will finish up that the error rate decreases because the coaching knowledge will increase.

The aim of this paper[3] is to deliver a deep learning primarily based framework for countenance recognition. This mechanism focuses on the main components of our face and provides less importance to different regions on face. This paper proposes basic cognitive process convolutional network primarily based deep learning framework to classify emotions in face pictures. It's clear that, whereas sleuthing AN feeling not all components of face square measure necessary. Solely provides importance to specific regions to induce the feeling. There square measure four convolutional layers within the feature extraction half. Then they're followed by a drop out layer and 2 totally connected layers. The abstraction electrical device includes 2 convolutional layers. Once transformation parameters square measure regressed the input is modified to sampling grid. Then the model is trained by optimizing a loss perform.

This paper[4] discuss a couple of good home. It is associate one in all the appliance of each wherever computing during which the house atmosphere check by close understanding to facilitates remote access and services for context awareness. This paper is useful to know good home researches that square measure occurring antecedently related to technologies. The major parts and it's connections square measure in short delineate here. This paper informs concerning sensors, multimedia device, communication protocols and systems that square measure used the good home systems. This paper firm the right guideline for future use. This paper introduce many future scopes of good home systems. The difference forms of devices square measure connected through a standard middleware for establishing good home automation system. Because the multi selling system can synchronic in future. To overcome the restrictions of the varied combined devices uses a network created by middleware could be an effective answer. The unhealthy laxness dodging create the house automation is to be a lot of good in future and realize the electricity usage of the house is additionally create the house automation system is to be a lot of good in future. In future home automation system can attain solid quality owing to center of intelligent service dissipation.

This paper[5] elaborates the thought of mistreatment an adaptive system for managing manage electricity consumption. The aim of the answer is to scale back the full current consumption, and decrease their monthly electricity bill. The solution offer high degree of ability to different type of users supported a component-oriented architecture. In terms of how to access the appliance and therefore the interaction with the individual devices and freedom from numerous sorts and configurations of devices. It leverages the advantages of accessible tools and technologies like device controllers, net services, mobile platforms, along with standard ideas of AI. Some of the services that may be obtainable within the close to future, like meter knowledge management systems. This resolution will manage and monitor grid energy storage and manage renewable energy sources beside antecedently mentioned decrease of energy consumption. If it obtainable, and thus its application leads to offloading power system ranging from rock bottom level of roughness – the tip user.

In this work [6] discuss concerning Facial purpose detection. It's concerned in pc vision, there are several applications. It is a significant task, since facial shapes are vary with face expression and cause. During this paper we have a tendency to labelled this downside by suggesting discriminative deep face form model that's developed supported Restricted Boltzmann Machines model (RBM). The joint spacial relationship amidst all facial points are captured by victimisation discriminative deep face form model. The discriminative deep model integrates downside-up measurements from native purpose detectors during a unified framework and top-down information from the embedded face form patterns. During this system used effective algorithms to extract true facial point locations from their measurements. Here we have a tendency to notice sixty eight facial points from a picture supported the discriminative deep face form model. The facial purpose detection contains many stages that the potency of the system is larger than different methods. Here we are able to see that the effectiveness of the projected facial point detection rule versus progressive strategies from Experimental result. Through deep studies on info sets, it is clear that the projected method's error rate is a smaller amount than the progressive strategies. The dense feature extraction step is inefficient during this system. That the future work could also be stress on this disadvantage.

This paper[7] illustrates a sensory activity model of countenance clarity and pure mathematics. It's by victimization deep learning and inventive input. Here it admits the expression of human and conventionalized characters by coaching a pair of convolutional neural networks. Then by performing arts transfer learning technique we are able to learn the mapping from humans to characters which might be more wont to make a shared embedding feature area. This paper uses a sensory activity model to induce character expressions similar to humans. This model will be enclosed to animation pipeline that helps artists and animators for finer recognition of expressions.

