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RESTAURANT SYSTEM TO CALCULATE WAITING TIME AND AGE, GENDER INSIGHTS

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Abstract - *The growing population has increased the waiting queues in almost all the places out of which one is restaurant. People are curious to know whether a particular place matches their taste or not. The existing system is completely manual and some of the previous researches say that the best way to make the queuing system fast is to make it automatic. Restaurant Insights offers a solution which can help to make this happen and also provides some additional features. The main objective of our system is to show the waiting time and also the average age group visiting restaurants to our customers. Even the restaurants will be able to view a detailed insights of the people visiting their restaurant which can help them in many ways which are discussed below.*

Key Words: **Restaurants, Age and Gender classification, Waiting time, People counting, Analytics.**

1.INTRODUCTION

There are always long waiting queues present outside restaurants. Many people leave the restaurants after looking at waiting line. This is very annoying for the customers who want to visit their desired restaurant and after reaching the restaurant get to know that there is a long waiting queue. Many customers leave the restaurant watching the long queue, which is a loss for the restaurant too. So, we decided to build a system that can help people view the waiting time on our website anytime and anywhere.

Customers visiting the restaurants are always curious about the age group visiting the restaurant as they want to know the vibe of the place. Even for the restaurant when they decide to add a new dish to their menu, they can add a dish that will be suitable for the age group visiting their restaurant. So, we decided to create a system where customers as well as the restaurant can view the average age group visiting their restaurant. This project not only can we used for restaurants but also for various other platforms.

This project deals with a lot of ideas that need to be researched to be able to execute properly. The project deals with a lot of research areas in Machine Learning and Deep Learning which is in a preliminary stage. This becomes the core obstacle of the project which we need to overcome to be able to execute the project. Following are the major challenges which need to be tackled for the project lifecycle

- *Accuracy:* As stated above the current algorithms and tools are too naive to carry out the objective as it gives a very low accuracy. The model needs to correctly analyse and improve its accuracy by tweaking and twisting current techniques.
- *Waiting Time:* There is no algorithm present which can help to find out the waiting time for the queue in the restaurant. Thus, it becomes a big hurdle to create our own machine learning algorithm.
- *Realtime analysis:* Our system has to be quite fast to give the most accurate waiting time to our users. So, our real-time analysis speed must be quite fast compared to other systems.

2. LITERATURE REVIEW

There are some existing systems that help in detecting age and gender of the people and help in people count. Some of these systems do use real-time data while others just use a video to detect the attributes. [1] proposes an automatic real time system for estimating age and gender from the face images. [1] acquires front face images by detecting the face and estimating the pose. To extract face features LBP and Gabor filters are used. To estimate age and gender, Adaboost is used which issued to supervise the learning approach. The experiments are performed by using one benchmark database, to validate performance of the proposed method. Estimating the age and gender automatically of the face of a person needs detection, tracking, and normalization of the face in the image series. The extracted features of the face images will be used in estimating age and gender, and then one face tracking method is used for counting people and for measuring stay time. Gabor LBP features are being used for estimating age and gender by using Adaboost classifiers and linear SVM. Accuracy is 72.53% for age and 98.90% for gender. POSIT (Pose from Orthography and Scaling with Iterations), is a hybrid pose estimating algorithm which is on the basis of algebraic and optimization algorithms, will be applied for the head pose estimation. The tracking method is on the basis of a multi person tracking algorithm.

[2] proposes a model which uses a CNN(Convolutional Neural Network) architecture to determine the age and gender of any face of human from unfiltered real world environment. The labels of age and gender are addressed by a novel CNN(Convolutional Neural Network) approach which are a set of different annotations and training the classifier which predicts the age group and the gender of a human face. [2] designs an image pre-processing model and a quality

which prepares and also pre-processes the unprocessed images of the CNN model which also increases the accuracy level of age and gender model. [2] uses large-scale datasets which helps in making a better trained CNN model. At last, OIU-Audience benchmark which is being used in evaluating the performance level of the CNN model, thus this approach produces a good accuracy for the age and gender estimation. The approach requires image pre-processing (landmark detection, face detection and also face alignment) stage which pre-process and prepares the images of the face before they will be the input to the network proposed. The result of this paper has been classified into three steps: image pre-processing, feature learning and Classifying itself.

