Published by :
https://www.ijert.org/
An International Peer-Reviewed Journal

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 05 , May - 2026

CircleMart++: Design and Implementation of an AI-Driven Secure Geo-Fenced Marketplace for Second-Hand Goods

1st Ravikant Taur
Dept. of Information Technology
GHRCEM
Pune, India

2nd Priti Ambhure
Dept. of Information Technology
GHRCEM
Pune, India

3rd Saee Ghadge
Dept. of Information Technology
GHRCEM
Pune, India

***Abstract*—In recent years, online platforms for buying and selling second-hand goods have grown rapidly, but this rise has also brought serious concerns about fake users, scams, and privacy risks. Many popular resale platforms allow users to register and list products with little or no verification, making them easy targets for fraud and misuse. To overcome these problems, this paper introduces CircleMart++, a secure and trust-focused resale platform designed to create a safer environment for both buyers and sellers. The system uses a combination of live camera verification and email OTP confirmation to ensure that only genuine users can register and log in. Sellers can post items only by capturing real-time product images, which are then checked using reverse-image search to prevent the use of stolen or misleading photos. The platform also applies geo-fencing to show listings only within a local radius, making face-to-face transactions more reliable. A built-in encrypted chat feature further protects user privacy and reduces spam or unwanted contact. With these features working together, CircleMart++ aims to build a transparent, efficient, and trustworthy digital marketplace that minimizes fraud and enhances user confidence in online second-hand trading.**

***Index Terms*—CircleMart++ Second-hand marketplace, user verification, face recognition, live camera authentication, OTP verification, reverse image search, geo-fencing, encrypted communication, fraud prevention.**

I. Introduction

In recent years, the growing popularity of second-hand marketplaces has been accompanied by a surge in fraudulent activities, fake user profiles, and privacy violations that threaten user safety and trust. Many users report receiving counterfeit or damaged products that differ from the listed descriptions, while others encounter fake sellers who disappear after collecting advance payments. Unverified accounts and minimal identity checks make it easy for scammers to create multiple profiles, exploit buyers, and repeatedly engage in deceptive transactions. Beyond financial fraud, users—especially women and students face spam calls, unsolicited messages, and privacy breaches due to mandatory phone number sharing on these platforms. Such recurring issues highlight the absence of proper verification, moderation, and secure communication mechanisms in existing resale systems, resulting in a widespread lack of accountability and declining confidence among genuine users.

Several existing platforms and research efforts have attempted to address the growing issues of trust and safety in second-hand marketplaces, but most solutions remain limited in scope and effectiveness. Popular platforms like OLX, Quikr, and Facebook Marketplace have introduced basic features such as user ratings, in-app chat options, and post-reporting tools, yet these measures often fail to prevent fraud before it happens. Identity checks are either optional or easily bypassed, allowing scammers to return under new accounts. While some international systems, like eBay, have implemented reputation scores and AI-driven fraud detection, these approaches are not well suited for India's mobile-first, semi-urban user base. Other studies have proposed models for user authentication and product verification, but they often lack real-time validation or location-based controls. As a result, buyers and sellers continue to face fake listings, cross-regional scams, and privacy risks, showing that current systems treat safety as an add-on rather than a core design principle.

To overcome these limitations, this research introduces CircleMart++, an AI-powered and hyperlocal resale platform designed to make online second-hand trading safer, faster, and more reliable. The platform integrates multiple layers of verification and security, including live camera-based user verification, OTP authentication, and AI-driven fraud detection to ensure that only genuine users participate in transactions. Product listings can only be uploaded using the device's live camera, which prevents the reuse of images taken from the internet. An integrated geo-fencing system limits listings to a local radius, encouraging nearby exchanges and reducing cross-regional scams. The platform also features encrypted in-app chat to protect user privacy, automated listing expiry to remove outdated posts, and an AI-based behavior analysis module that flags suspicious activity in real time.

