

Intelligent Emotion-Oriented eCommerce Systems

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Abstract: - Emotion-oriented eCommerce is a new research field. Intelligent emotion recognition techniques based on modern mathematical models using computational intelligence are presented. Progression within this field of study is highlighted. The requirements for designing of intelligent emotion-oriented eCommerce systems are defined. A model for simulation of intelligent emotion-oriented eCommerce systems is proposed. It is an important tool supporting the experimental study and design of emotion-oriented eCommerce systems.

Key-Words: - eCommerce, Emotion recognition, Computational intelligence, Modelling, Affect

1 Introduction

Electronic commerce is increasingly popular in today's businesses [5] and is becoming an integral facet in the online shopping experience [1]. Emotions are influencing customer cognitive processes and eShopping behaviour [28]. 'Affect' is an umbrella term to describe human moods and emotions [18]. It is an important variable in cognition and decision behaviour. Future research should investigate affective eCommerce as online decision behaviour. Affect, emotion, and subjective experience should be factored into the design of eCommerce systems [23].

Computational Intelligence (CI) techniques are more suitable than standard techniques for emotion recognition [9]. CI can be used also in simulation of emotion-oriented eCommerce systems.

Emotions play a significant role in an electronic commerce environment. Emotion-oriented eCommerce is a new research field. During recent years, the use of intelligent systems in eCommerce has increased significantly, providing a new perspective on the overall shopping experience. The aim of the paper is to propose and discuss the application of computational intelligence models involved in emotion recognition, simulation and design of emotion-oriented eCommerce systems.

As a first step towards creation of intelligent emotion-oriented eCommerce systems should be defined its design requirements. Then a model for

simulation of emotion-oriented eCommerce systems will be very useful for their study and design.

2 Intelligent Emotion Recognition

Emotion recognition involves assigning computers with the ability to observe, interpret and generate affect features. Its intent is to improve the quality of communication between the customer and eCommerce system. The capturing and processing of emotions by the computer is a new study. The standard procedure of affective interaction consists of affect information capture and modelling, affect understanding and expression.

Researchers are utilizing various methods of capturing emotions of the user. Such data should be processed to generate an adequate emotional response that would satisfy the customer's needs. Bianchi-Berthouze [16] developed a technology that improves the sense of engagement or immersion of its customers (positive usability) by taking into account their affective states. Their body postures were used as an indicator of human affective states. Picard [22] utilized a number of techniques for capturing emotive behaviour, namely eye-tracker, face reader, affective learning companion, conductive chat, emote mail, interface tailor, mouse behaviour analysis and relational agents.

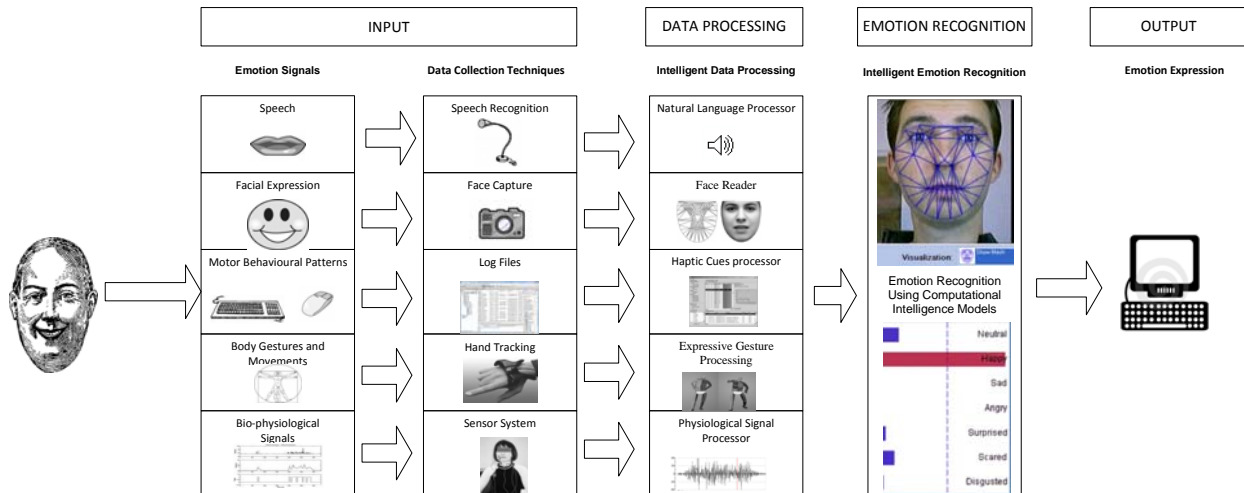


Fig. 1: Intelligent Emotion Recognition.