[3] uses Machine Learning and first predicts the waiting time on the queues of bank, and then propose in which way the plan can be generalized into some other industries, than automatize it. [3] uses Queuing optimisation techniques. A dataset which contains entrances of the humans that are standing in a queue in the bank is utilized firstly, than after instructing a neural network which is completely connected the fault was 3.35 mins before/after actual waiting time was achieved. [3] presents a web application which manages queues of the various structures and the industries. All queues can have different parameters so that the model must be changed in the way accordingly. The usefulness and also the capacity of the system are checked by using a simulator. [3] including two different types of users that are: first creator and second client. Creator means the one which needs logging to the platform for creating a queue that provides a name of queue and also an explanation. Client is the one who does not need any credentials for logging in to the platform, searching for some queue by the name of queue and also by the name of creator, and then join the queue. After joining the queue, the client gets the details of the entire queue that includes the positioning of the queue and also the waiting time(estimated) that is foreseen by one neural network which is taught for that one queue by analysing the previous data of queue. [3] uses ReLU(Rectified Linear Unit) which is a active function for the layers that are hidden, and also the Adam optimization algorithm is used for updating the iteration of all the weights on the basis of the training set data.

[4] shows how people entering an area can be tracked and also the number of people leaving which gives a count of the number of people inside the area. [4] distributes the system into 2 phases, Phase 1 is Detecting: In phase 1, an expensive object tracker is executed to if any new objects have entered and to see if the system is able to find lost objects during the tracking phase. An object tracker is created or updated with new box coordinates. Phase 2 is Tracking: System is either in the tacking phase or in the detecting phase. As the object moved around the phase, an object tracker is created to track the object. This is done for each detected objects. It is continued till nth frame is reached and then object detector is re-run. This process is repeated again from the start. [4] uses SSD (Single Shot Detector) with a MobileNet architecture. The tracker computes the centroid (centre) of the box.

[5] focuses on two main challenges: the scene background is estimated and real persons total number in merge-split scenarios. [5] distributes the process in some steps: Background estimation, Segmentation, Shadow removal and Tracking. Kalman filter is used to track moving objects. Even under heavy occlusion, a robust estimation is of object's future estimation is allowed.

[6] develops an extraction function of a candidate region of a face which also has the colour information and all the parts of the face combining them with age and gender estimation model. They have used frontal face images only. The algorithm will be applied to real-time captured images of face. The results are 93.1% for gender and 58.4% for age.

[7] have created an application for analysis of video data using machine learning model. The gender and age are classifies on the basis of local binary patterns and adaptive features. They have achieved an accuracy of 94% in gender detection. Their age detection algorithm has provided best results in MORTH database. The processing stage of video are combined together to real-time system for analysis of audience. Their method extracts complete information of people from input video and then collect and analyze this to calculate different statistical parameters. The machine learning algorithm used is on the basis of LBP features that helps us to recognize the gender of the person for that video system. Pipeline is interesting in practical applications as same features is used to solve both problems. So the LBP descriptors are computed once per each face.

[8] focuses on counting the number of people passing through one corridor. The main issue of this domain is counting the number of people passing through that supervised area. There are two steps used for counter. First is to detect the people and then track the count of people directionally. To find people HOG descriptor and some trajectories of the people entering the area are produced using the Kalman channel. The system then modifies the inside and outside count on the basis of the trajectories produced by the Kalman filter. The result obtained has an accuracy of 91% to 100%. Accuracy depends on the number of people intersecting the specified zone where the counting is done. At the detecting step they have used head-shoulder based HOG feature to find the people and in the next tracking step they have used the Kalman filter.