In this paper[8] discuss regarding Context aware applications respond and adapt to changes within the computing setting. It's the construct of leverage info regarding the top user to boost the standard of the interaction. Appearing context-enhance edges use localization, presence, social qualities, and different surrounding informations to forecast associate finish user's immediate desires, propose additional artificialized, condition-aware homes connect all the devices and appliances in your home thus these devices will communicate with one another and with user. Context awareness will one in all the applying of good home technology. Context awareness have an excellent role for developing and protective the good Home. Good home technology brings out numerous edges, but there are have disadvantages. One of the disadvantage of installation of good home technology is quality of the system over usability of the system. Consider some following points after we arrange to produce a system for excellent ability of the system. The following points square measure however massive are going to be the system be? The elements of system square measure what reasonably elements, are they basic, such a lightweight rheostat, or more practical like associate device or a video camera? However intuitive can the system be to a non-user. How many individuals are going to be needed to use the system? Who can acumen to work the system? WHO can acumen to take care of the system and address failures. How typically can those who will solely operate the system be left alone within the home. However straightforward is it to form changes to the interface?

In this paper[9] we have a tendency to propose a vision-based machine intelligence system. ON/OFF state of sometimes used unit appliances are often sense by victimization this technique. In terms of value and implementation the sensor-based home automation system suffers vital quality. In terms of value and accomplishment to overcome the quality of home automation system this technique uses vision-based machine intelligence while not being obsessed on the quantity of appliances and sight the states of multiple appliances. A completely unique home automation system can get by this planned technique of sensing the states of appliances. Multiple beneficents are provided by this planned home automation interface over classical home automation interfaces that integrate the employment of assorted distinct sensors. The visual watching of the house and sense of the house are often switch while not transmittal pictures then it makes this technique a bimodal approach towards Home automation. The planned machine learning based mostly approach update the user regarding the state of the appliance on an internet site and economical switch ON/OFF the appliances consequently. Once the quantity of appliances in an exceedingly home will increase, the sensors provide less quality in terms of value and implementation. An internet site that ready to management the states of appliances beside watching the house victimization camera pictures by victimization bimodal approach was conjointly mentioned within the paper. The presently planned technology for home automation is extremely a lot of restricted to detection the states of TV, Fan, Tube lightweight of a given color that acts as a significant constraint to generalize the model to figure on any set of TV, Fan, and Tube lightweight.

This paper[10] is discuss a few novel technique to acknowledge countenance. Here we have a tendency to use Active look Model (AAM) to extract facial regions supported Facial Action writing (FACS). The most aim of this technique is to acknowledge expression effectively on effective expression regions It contains 3 parts: expression recognition through Support Vector Machines (SVMs), extraction of facial regions supported AAM and extraction of facial expression by Dennis Gabor ripple transformation. To reduce influences of face cause the system extracted and normalized the facial regions by exploitation AAM. AAM has higher performance than different strategies therefore will effectively increase the popularity accuracy. The performance of Active look Model in eliminations of the influence of various facial region size, head cause and lighting condition is larger than different models. Because of this property the AAM is employed to extract facial regions before extracting options by Dennis Gabor ripple transformation. The SVM is employed here acknowledge expression for resolution the issues of tiny sample size and overfitting. Through in depth studies on this technique it's clear that it's high performance than different systems.

IV. IMPLEMENTATION

4.1 Software Part

4.1.2 Emotion Images preprocessing

- Resize
- Edge enhancement

4.1.2 Architecture creation

- Load VGG16
- Load weights
- Add LSTM

4.1.3 Training emotion detection model

- Train model using images
- Save model

4.1.4 Preprocess Energy consumption data

- Remove unwanted values
- Get monthly consumption values
- Logistic regression model is used
- model will be saved after training
- Clean data
- Use apriori algorithm for finding frequent item sets

4.2 Hardware Part

4.2.1 Sensor Interfacing

DS18B20 temperature sensor is interfaced to digital pin of Arduino Nano controller board.

MQ-5 gas sensor and LDR module sensors are interfaced to analog pins of Arduino Nano controller board.