A. Our Contribution

The key contributions of this research are as follows:

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 05 , May - 2026

- Developed a secure second-hand marketplace system with real-time user verification using live camera face authentication and OTP-based validation.
- Enabled authentic product posting by restricting image uploads to live camera capture, preventing reused or fake online images.
- Integrated a geo-fencing mechanism to display listings within a 15–16 km radius, fostering safe and nearby buyer–seller interactions.
- Designed a streamlined and intuitive workflow to simplify user onboarding, product listing, communication, and purchase processes.
- Implemented an encrypted in-app chat system to ensure private and secure buyer–seller communication.
- Built a scalable backend architecture using Node.js, Express.js, and MongoDB to ensure reliable performance and secure data handling.

B. Organization of the Paper

The rest of this paper is organized as follows: Section II provides the Literature review and related study. Section III highlights the problem definition and research objectives. Section IV explains the proposed system architecture, methodology, and algorithmic framework. Section V discusses experimental setup and evaluation metrics. Finally, Section VI concludes the paper.

II. Literature Review

Research on online second-hand marketplaces consistently highlights that trust, satisfaction, perceived value, and sustainability are essential drivers of consumer participation. Kaur and Manna [1] emphasized that user satisfaction connects perceived value with behavioral intention, suggesting that review features and personalized recommendations enhance engagement. Hinojo et al. [2] and Jang [3] identified trust, user confidence, and interface quality as key factors influencing platform loyalty, while Frahm et al. [4] and Ferraro et al. [5] found that affordability, uniqueness, and trendiness motivate resale activity, though hygiene and quality concerns deter users. Turunen et al. [6] and Roux and Guiot [7] highlighted the social and environmental impact of resale, showing how it fosters empowerment, sustainability, and circular consumption. Wilts et al. [8] demonstrated that second-hand markets reduce waste and support resource efficiency. Gu et al. [9] examined buyer–seller interactions, noting that trust and pricing strategies influence transaction frequency. Bae et al. [10] and Li et al. [11] discussed how AI-driven tools and transparent certification systems strengthen consumer confidence. Luo et al. [12] and Abbes et al. [13] stressed the importance of community engagement and social capital in building long-term trust. Guiot and Roux [14] developed a motivational scale to analyze drivers of second-hand shopping, while Stolz [15] explored luxury resale, revealing that authenticity and prestige motivate purchases despite persistent trust barriers. Zhi (2021) [16] designed and implemented a campus-based second-hand market trading platform using web technologies, emphasizing the convenience of peer-to-peer transactions and the potential for sustainable campus economies. Similarly, Van Loon et al. (2018) [17] investigated the significance of second-hand markets in circular business models, proposing analytical insights into how leasing and selling strategies can influence resource efficiency and sustainability. Rui (2020) [18] contributed to e-commerce innovation by integrating image recognition and deep learning techniques for product classification in cross-border platforms, thereby improving search accuracy and user experience. In the field of user authentication, Wang et al. (2017) [19] proposed a deep reinforcement learning-based face recognition system to enhance the security and adaptability of online user verification methods. Complementing this, Drusinsky (2021) [20] discussed the critical issue of authentication responsibility in e-commerce logins, highlighting the growing importance of transparency and trust in digital identity management. CircleMart++ ensures real user verification, authentic product validation, and secure communication, making it more reliable and fraud-free.

III. Problem Statement

The problem is to build a verified and geo-fenced resale system that restricts transactions to local users, preventing fake profiles, false listings, and long-distance fraud.

IV. Proposed Methodology

CircleMart++ is designed to establish a secure, intelligent, and geo-fenced resale ecosystem for second-hand goods. This section details the problem definition, system design, algorithmic framework, and data integration pipeline that collectively enable trust, authenticity, and automation in the platform.

A. Problem Definition and Research Objective

Existing second-hand trading platforms suffer from fake listings, reused product images, and unverified users, leading to mistrust among participants. The core research problem can be summarized as follows:

To address these issues, the following research objectives are proposed:

- Develop an AI-based framework for automated user and image verification.
- Enforce geo-fenced trust zones to enable hyperlocal, safe, and community-based trading.
- Introduce real-time product validation to ensure that all listings are genuine and uploaded through live camera capture.

B. Overall System Design

CircleMart++ follows a modular and layered architecture to ensure scalability, maintainability, and data privacy. The major functional layers of the system are outlined below.

1) System Architecture: The architecture of CircleMart++ is designed to provide a secure, intelligent, and scalable framework for online second- hand trading. It follows a modular, layered structure that ensures efficient processing, real-time interaction, and robust data security.

