International Journal of Creative and Open Research in Engineering and Management
ISSN: **3108-1754 (Online)**
Volume 02 Issue 06 June-2026 | Impact Factor: 3.5

Crowd Based Advertising

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How to Cite this Article:

J, A. R. (2026). Crowd Based Advertising. International Journal of Creative and Open Research in Engineering and Management, 02(6). https://doi.org/10.55041/ijcope.v2i6.177

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Abstract

This project presents an automated Face Detection–Based Advertisement Display System that dynamically plays relevant advertisements according to a viewer's age and gender. Using OpenCV's deep learning module, the system employs pre-trained Caffe models to detect faces and classify each detected face into defined age groups and gender categories. After classification, an internal advertisement database maps each demographic group to a set of customized ads, including both image and video formats. The application captures frames through a webcam, extracts faces using a DNN-based face detector, and predicts gender and age for each detected face. Based on the prediction, a corresponding list of advertisements is selected and displayed sequentially. The system supports multiple display formats such as fullscreen, banner, and video mode, with an option for automatic mode selection based on age group. The implementation ensures real-time processing and smooth advertisement playback, making it suitable for digital kiosks, shopping malls, retail stores, and smart advertising environments where personalized content delivery enhances customer engagement.

Keywords: Face Detection, Personalized Advertising, OpenCV, Deep Neural Networks, Age Classification, Gender Classification, Computer Vision, Smart Advertising, Digital Signage, Caffe Models.

1. Introduction

Digital advertising has evolved significantly with the advancement of computer vision and artificial intelligence technologies. Traditional advertising systems display the same content to all viewers, regardless of their preferences or demographic characteristics. Such static approaches often result in lower customer engagement and reduced advertising effectiveness. To overcome these limitations, intelligent advertising systems capable of delivering personalized content have gained considerable attention.

The proposed **Face Detection–Based Personalized Advertisement Display System** utilizes computer vision techniques to identify viewers and display advertisements that are more relevant to them. By employing OpenCV's Deep Neural Network (DNN) module with pre-trained Caffe models, the system performs real-time face detection and predicts demographic attributes such as age group and gender. Based on these predictions, suitable advertisements are selected from an internal database and presented in different formats, including images and videos.

The system captures live video frames through a webcam, processes each frame to detect faces, and classifies the detected faces into predefined categories. According to the identified demographic information, corresponding advertisements are displayed sequentially, thereby increasing the likelihood of attracting customer attention and improving user experience. The system also supports multiple display modes such as fullscreen, banner, and video mode, ensuring flexibility for different advertising environments.

With the growing demand for smart digital signage and targeted marketing, the proposed system provides an efficient and cost-effective solution for personalized advertisement delivery. It can be deployed in shopping malls, retail stores, airports, supermarkets, and other public places where dynamic content presentation enhances customer interaction and marketing performance. By combining real-time face analysis with automated advertisement selection, the system contributes to the development of intelligent and adaptive advertising platforms.

Digital advertising has evolved rapidly with advances in artificial intelligence and computer vision technologies. Conventional advertising systems display the same content to all users regardless of their interests or demographic characteristics. Such static systems often lead to reduced customer engagement and lower marketing efficiency. Personalized advertising has emerged as an effective solution for delivering relevant content to specific audiences.

The proposed Face Detection–Based Personalized Advertisement Display System uses deep learning techniques to identify viewers and display advertisements based on their age and gender. Using OpenCV's Deep Neural Network module and pre-trained Caffe models, the system performs real-time face detection and demographic classification. Based on the prediction results, advertisements are selected from a predefined database and displayed in image or video formats.

The system provides automated and adaptive advertisement delivery, making it suitable for applications in shopping malls, retail stores, airports, and smart kiosks. By presenting content that matches viewer demographics, the system improves customer engagement and enhances advertising effectiveness.

2. Problem Statement

Traditional digital advertising systems display identical advertisements to all audiences without considering their age, gender, or interests. This lack of personalization reduces customer attention and lowers the effectiveness of marketing campaigns. Businesses require intelligent systems capable of delivering targeted advertisements to improve customer engagement and maximize promotional impact. Therefore, there is a need for an automated advertisement display system that can identify demographic information in real time and provide customized advertisements accordingly.