LM016l ALCD is interface to digital pins of Arduino Nano controller board.

4.2.2 Serial communication between Raspberry Pi and Arduino Nano

Arduino Nano is serially interfaced to Raspberry Pi via TX, RX pins of respective controller boards.

4.2.3 Running MQTT client on Raspberry Pi

Raspberry Pi will be running as MQTT client, which will send collected data from Arduino to MQTT server. 5V relays are interfaced to Raspberry Pi, collected data from host controller is used to activate each of the relays.

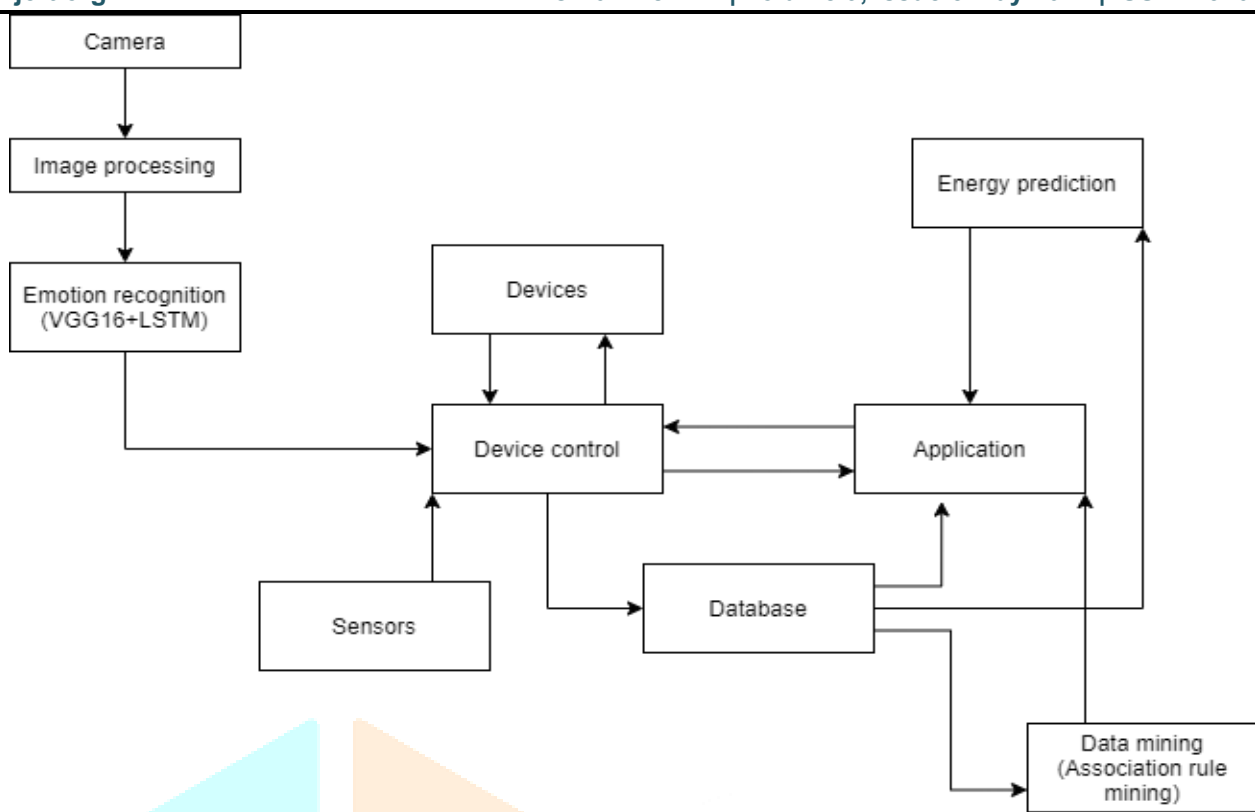


figure1: block diagram

The system here is to regulate home appliances in three modes. In emotion detection mode, the emotion of the user is captured by a camera module. The captured image is then processed. Image process could be a methodology to perform some operations on the image, to induce associate increased image or to extract some helpful data from it. Then the options of the images square measure extracted and compares it with the images in image database. There we have a tendency to use VGG16+LSTM design for emotion recognition. After feature extraction this can classify and discover captured emotions of the user. Once the emotion is detected then it's given to device management. Then the system will change automatically change configuration by changing device states. According to each emotion the device will activated/deactivated as defined previously. As each emotion detects the environment will be changed. A manual mode will be also there which can be used to control devices using applications. The another mode is automatic mode. In this mode devices are configured according to the values received from the sensor. The GUI is an application which can perform manual mode operations as well as status of each devices can be predicted. Also we can monitor the energy consumed by each device. We can also implementing association rule mining to find out the frequent item sets from monthly data. Association rule mining will helps to find users pattern of using devices in home. So that the user can analyze which patterns consumes more energy and hence energy can be saved.

V.CONCLUSION

This system liberate high accurate automatic control of home appliances with energy consumption and prediction. The main intention of automatic control of home appliances is to frame our home function grandiose. The intended system purely conserve prediction of energy to the next month and also monitoring energy usage. The user itself could get energy dissipation of the appliances duo to this main characteristic. This system is very useful for energy efficient sociality.