CircleMart++ works as a secure and smart platform for buying and selling second-hand items locally. Users sign up

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ISSN: 2278-0181
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through a live camera check and OTP verification, ensuring that everyone on the platform is genuine. Products are listed and visible only within a 15–16 km radius, which promotes local trading and reduces the risk of scams. Buyers and sellers communicate through an encrypted chat, keeping conversations private and safe. The system automatically removes expired listings, so only active products are shown. AI-based checks help detect suspicious activity, making transactions more trustworthy and smooth for all users.

The proposed methodology focuses on integrating intelligent verification, automation, and localized engagement to create a safe and trustworthy second-hand marketplace. TensorFlow.js and face-api.js are used for live facial verification, enabling quick and accurate authentication without manual approval. Email-based OTP verification adds an additional layer of identity validation, while geo-fencing enhances trust by restricting transactions to nearby users. The system also features encrypted in-app chat, ensuring that all communications remain private and protected from misuse. Furthermore, automated listing expiry removes outdated posts, keeping the marketplace organized and relevant.

A high-level architectural diagram of the proposed system is illustrated in Fig. 2, showing the interaction among these functional modules.

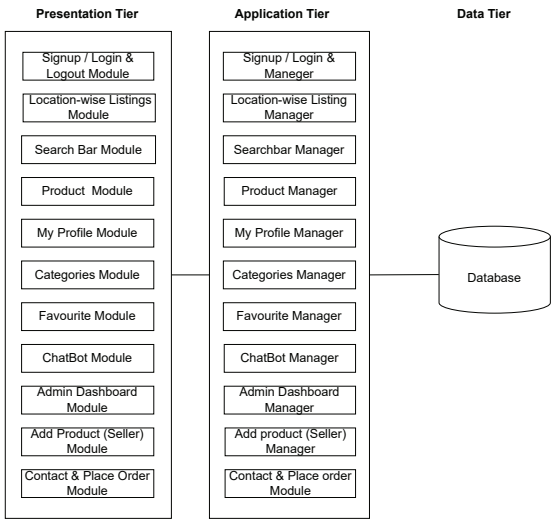

Fig. 1. 3-Tier Architecture of CircleMart++ System.

2) System Implementation and Workflow: The CircleMart++ platform is designed with a user-first approach to make every process simple, secure, and accessible. Users can easily register using a few basic details, followed by live camera verification and email-based OTP confirmation, ensuring a smooth yet secure onboarding experience. The interface is intuitive, allowing users to quickly navigate between buyer and seller dashboards without technical complexity. Buyers can easily browse nearby products within a 15–16 km radius, view product details, chat securely with sellers, and place orders in just a few clicks. Sellers, on the other hand, can effortlessly list products by entering details and capturing live images directly from their device, avoiding complex uploads. Real-time communication, automated product verification, and geo-fenced listings together reduce user effort and confusion. This simple, guided workflow ensures that even first-time users can interact confidently, making CircleMart++ both easy to use and highly secure.

C. Proposed Algorithmic Framework

The methodological framework is divided into four major components, each handling a specific dimension of trust and security.

1) User Verification Module: This module ensures that only genuine users can access the CircleMart++ platform through dual-layer verification combining live face authentication and OTP validation.

a) Step 1: Live Face Capture: The system captures a real-time facial image I_u from the user's device camera. Using *face-api.js*, the facial landmarks and key points are extracted to generate a feature representation F_u: where $f(\cdot)$ denotes the facial feature extraction function.

User Verification Module: Step 1: Live Face Capture: The system captures a real-time facial image I_u from the user's device camera. Using *face-api.js*, the facial landmarks and key points are extracted to generate a feature representation F_u:

$$F_u = f(I_u)$$

where $f(\cdot)$ denotes the facial feature extraction function that processes the input image and outputs facial feature vectors.

Step 2: Feature Embedding:
The extracted facial features F_u are converted into a compact numerical vector representation, known as an embedding E_u, using a deep learning model such as FaceNet or MobileFaceNet:

$$E_u = g(F_u)$$

where $g(\cdot)$ represents the embedding generation model that encodes facial characteristics into a fixed-dimensional feature space.