People express emotion through facial expression, body movements and gestures, voice behaviour and other bio patterns. Fig. 1 summarizes the key technologies in emotion recognition starting with input signals, data collection and processing, emotion recognition based on computational intelligence modelling and emotion expression.

2.1 Speech Processing

A powerful method for communicating and expressing emotion is through speech. Research on emotional speech focuses on typical acoustic features [31]. Such elements like pitch (level, range and variability) and speaking rate have been analysed by researchers in addition to tempo and loudness [27]. People express their feelings by the acoustic features and by the content of what they want to say (words, phrases and syntactic structures) [31]. The use of speech recognition techniques is useful as the user's tone and intonation depicts the emotional state of the user.

2.2 Facial Expression

Facial expressions are one of the principal methods that are used to detect human emotions [30]. Ekman [8] outlined some typical features associated with the six basic emotions namely joy, anger, surprise, disgust, fear and sadness. The Facial Action Coding System (FACS) details a set of muscular movements for each of the basic emotions [7].

2.3 Motor Behavioural Patterns

The form of communication can be easily conveyed by using the standard mouse and keyboard provided by any computer system. The mouse and keyboard can identify motor-behavioural parameters from log-files. The analysis of mouse clicks, mouse speed, or keystroke speed provides an uncomplicated method of measuring emotions without any additional devices.

2.4 Body Gestures and Movements

Body gesture and movement refer to the different positions of the body and its changes over a period of time [31]. At present the study of body gestures and movements is focused on hand tracking. It conveys many meanings, for example a clenched fist may indicate an aroused emotion of fear, anger, or excitement. There are two methods of analysing the movement in the hand: the apparentness or the 2-D method [7] which analyses the apparent features of hand movement using 2-D images and the 3-D method which does the same as the former in a 3-D environment [32].

2.5 Biosignals

Detecting and recognising biological signals is an essential aspect of emotion recognition [22]. Picard [24] developed a sensor system measuring biosignals such as heart rate, skin conductivity, respiration, temperature, pulse, electrical activity

in the muscles, etc. that allows the detection of various emotional states in a user [22].

2.6 Intelligent Data Processing

Most of the research does not combine different modalities into a single system for the analysis of human emotional behaviour: different channels of information (mainly facial expressions and speech) are considered independent to each other [3]. As data is collected it must be processed and analysed and the appropriate intelligent data processing techniques like computational intelligence must be applied.

2.7 Emotion Recognition based on Computational Intelligence Models

Computational intelligence (CI) has been defined as “the study of adaptive mechanisms to enable or facilitate intelligent behaviour in complex and changing environments” [9]. Appropriate for emotion recognition are CI methods like Fuzzy Systems, Genetic Algorithms, Neural Networks, and especially Swarm Intelligence which includes Particle Swarm Optimization, Ant Colony Optimization, Bee Colony Optimization and Wasp Colony Optimization.

3 Intelligent emotion-oriented eCommerce Systems

Studies on intelligent emotion-oriented eCommerce systems are very limited up to this point [14]. Any affective eCommerce system would need to assess the affective state of the customer through affective sensing and recognition in order to determine an appropriate reaction [12]. Affective responses to web interfaces play a significant role in the acceptance of banking websites [26]. In [22] is investigated the possibility of designing emotive interfaces which involves customers emotionally and enhance the quality of decisions made during the interaction process. Experiments on recording the emotive reactions of the participants to interface design of cyber banking sites are carried out. The influence of induced emotions on motor-behaviour parameters while shopping on an eCommerce website for office supplies was investigated. Bio physiological parameters like

respiration, pulse, skin conductance level and corrugator activity were measured. Experiments proved that emotive behaviour can be successfully analysed through the use of the mouse and keyboard [20].

Intelligent emotion-oriented eCommerce system can be seen as a system that can effectively identify, interpret and respond to a customer’s emotions in eCommerce environment.

The idea of developing emotion-oriented eCommerce systems may be difficult to conceive, however, this type of eCommerce systems provide many advantages. Despite the many capabilities the computer system may possess, e.g. storage of large volumes of data, processing speed and performing complex calculations, computers are unable to determine the way the user may feel or think. An eCommerce system which is able to detect the emotional state of the user should be able to take the necessary steps to produce a positive emotional environment for the user.