The methods used for counting people on the basis of moving interest points have showed fine performances but temporary stopped people issue is still challenging. So [9] proposes a method to count both in motion and still people. This method proposes to first separate in motion and the still points using motion information. The texture figure of points has been used to find temporary static point. Final count of people is measured using both still and in motion points. The results have shown that the method identifies the static points correctly. The method proposed also decreases the inaccuracy in estimation of temporary static people.

In [10] human detection and counting is done using python through webcam, recorded videos or images.

Here, single shot detector algorithm(SSD) and convolutional neutral network(CNN) is used for human detections. SSD is used to acquire live stream from camera and then CNN is used to identify person and assign a private id to it. The system detects a person through their body parts

like head, hands and legs. Basically, an image, video or webcam inputs are then and are divided into regions. Then these regions are classified as classes using CNN. After that all the classes are combine to give one image. To improve accuracy, SSD is introduced for the detection of object classes and offsets. Some more technologies used in this paper for human detection and counting are OpenCV contrib , Cmake, Visual Studio.

Network model pruning is used for age-gender estimation in [11]. Because of big footprints of memory and workloads, deep neural network is not used. Before applying pruning schemes, many pre-training models are modelled and characterised. Types of pruning are weight, layer and filter. These prunings are then analyzed in the form of accuracy and complexity to find optimal pruning conditions. The model's size is decreased by 90% with a loss in accuracy of 2%-9%. Network pruning techniques and combined schemes of pre-training models are explained in the paper. Also the result of the final model and the original one are compared with each other.

3. PROPOSED SYSTEM

A. Components of the proposed system as shown in figure 1:
1) *Data collection:* We need to collect some datasets to use our Age and Gender estimation model and increase our accuracy.
2) *Age and gender estimation model:* Here we will be using real-time face detection and deep learning model to find out the age and the gender of the people entering the restaurant.
3) *People Counting model:* Here we will be using real-time detection and an algorithm to count the people entering the restaurant and also this model will be used on other camera to count the number of people present in the waiting area and this count will be used by the next waiting time model.
4) *Waiting time model:* In this model we will apply a Machine Learning algorithm to the count that we get from the people counting model and get the waiting time of the queue.
5) *Displaying Data:* After getting all the data we will display the relevant data to the customers as well as show the

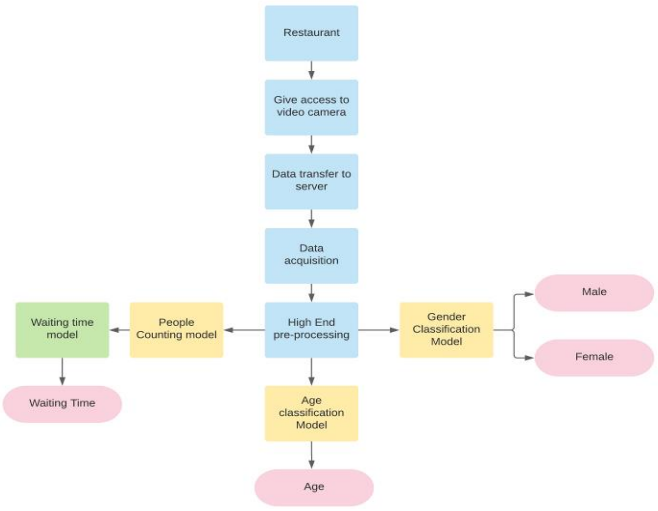

Figure -1: Proposed System Architecture

4. CONCLUSION

To our best knowledge, very few publications are available in the literature survey that address the issue of waiting time. Although several studies are available for age and gender detection through face images, little attention has been paid to video-based solutions. Most of the previous studies do not consider a system for restaurants. We, thus, propose a system for overcoming the given problems and make it easier for the people as well as the restaurants to view age, gender and waiting time.

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