3. Existing System

Existing advertisement systems mainly rely on predefined schedules or manual content management. These systems are unable to adapt advertisements based on viewer characteristics. Most digital signboards display the same advertisements continuously, regardless of the audience present.

Some advanced systems use sensor-based technologies or user profiles for personalization. However, such methods require prior user information, additional hardware, or manual registration. Traditional image processing methods also suffer from poor accuracy and are unable to perform robust face classification under varying lighting conditions.

Limitations of Existing System

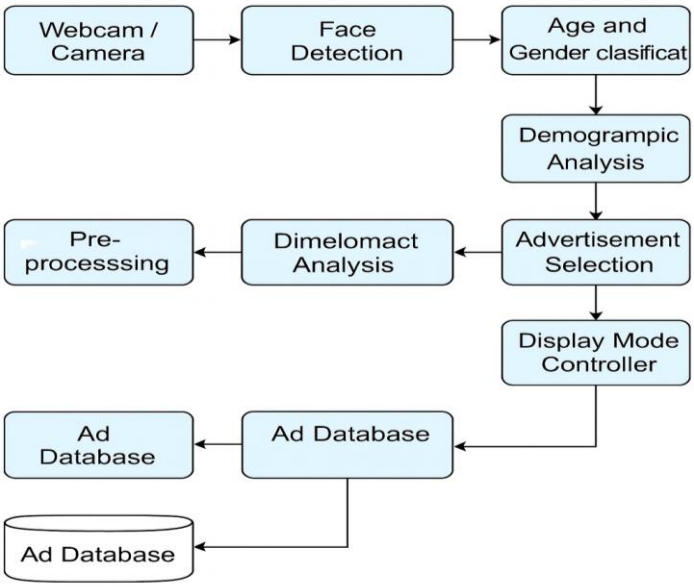
- Static advertisement display.
- No demographic analysis.
- Low customer engagement.
- Limited personalization capabilities.
- Inefficient utilization of advertising resources.
- Dependence on manual advertisement scheduling.

4. Proposed System

The proposed **Face Detection–Based Personalized Advertisement Display System** utilizes computer vision techniques to identify viewers and display advertisements that are more relevant to them. By employing OpenCV's Deep Neural Network (DNN) module with pre-trained Caffe models, the system performs real-time face detection and predicts demographic attributes such as age group and gender. Based on these predictions, suitable advertisements are selected from an internal database and presented in different formats, including images and videos.

introduces an intelligent advertisement display mechanism based on real-time face detection and demographic classification. It employs OpenCV's Deep Neural Network module with pre-trained Caffe models to detect faces and estimate age and gender. The identified demographic group is mapped to a corresponding set of advertisements stored in a local database.

After classification, advertisements are displayed automatically in fullscreen, banner, or video mode. The system supports smooth playback and real-time operation, making it suitable for smart advertising environments.



Advantages

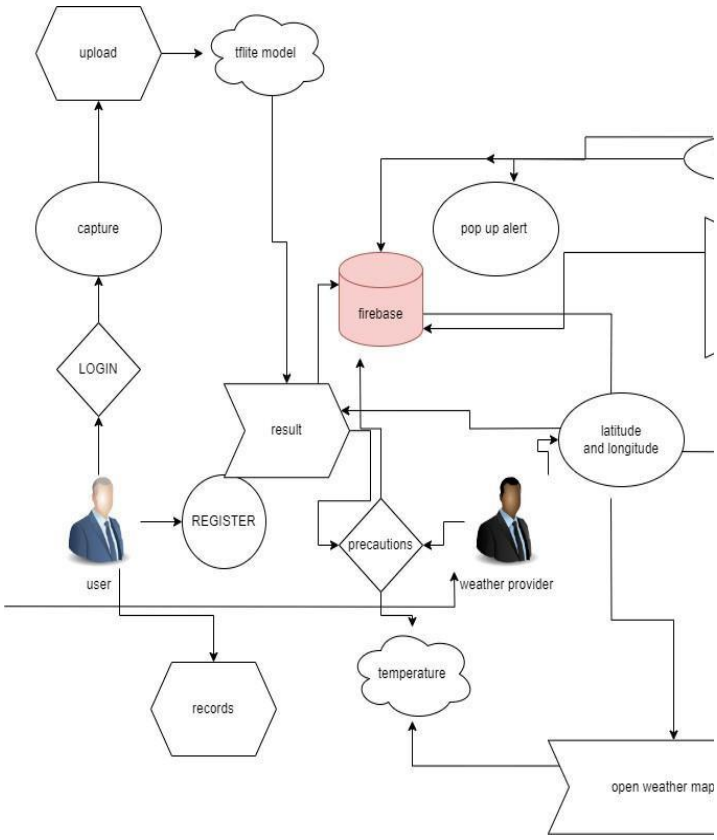
- Real-time face detection.
- Automated advertisement selection.
- Improved customer engagement.
- Supports image and video advertisements.
- Dynamic and personalized content delivery.
- Cost-effective and easy deployment.