V. ACKNOWLEDGMENT

We use this fortune to convey our emotional expression towards all those that have directly or indirectly to make completion of our work is to be possible or easier Mr.Sreeraj R – HOD, Computer science and Engineering for his recommendations and encouragement. We tend to deeply glad to our guide Ms. Nighila Ashok –Assistant prof, Computer Science and engineering giving more valuable time and suggestions that needing inputs within the prepration of this paper.

VII REFERENCES

- [1] Lucey, Patrick, Jeffrey F. Cohn, Takeo Kanade, Jason Saragih, Zara Ambadar, and Iain Matthews. "The extended cohn kanade dataset (ck+): A complete dataset for action unit and emotion-specified expression." In 2010 IEEE Computer Society Conference on Computer Vision and Pattern Recognition-Workshops, pp. 94-101. IEEE, 2010.
- [2] Enrique Correa, Correa, E., A. Jonker, M. Ozo, and R. Stolk. "Emotion Recognition using deep convolutional neural networks." Tech. Report IN4015 (2016).
- [3] Minaee S, AbdolrashidiMinaee, Shervin, and AmiraliAbdolrashidi. "Deep-Emotion: Facial Expression Recognition Using Attentional Convolutional Network." arXiv preprint arXiv:1902.01019 (2019).
- [4] M. R. Alam, M. B. I. Reaz and M. A. M. Ali, "AAlam, Muhammad Raisul, Mamun Bin IbneReaz, and MohdAlauddinMohd Ali. "A review of smart homes: Past, present, and future." IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews) 42, no. 6 (2012): 1190-1203.
- [5] SakshiPandey,ShanuJaiswal,NitinYadav,Jayashreesonawane."IOT based Home automation and analysis using machine learning"(2019).
- [6] Y. Wu and Q. Ji, "Discriminative Deep Face Shape Model for Facial Point Detection," Int. J. Computer.Vision., vol. 113, no. 1, pp. 37–53, 2015.
- [7] Aneja, Deepali, Alex Colburn, Gary Faigin, Linda Shapiro, and Barbara Mones. "Modeling stylized character expressions via deep learning." In Asian Conference on Computer Vision, pp. 136-153. Springer, Cham, 2016.
- [8] R. J. Robles, T-H. Kim, "Review: Context Aware Tools for Smart Home Development", International Journal of Smart Home, vol. 4, pp.1–12, Jan 2010.
- [9] Suraj,IshKool,Dharmendra Kumar ,ShovanBarma .""Visual Machine Intelligence for Home Automation".2018 IEEE.
- [10] L. Wang, R. Li, and K. Wang, "A novel automatic facial expression recognition method based on AAM," J. Comput., vol. 9, no. 3, pp. 608–617, 2014.

