

Emotion Analysis of E-Customers Using Face Recognition

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Abstract - In Today's world it is easy to recognize the emotion of a person by just looking at his/her facial expressions. For a sales person it is important to know whether his customers is convinced to buy a product or not, the factors through which he can identify this is by observing the behaviour and emotions. For e-commerce such as Amazon and Flipkart it becomes difficult to identify the emotional state of a person. The interaction and communication between human beings and computers will be more natural if computers are able to understand and respond to the emotions of an individual [1]. This paper provides us a way through which the e-commerce business can plan strategies, recommend relevant products and keep a track of customer's habit using facial emotions.

Keywords - FER – Facial emotion recognition, SCQ Framework, Factor Mapping, AI, Video file ingestion, Restful service.

I. INTRODUCTION

Facial expressions play an important role in recognition of emotions and are used in the process of non-verbal communication, as well as to identify people and their emotions, gender and Age. They are very important in daily emotional communication, just next to the tone of voice [4].

Facial emotion recognition (FER) is an important subject in the field of computer and AI (artificial intelligence) gaining its popularity over the period of time [7]. Traditional systems are in place and also detects a person's emotion through an image but lacks to detect the real time emotions of a person. An ecommerce business cannot rely on such static data, for better recommendation of the product live data is much needed rather than a static one.

The emotional state of a person is key consideration for the e-commerce business. Some of the e-commerce business also offers a subscription-based strategy on their products e.g. Amazon provides prime subscriptions for Amazon Prime entertainment application, to increase their customer reach. Here face detection comes into the picture, through integration of our functionality, the business will be able to get the insights of the number of different people and their details, sharing a single subscription. Also, by detecting the emotional state of a person the application can provide better recommendations, based on age and gender as well. Though the integration of our functionality clients can know whether their customers are happy, sad, angry or disgust with their recommendations or not and can suggest accordingly.

Figure 1.1 shows the various emotional state of an individual such as neutral, joy, surprise, anger, sadness, fear and disgust.



Figure 1.1: Emotional State of an individual [4],[8]

II. METHODOLOGY

- “Defining the problem correctly is half problem solved”.[2] This approach is followed in framing questions and to define hypothesis properly using first principles thinking [2].
- Barbara principle is used to develop hypothesis to solve the problem in a more realistic way. Barabara Minto’s Pyramid principle is a tree structured thinking and communication technique i.e. from ‘Root’ to ‘Branches’[2],[3].The core of Minto’s thinking method is to group little Ideas to the presenter thought process into small clusters that support the main idea in increasing the granularity[2],[3].
- The SCQ framework helped us to move through a path with insights to practical outcomes. The SCQ framework divides the problem statement as follows:

Situation- Currently where are we? : This helps in relevance establishment. It tells us what exactly we want to do.

Complication: It tells us: What is the obstacle that is preventing us from doing it?

Questions: What we need to do to remove that obstacle?

The SCQ framework helped us to define the hypothesis which helped in model building that was used in predicting the emotional state. [2]