3.1 Requirements for Design of Intelligent Emotion-oriented eCommerce System

An intelligent emotion-oriented eCommerce system should be designed to effectively accommodate techniques that would identify affective behaviour in the customer. The identification of the emotional state of a potential customer should be followed by the appropriate response from the system which will encourage the customer to make a favourable purchase decision.

The design of such a system should allow mixed interaction where control is shared between the customer and the system. There are two scenarios that could be investigated in relation to intelligent emotion-oriented eCommerce systems:

- (1) *Customer - to - the intelligent emotion-oriented eCommerce systems* – The customer communicates with the system via the chosen input medium.
- (2) *Intelligent emotion-oriented eCommerce systems - to - Customer* - The system would request input from the customer and in return provide the necessary feedback.

The intelligent emotion-oriented eCommerce system is best suited for a *business-to-customer* eCommerce environment as the aim is to gain the customer’s trust and loyalty. The ultimate goal is

customer satisfaction and appealing to the emotions of customers provides a pathway for solidifying a positive purchase decision. The intelligent emotion-oriented eCommerce system should therefore adapt to the following requirements:

- Follow a social model that takes into consideration the affective behaviour of the customer;
- Follow a framework that would address the aesthetic dimensions of an interface, interaction and information delivery which would facilitate easy communication between the system and the customer;
- Making provision for rational and reasoning requirements in which the system would know how to appropriately respond to the customer's state and requests.

It is important that an intelligent emotion-oriented eCommerce system is able to seamlessly adapt to a real world environment. It must be able to respond intelligently to unorthodox situations posed by the customer. Therefore, the design consideration for this system should involve but not limited to emotion models, various interactive techniques, adaptability and knowledge of perception, reasoning and customer's profile and their general environment.

Many dimensions of website design have been outlined by authors dealing with aesthetics, customers' trust and web usability. However, there are few articles that answer the question - *What emotions influence the customer's purchase decision and how these emotions can be encouraged by the use of proficient website design?* In essence, research studies lack a comprehensive framework explicitly geared towards emotion-oriented eCommerce systems.

Design requirements should include the identification of *non-purchasing emotions* versus *purchasing emotions*. This determination can be made by conducting simulations and experiments designed to identify those emotions that are involved in the purchasing process. Companies want their products sold, therefore changing a negative emotion to a positive emotion which leads to a favourable purchase decision, should be of paramount importance as illustrated in Fig 2.

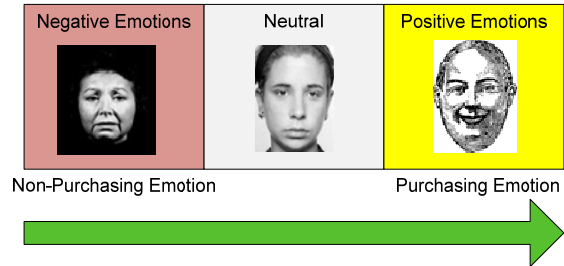


Fig. 2: Moving from Non-Purchasing Decisions to Purchasing Decisions.

There are a number of factors that can be considered in achieving the above purchase decision:

- Design elements – e.g. typography, graphics, audio, use of colours, frames, navigation, etc.
- Customer's initial mood
- Internal and external disturbances that affects the customer's experience – e.g. noise, computer's speed, etc.

Taking into account above requirements for design of emotion-oriented eCommerce systems very useful will be a simulation model of this system.

3.2 Simulation Model

A model of emotion should be able to identify events and objects involved in the interaction process. Emotion models should demonstrate the computer's ability to express emotions at the right intensity and appropriate time. Appraisal theories have influenced the development of computational models of emotion. Essentially, our appraisal of a situation causes an emotional or affective response.