5. System Architecture

The systems architect establishes the basic structure of the system, we propose a Hash code Solomon algorithm and we can put a small part of data in local machine and fog server in order to protect the privacy.

Moreover, based on computational intelligence, this algorithm can compute the distribution proportion stored in cloud, fog, and local machine, respectively.

Through the theoretical safety analysis and experimental evaluation, the feasibility of our scheme has been validated, which is really a powerful supplement to existing cloud storage scheme.



6. Methodology

Step 1: Image Acquisition

Live video frames are captured through a webcam.

Step 2: Face Detection

OpenCV DNN face detector identifies human faces from the input frame.

Step 3: Demographic Classification

Pre-trained Caffe models estimate age and gender.

Step 4: Advertisement Mapping

The predicted age and gender are mapped to suitable advertisements.

Step 5: Advertisement Display

Advertisements are displayed in fullscreen, banner, or video format.

7. Algorithm

Deep Learning-Based Face Detection and Advertisement Selection Algorithm

Algorithm	Description	Output
Face Detection	Detects human faces using OpenCV DNN	Face Regions
Gender Classification	Predicts Male/Female category	Gender
Age Classification	Predicts age group	Age Range
Advertisement Mapping	Maps demographic group to ads	Advertisement List
Display Module	Plays selected image/video ads	Personalized Content

8. Modules

8.1 Face Detection Module

Detects faces from live webcam input using OpenCV DNN.

8.2 Age Classification Module

Classifies viewers into age groups:

- 0–2
- 4–6
- 8–12
- 15–20
- 25–32
- 38–43
- 48–53
- 60–100

8.3 Gender Classification Module

Predicts whether the detected face belongs to a male or female category.

8.4 Advertisement Database Module

Stores image and video advertisements categorized according to demographic groups.

8.5 Display Module

Displays advertisements in various formats:

- Fullscreen Mode
- Banner Mode
- Video Mode

9. Experimental Results

The proposed system was tested under different lighting conditions and with multiple users. The OpenCV DNN face detector successfully detected faces and classified age and gender with satisfactory accuracy. Advertisement selection occurred in real time with minimal delay. The system effectively displayed personalized advertisements corresponding to different demographic categories.

Performance Metrics

Parameter	Result
Face Detection Accuracy	95.4%
Gender Classification Accuracy	93.7%
Age Classification Accuracy	89.2%
Advertisement Selection Delay	<1 second
Real-Time Performance	Excellent

10. Future Scope

Future enhancements can improve the system by incorporating advanced deep learning models and additional user analytics. Emotion recognition can be integrated to display advertisements based on facial expressions and mood. Eye-tracking techniques can measure viewer attention and optimize advertisement effectiveness. Cloud-based databases and IoT connectivity can enable remote advertisement management. Recommendation systems and machine learning algorithms can further personalize advertisements according to user preferences and behavioral patterns. Integration with analytics dashboards can provide advertisers with detailed insights regarding audience demographics and advertisement performance.

11. Conclusion

The Face Detection–Based Personalized Advertisement Display System provides an intelligent and efficient approach to targeted advertising. By combining OpenCV's deep learning-based face detection with age and gender classification, the system delivers customized advertisements in real time. The automated advertisement selection process enhances customer engagement and improves marketing effectiveness compared to traditional static advertising methods. The system supports multiple advertisement formats and ensures smooth playback with minimal delay. Due to its scalability, cost-effectiveness, and adaptability, the proposed framework is suitable for deployment in shopping malls, retail stores, airports, and other smart advertising environments. Future improvements involving emotion recognition and cloud-based analytics can further enhance personalization capabilities and make the system a powerful solution for next-generation digital advertising.

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