In our research the three components of SCQ are defined as follows

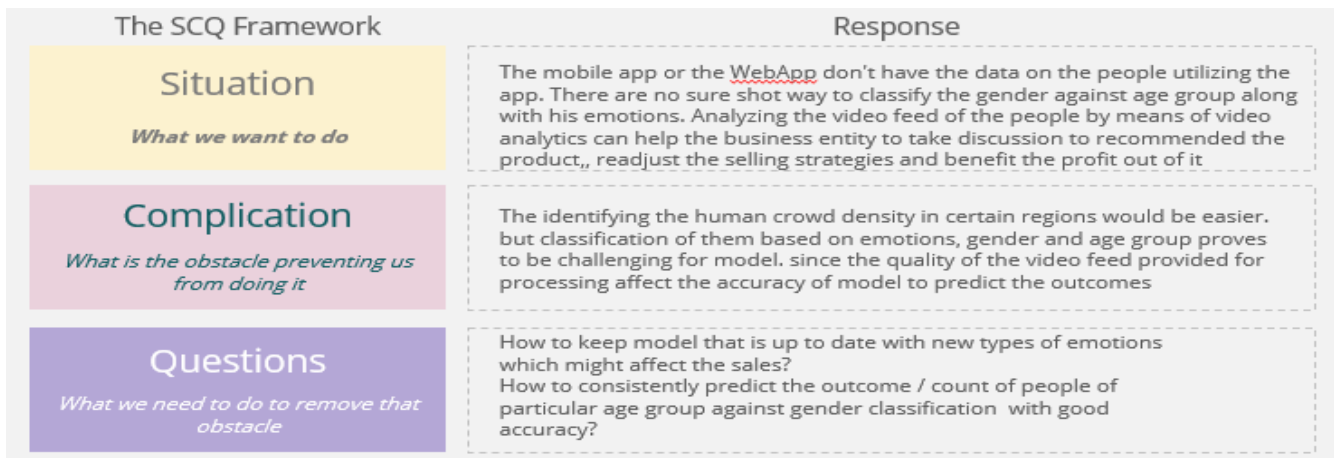


Figure 2.1: The SCQ Framework

III. FACTOR MAPPING

Factor mapping is a technique that we used to identify the various factors that can affect the e-customers emotional state towards purchasing a product, whether he will purchase that product or not. At first, we listed out all the possible factors and then grouped them in 2 major clusters that are Factors affecting the product sales and Factors affecting customer reach.

The Factors affecting the product sales are:

- Emotional state
- Age
- Gender

The Factors affecting the customer reach are:

- No of customer/subscription
- No of device logged in/subscription

We carried out deep analysis on each of the factors. Emotional state of the e-customer is an important factor that affects the purchase. Emotional state of a person depends upon the situation, thoughts and also the product he/she is looking at.

The age group and Gender factor is the supporting factor for the emotional state of an individual. It helps the e-commerce business to make accurate recommendations.

IV. ARCHITECTURE

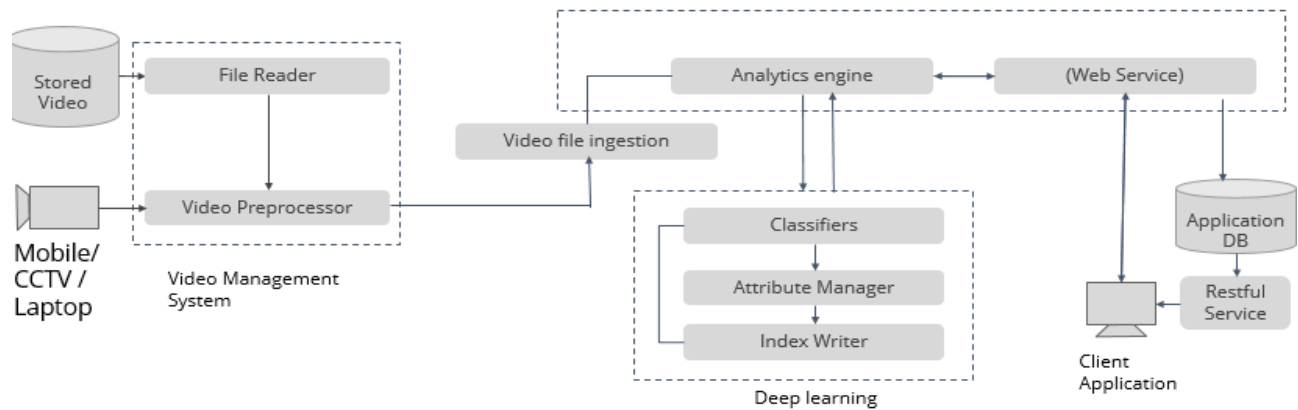


Figure 4.1: Architecture

Architecture components:

1. SQL Database
2. Input Source (Mobile, CCTV, Laptop)
3. File Reader and Video pre processor
4. Video file ingestion
5. Analysis engine
6. Restful service
7. Client Application

Our model takes input data from the 2 main sources, one is the historical data which is stored in a database and another one is from an input device such as mobile devices, laptop and CCTV. A file reader is used to read the images from the historical data. The data obtained from these input sources is fed to a video pre-processor. Video pre-processor divides the videos in a frame and then filters it by removing duplicate frames, it also compresses the video without degrading the quality. Then this partial processed data is fed to an analysis engine through a video file ingestion. Analysis engine uses classifier, attribute manager and index writer to classify the data, extracts attributes from a cluster and classifies it in subclasses based on similar attributes.

“A classifier can be defined as a hypothesis or discrete-valued function, which is used to assign class labels to a set of data based on a particular data point” [5].