Step 3: Similarity Matching:
The system compares the new user's embedding E_u with stored embeddings E_j from the existing database to prevent duplicate or fake registrations. The cosine similarity score $S(E_u, E_j)$ is computed as:

$$S(E_u, E_j) = 1 - \frac{\|E_u - E_j\|_2}{\max(\|E_u\|_2, \|E_j\|_2)} \quad (1)$$

If $S(E_u, E_j) > \tau$, where τ is a predefined similarity threshold, the registration request is flagged or rejected as a duplicate.

{Step 4: OTP Validation: To ensure a secondary layer of security, an email-based One-Time Password (OTP) is generated and sent to the registered email address. The user must

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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input the received OTP O_u for verification . The validation process is defined as:

$$V(O_u) = \begin{cases} 1, & \text{if } O_u = O_s \\ 0, & \text{otherwise} \end{cases} \tag{2}$$

where O_s is the system-generated OTP. Successful validation ($V(O_u) = 1$) completes the registration process.

2) Image Authenticity Verification: This module ensures that uploaded product images are genuine and not reused from other sources.

- Product images must be captured in real-time through the device camera.
- Reverse Image Search is applied to detect reused or manipulated content.
- Perceptual hashing is used to compute a unique image signature:

$$H(I) = \text{hash}\big(\text{dct}(\text{resize}(I, 32 \times 32))\big) \tag{3}$$

- The computed hash $H(I)$ is compared against stored image hashes to identify duplicates or reposted images.

3) Geo-Fencing Algorithm: The Geo-Fencing Algorithm in CircleMart++ limits product visibility to a 15–16 km radius, allowing buyers to view only nearby listings. This ensures safer, local buying and selling, reduces fraud, and promotes trusted community-based exchange of goods.

1) Capture Location: The system retrieves the GPS coordinates of both the seller and the buyer, represented as (lat_s, lon_s) and (lat_b, lon_b) respectively.
2) Compute Distance: The geographical distance between the two users is calculated using the Haversine formula [21]:

$$\begin{aligned} &\Delta\phi = \phi_b - \phi_s, \qquad \Delta\lambda = \lambda_b - \lambda_s, \\ &a = \sin^2\!\left(\tfrac{\Delta\phi}{2}\right) + \cos\phi_s \, \cos\phi_b \, \sin^2\!\left(\tfrac{\Delta\lambda}{2}\right), \\ &c = 2 \, \text{atan2}\big(\sqrt{a}, \sqrt{1-a}\big), \\ &d = R\,c, \end{aligned} \tag{4}$$

where r is Earth's radius ($\approx$ 6371 km). The listing is visible if $d \leq 16$ km.
where:

- d = distance between buyer and seller (in km),
- r = radius of the Earth ($\approx$ 6371 km).

3) Compare Distance: If $d \leq 16$ km, the product listing is shown to the buyer; otherwise, it remains hidden.
4) Display Results: The filtered, location-based listings are displayed to the buyer for local exchange.

This geo-fencing feature improves safety, supports local buying and selling, and makes sure that all transactions happen within a verified nearby area.

D. Data Flow and Integration Pipeline

Data from all layers are securely transmitted using encrypted APIs, maintaining end-to-end confidentiality and system integrity. A sequence or modular flow diagram (Fig. 2) can be included to visualize these interactions.