The model most often used to incorporate emotion into eCommerce system which is based upon the appraisal theory is the *OCC model* [30]. It addresses the problem of representing emotions not by a set of basic emotions but by grouping emotions according to cognitive eliciting conditions. It believes that emotions arise from valenced (positive or negative) reactions to situations involving events, agents and objects [22]. Another computational model of emotions based upon the appraisal theory is the *EMA* (EMotion and Adaptation [11]. The agent's

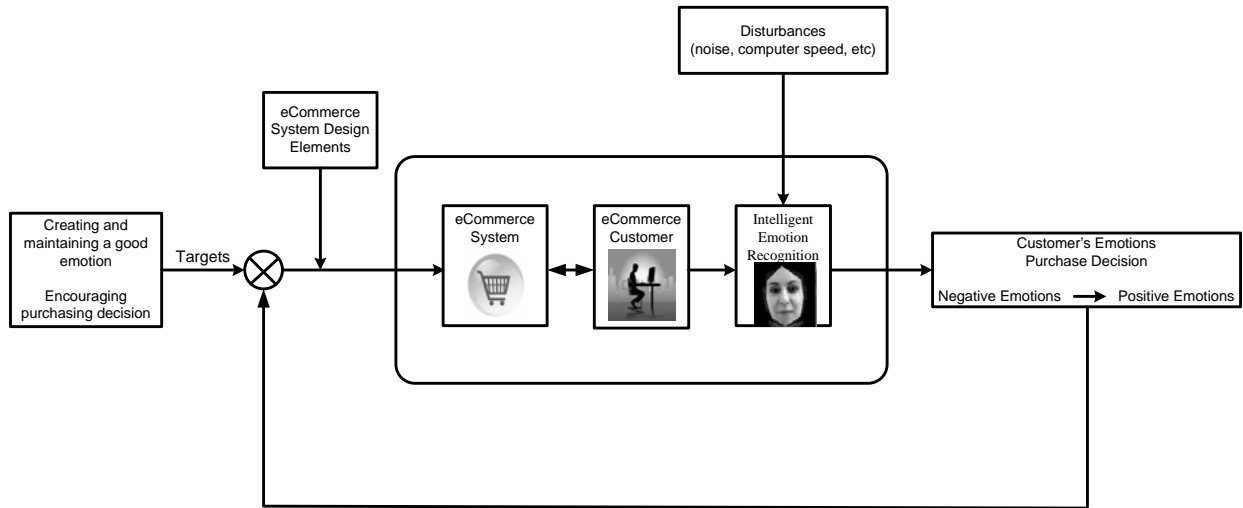


Fig. 3: Simulation model of intelligent emotion-oriented eCommerce system.

interpretation of its “agent-environment relationship” is considered to be a representation of beliefs, desires, intentions, plans and probabilities, which is referred to as causal interpretation to emphasize the importance of causal reasoning as well as the interpretative (subjective) character of the appraisal process [11].

A model for simulation of intelligent emotion-oriented eCommerce systems following the basic control structure shown in Fig. 3 is proposed. The target variables identify what the system should do and the input variables are appropriately linked to the eCommerce system. The input variable refers to the design elements required for the design of an emotion-oriented eCommerce System. The customer would interact with the system through a designed interface. The output variables will affect the eCommerce customer and the decision they make. There is also the opportunity to identify and collect the necessary bio-physiological data emitted from the customer. Positive feedback, may lead to the eventual purchasing of a product, whilst negative feedback will lead to product evaluation and system design modification. The decision made by the customer, will establish if further emphasis need to be placed on the input variables. In addition, designing such an environment must take into consideration the disturbances which may affect

the purchasing decision of the customer and the creation of a good mood.

A control-oriented method for simulation of eCommerce environment using MATLAB SIMULINK is suggested. SIMULINK allows for the visual understanding how a dynamic system like eCommerce system operates. Detailed dynamic models are required for performing ephemeral stability studies. An eCommerce system presents a dynamic system. SIMULINK applications can be applied to represent this dynamic environment.

4 Conclusions

Much thought and analysis should be invested in designing an interface that would elicit positive emotions. The business community would benefit significantly if they understand and apply the right tools when considering the emotions of the customer. Consumers are emotional beings and the emotions which they exhibit will ultimately affect their purchase decision. It is imperative that studies and research in the area of intelligent emotion-oriented eCommerce systems has a scientific and empirical foundation.

This paper raises issues of studies in intelligent use of computers in an emotion-oriented eCommerce environment. Intelligent emotion recognition techniques based on modern mathematical models using

computational intelligence are presented. The requirements for designing of intelligent emotion-oriented eCommerce systems are defined. A model for simulation of intelligent emotion-oriented eCommerce systems is proposed. It is an important tool supporting the experimental study and design of emotion-oriented eCommerce systems.

Emotion-oriented eCommerce research field is relatively new which presents many opportunities to research subject matters that show computers beginning to recognise and respond to certain expressions of customer emotion in an online shopping environment.

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