Now that we have data for each facial attribute, we migrate it to clients application database, using restful service client’s application then can use this classified data, having all the data about e-customer, their emotional state, age and gender, to give recommendation and take business decisions.

V. MODEL DEVELOPMENT

Traditionally for detecting the emotions of a person, many data analysis techniques were used. But the changing technical world couldn’t rely on this technique due to lack of real time data about e-customers. Every model must be capable enough to adapt and change with the changing world of technology.

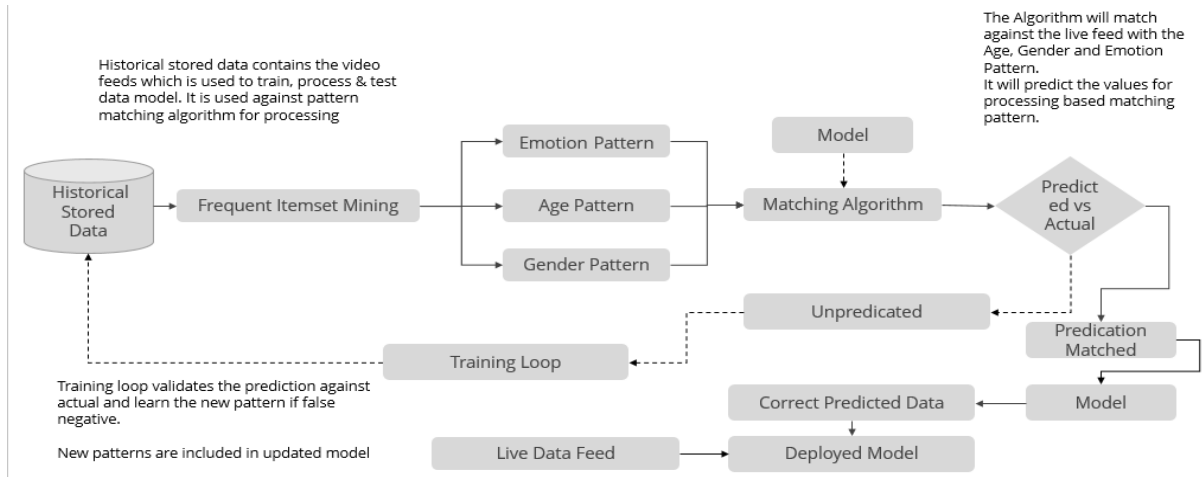


Figure 5.1: Model Development

Our model consists of a clustering algorithm which will help to find out the customers purchasing patterns and then fed this data to an artificial neural network which trains itself and will be robust enough to detect the purchasing pattern. Our model required 2 data set out of which one was the historical data which was used to train our model and other set of data to test the accuracy of the model.

A dataset or Item set from historical data was selected for mining. After mining different patterns were classified on the basis of emotion, age and gender so that we have updated pattern every time. The identified pattern was then fed to a matching algorithm, whose main task is to match the fed pattern with the real time data. The algorithm also detects the new patterns and differences.

Once pattern is recognized against the existing pattern it is then labelled using a combination of three attributes Emotion, Age and Gender. E.g. Emotion: Happy, Age: 23, Gender: Female. If the person is known Name attribute is also labelled E.g. Name: Clark Kent. This pattern then will be given as an input to a neural network, so that it will analyse and increase the accuracy. If the pattern is not predicted i.e. new pattern is detected, it is fed to a training loop, training loop validates the prediction against the actual and learn the new pattern. This new pattern is then added to the frequently mined dataset. Again, the same above procedure is followed for the new pattern and even then, if the pattern is not predicted then it is marked as unknown and fed to a neural network. The neural network will then can classify the pattern more accurately by adjusting the weights and will make the system more robust.

VI. RESULTS AND INSIGHTS

Model Results

Business

Age Group, Gender and Emotion Relation

It was found that there was significant variation in the emotions of people based on gender & also for the range of group detected varies.

Visualizing the Data

After modelling the data it was easier to detect the emotional state of people and distinguish them based on age group and gender.

Figure 6.1: Results and Insights [6]

VII. CONCLUSION

Live face detection data is a crucial information for e-commerce business, a system to provide this data with the emotional state, age and gender specification of a person is required. Our aim is to get accurate detection of emotional state of the e-customers so that the business can recommend accurate product as per the emotional state, age and gender, which will contribute in increasing the sales of business. The additional benefit that the business will get from this system is, they can manage their subscription plans and limit of users/subscription.

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