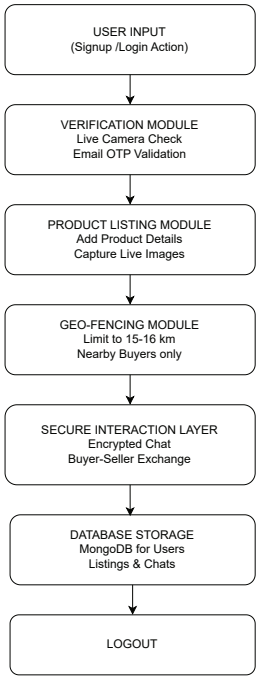

Fig. 2. Proposed system Workflow diagram of CircleMart++

V. Experimental Evaluation

A. Experimental Setup

CircleMart++ were conducted on a Windows 11 environment equipped with an Intel Core i5 (8th Gen) processor, 8 GB RAM, and a 256 GB SSD. The system architecture consisted of a React Native front end for mobile deployment and a Node.js–Firebase backend for real-time communication and data handling. Testing was performed using the Android Studio Emulator to simulate live user interactions and data flow. Verification components were implemented using FaceIO API for selfie-to-ID authentication and TinEye API for reverse image detection. GPS-based listing filters and encrypted chat functions were tested through Google Location Services and Firebase Cloud Messaging (FCM), respectively. A controlled dataset of 100 registered users and 200 product listings was created to measure platform responsiveness, verification accuracy, and overall reliability. Performance data were collected using Firebase performance analytics tools to evaluate system load handling, latency, and verification throughput under varying conditions.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 05 , May - 2026

TABLE I
TOOLS AND TECHNOLOGIES USED IN CIRCLEMART++

Category	Tools / Technologies	Description
Backend	Node.js, Express.js	Server-side logic and API routes.
Database	MongoDB Atlas	Stores users, products, orders, and embeddings.
Frontend	React.js	User interface and live camera capture.
AI Libraries	TensorFlow.js, Face-API.js	Face detection and recognition.
Image Verification	, Feature Embedding, Cosine Similarity	Reverse image check.
Security	JWT, Nodemailer (SMTP)	Authentication and OTP verification.
Chat	Socket.IO, WebSocket	Real-time buyer–seller chat.
Recommendation System	Content-based Filtering	Suggest products based on preferences.
AI Chatbot	HuggingFace Falcon-7B	NLP chatbot for conversation.
Environment	.env, dotenv,	Environment variables and image uploads.

B. Evaluation Metrics and Baseline Approaches

The evaluation focused on three key metrics: Verification Accuracy, System Latency, and User Experience. Verification Accuracy measured the reliability of ID matching and the detection of fraudulent or duplicate listings. System Latency assessed the average time taken for listing uploads, reverse image verification, and encrypted message delivery. User Experience was evaluated through participant feedback on usability, interface design, and perceived security. To assess the effectiveness of CircleMart++, comparisons were made with leading Indian resale platforms, OLX and Quikr, which served as baseline systems. Experimental results showed that CircleMart++ provided faster verification, reduced fraudulent listings, and improved user trust through integrated identity validation and hyperlocal filtering. The results demonstrate that CircleMart++ offers a secure, efficient, and user-centric approach to second-hand digital trading.

VI. CONCLUSION AND FUTURE WORK

In this paper we have addresses the major shortcomings of existing second-hand resale platforms by prioritizing user security, authenticity, and privacy. With live photo uploads, government ID verification, reverse image detection, and GPS-based listing filters, the platform ensures that only verified users and genuine products are part of the ecosystem. The integration of encrypted in-app chat and an automatic listing expiry system further enhances safety and provides a clean, user-friendly experience. Through these innovations, CircleMart++ establishes a trustworthy, hyperlocal, and intelligent marketplace for pre-owned goods.

For future development, CircleMart++ will integrate a secure in-app payment system to enable safe and direct transactions. Reverse image checks will be enhanced to detect suspicious behavior early, and blockchain technology will be explored to create tamper-proof verification and transaction records. The platform will also expand accessibility by supporting multiple regional languages and introducing an advanced admin dashboard for real-time monitoring and management. These advancements aim to make CircleMart++ not only a safer resale solution but also a scalable model for transparent, community-driven, and sustainable digital marketplaces.

