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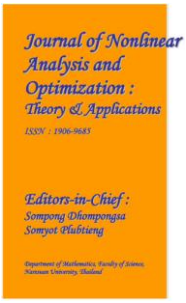

DEEP LEARNING FOR CUSTOMER BEHAVIOR ANALYSIS IN RETAIL: PREDICTIVE ANALYTICS FOR PERSONALIZED SHOPPING EXPERIENCES

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Abstract
Based on the development of the current work, an emotional monitoring system is introduced to track the shopping experience at various touch points in a retail store. information gleaned from facial recognition and biometric phrases. An initial assessment has been conducted to ascertain the system's efficacy in a practical setting with reference to identifying clients' emotions and their sex, age, and ethnicity prejudice. In light of this, data supplied by the system has been compared to older methods' outcomes analysis of a video. Findings indicate that the suggested system can be efficiently employed to facilitate the examination of client experience within a shop setting.
Keywords— face recognition, facial expression,emotion tracking,emotion analysis,customer experience, shopping experience

Introduction

In a retail setting, customer satisfaction is a major factor in determining business success. Indeed, it could impact the likelihood that a client will make a purchase their level of happiness , and their loyalty The greater the extent to which a shopping experience can captivate customers and generate thrilling and unforgettable moments, the greater its impact on their contentment and purchasing decisions.

Shops nowadays include appealing spaces (such as bars, games, fountains, and other enjoyable elements) and other enjoyable elements that are meant to create specific moods or entertainment sets where people can enjoy memorable and emotional events (like VIP events, the author's presentation of a new book or album, etc.). To guarantee a positive customer experience (CX), entertainment and the planning of inventive and humorous events are insufficient. Businesses must handle every hint they are giving to customers in accordance with a thoughtful and thorough CX strategy. Research from several domains and disciplines concur that the primary level of response to any given environment is affective and that the quality of typically is guided by the emotional impact the relationship a customer has with a brand, the way they behave, and ultimately his or her choices. Understanding the particular emotions generated from manipulating the shop setting lead to an increased comprehension of the part that emotions play in impacting the general quality of the CX and the consumers pleasure and encouraging repeat purchases .Thus, in this situation, it's essential to keep an eye on and examine the feelings and actions of the clients in order to appropriately determine the necessary steps (such as changing or introducing.

Research Background

CX is the individual's reaction (both internal and subjective) to every encounter with a brand, whether it is direct or indirect . This kind of reaction is comprehensive in character and is based on clients' social, emotional, and cognitive reactions to the stimuli observed throughout the conversation . Realising in the moment how each of these separate components contribute to the assessment of the customer experience is a subject that greatest attention in the retail industry, as it is the a requirement in order to offer specialised services. Numerous research, suggest techniques for the examination of

customers reaction as well as the CX quality indicator along the customer's travel, which are predicated on the development of the curve of emotions .

Indeed, the potential of a system that can detect and monitor customers' static and dynamic characteristics, including age, gender, ethnicity, emotions, and behavior, in real-time is groundbreaking, especially in the context of the retail sector. The increasing availability of sensors and smart devices connected to the Internet, coupled with the rise of Cyber-Physical Systems and the Internet of Things (IoT), has led to an exponential growth in the volume of available data.

Retailers now have the capability to collect a wealth of information about customers, ranging from basic demographics such as age, gender, and ethnicity to more nuanced data like emotional states and behavioral patterns. This extensive data collection can be facilitated through the use of sensors that capture customer movement, dwell time in specific areas, and even real-time monitoring of queues.

The integration and analysis of these diverse data sets offer retailers valuable insights. By correlating demographic information with customer behavior, retailers can make informed decisions related to various aspects of their operations, including:

Product Placement: Understanding where customers spend the most time and placing products strategically in those areas.

Pricing Strategies: Analyzing customer demographics in relation to purchasing behavior to optimize pricing.

Assortment Optimization: Tailoring product offerings based on the preferences and characteristics of the target demographic.

Promotion Design: Creating targeted promotions that resonate with specific customer segments.

Cross-Selling Opportunities: Identifying opportunities to suggest complementary products based on customer behavior.

Layout Optimization: Adjusting the store layout to enhance the overall shopping experience and encourage desired customer behavior.

Staffing: Optimizing staff allocation based on peak times and areas with high customer traffic.

This data-driven approach allows retailers to move beyond generic strategies and tailor their offerings and services to meet the specific needs and preferences of their customer base. However, it's crucial to approach the implementation of such systems with ethical considerations, ensuring customer privacy and consent are respected throughout the data collection and analysis process. Additionally, robust cyber security measures should be in place to protect sensitive customer information from unauthorized access.

The Proposed Emotional Recognition System

The proposed platform aims to analyze customer emotions and behaviors along the customer journey in a nonintrusive way.

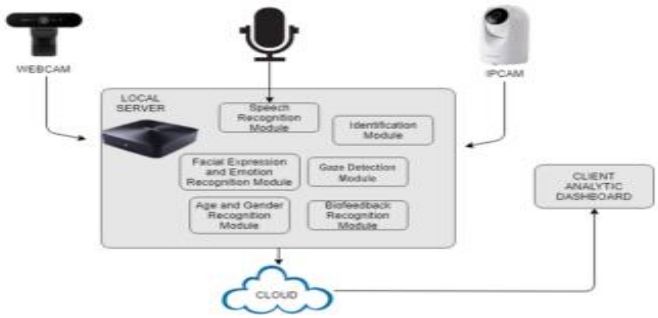

Figure 1 - The Architecture of the proposed deep learning based platform

These include the following: speech recognition, biofeedback analysis, identification modules, gaze detection, age and gender recognition, facial expression and emotion recognition, and speech recognition. With the exception of the last two, these modules employ IP Wi-Fi full-HD cameras with PTZ technology and autofocus or 4K webcams when available. Certain environmental restrictions prevent the use of cameras at eye level, so even in the best-case scenario, using IP or security cameras is typically the only option. The cameras, positioned in line with each Touchpoint,

deliver live video streams to the central server continually. The server analyses each video frame and provides the customer's gaze coordinates, age, gender, and emotional state measurements.
The Convolutional Neural Network embedded in the Expressions and Emotions Recognition module takes in all the different frames that make up the video stream as input and outputs a percentage value that corresponds to the intensity of the main emotions identified by Ekman (i.e., Joy, Sadness, Anger, Fear, Contempt, Disgust, and Surprise) . In addition, it offers measurements for the Engagement, which expresses how "engaged" the subject is, and the Valence, which indicates how positive or negative the experience was. These results have a good correlation with the Action Units idea, which is used to map users' emotions and evaluate their facial expressions and is explained in the Ekman's FACS manual . A Convolutional Neural Network trained on two distinct crowd-source datasets is used in this module.

Conclusion

This study presents an emotional recognition method mechanism that may monitor a client's feelings throughout their experience. Within the retail domain, this system presents several inventions. Actually, the system can offer to the business access to a vast amount of customer data (including impulsive feelings) that have never before been feasible to gather using conventional ethnographic methods, by keeping a discreet eye on your clients. As a result, adopting this technology will enable having a more detailed consumer profile than what can be found basic private information or from surveys. Real-time Emotional Recognition in Proposal
platform in contrast to the most popular instruments and techniques utilised for the identification and investigation of emotions, displays the ensuing benefits.

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