REFERENCES

[1] M. Kaur and R. Manna, "Sale of second-hand goods by consumers: Mediating role of satisfaction between perceived value and behavioural intentions," *The International Review of Retail, Distribution and Consumer Research*, vol. 35, no. 3, pp. 291–312, 2025.
[2] P. Hinojo, D. Suárez, and B. García-Mariñoso, "Drivers of consumer participation in online second-hand transactions," *Sustainability*, vol. 14, no. 7, p. 4318, 2022.
[3] Y. Jang, "The factors influencing users' trust in and loyalty to consumer-to-consumer secondhand marketplace platform. behavioural sciences, 13 (3)," 2023.
[4] L. B. Frahm, C. Boks, and L. N. Laursen, "It's intertwined! barriers and motivations for second-hand product consumption," *Circular Economy and Sustainability*, vol. 5, no. 1, pp. 653–674, 2025.
[5] C. Ferraro, S. Sands, and J. Brace-Govan, "The role of fashionability in second-hand shopping motivations," *Journal of retailing and consumer services*, vol. 32, pp. 262–268, 2016.
[6] L. L. M. Turunen, M.-C. Cervellon, and L. D. Carey, "Selling second-hand luxury: Empowerment and enactment of social roles," *Journal of Business Research*, vol. 116, pp. 474–481, 2020.
[7] D. Roux and D. Guiot, "Second-hand markets: Alternative forms of acquiring, disposing of, and recirculating consumer goods," in *Marketing Management*. Routledge, 2020, pp. 388–407.
[8] H. Wilts, M. Fecke, and C. Zeher, "Economics of waste prevention: second-hand products in germany," *Economies*, vol. 9, no. 2, p. 74, 2021.
[9] W. Gu, J. Luo, X. Yu, W. Zhang, and B. Li, "Dynamic decisions between sellers and consumers in online second-hand trading platforms: Evidence from c2c transactions," *Transportation Research Part E: Logistics and Transportation Review*, vol. 177, p. 103257, 2023.
[10] Y. Bae, J. Choi, M. Gantumur, and N. Kim, "Technology-based strategies for online secondhand platforms promoting sustainable retailing," *Sustainability*, vol. 14, no. 6, p. 3259, 2022.
[11] X. Li, J. Ma, X. Zhou, and R. Yuan, "Research on consumer trust mechanism in china's b2c e-commerce platform for second-hand cars," *Sustainability*, vol. 15, no. 5, p. 4244, 2023.
[12] N. Luo, Y. Wang, M. Zhang, T. Niu, and J. Tu, "Integrating community and e-commerce to build a trusted online second-hand platform: Based on the perspective of social capital," *Technological Forecasting and Social Change*, vol. 153, p. 119913, 2020.
[13] I. Abbes, Y. Hallem, and N. Taga, "Second-hand shopping and brand loyalty: The role of online collaborative redistribution platforms," *Journal of Retailing and consumer Services*, vol. 52, p. 101885, 2020.
[14] D. Guiot and D. Roux, "A second-hand shoppers' motivation scale: Antecedents, consequences, and implications for retailers," *Journal of retailing*, vol. 86, no. 4, pp. 355–371, 2010.
[15] K. Stolz, "Why do (n't) we buy second-hand luxury products?" *sustainability*, vol. 14, no. 14, p. 8656, 2022.
[16] H. Zhi, "The design and implementation of second-hand market trading platform in campus based on web," in *2021 2nd International Conference on Information Science and Education (ICISE-IE)*. IEEE, 2021, pp. 1341–1344.
[17] P. Van Loon, C. Delagarde, and L. N. Van Wassenhove, "The role of second-hand markets in circular business: a simple model for leasing versus selling consumer products," *International Journal of Production Research*, vol. 56, no. 1-2, pp. 960–973, 2018.
[18] C. Rui, "Research on classification of cross-border e-commerce products based on image recognition and deep learning," *IEEE Access*, vol. 9, pp. 108 083–108 090, 2020.
[19] P. Wang, W.-H. Lin, K.-M. Chao, and C.-C. Lo, "A face-recognition approach using deep reinforcement learning approach for user authentication," in *2017 IEEE 14th International Conference on e-Business Engineering (ICEBE)*. IEEE, 2017, pp. 183–188.
[20] D. Drusinsky, "Who is authenticating my e-commerce logins?" *Computer*, vol. 54, no. 4, pp. 49–54, 2021.
[21] C. Robusto, "The cosine–haversine formula," *The American Mathematical Monthly*, vol. 64, no. 1, pp. 38–40, 1957.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 05 , May - 2026

[22] F. Schroff, D. Kalenichenko, and J. Philbin, "Facenet: A unified embedding for face recognition and clustering," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015, pp. 815–823.

[23] Y. Zhang, H. Li, R. Wang *et al.*, "Multi-view cosine similarity learning with application to face verification," *Mathematics*, vol. 10, no. 11, p. 1800, 2022.