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Survey On "Deepvision's Human Eye Blink Pattern Analysis for Deepfake Detection"

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Abstract - *Deepfake technology has rapidly evolved, enabling the creation of highly convincing synthetic media, including images, videos, and audio recordings. These maliciously manipulated digital artifacts can have severe consequences for privacy, security, and trust in digital content. Therefore, the development of effective deepfake detection methods is of paramount importance. This paper proposes a novel approach for deepfake detection based on the analysis of human eye blinking patterns. The human eye blink is a unique and subtle behavioral trait that is challenging to replicate accurately in deepfake videos. We leverage this inherent biometric feature to identify anomalies in video content and distinguish between genuine and synthetic videos.*

Key Words: Eye Blink to Speech, Machine Learning.

1.INTRODUCTION

Deepfakes have raised alarming concerns due to their potential to deceive, manipulate, and spread misinformation. These AI-generated forgeries have become increasingly convincing, making them difficult to detect through conventional means. As a result, researchers are turning to human physiological and psychological indica- tors to tackle the problem of deepfake detection. One of the intriguing aspects of deepfake detection is the role of human eye blinking patterns. Blinking is a natural and involuntary behavior that occurs frequently and rhythmically in humans. It serves multiple functions, including protecting the eye, moisturizing the cornea, and regulating visual input.

It becomes very important to spot the difference between the deepfake and pris tine video. We are using AI to fight AI. Deepfakes are created using tools like Face App and Face Swap, which using pre-trained neural networks like GAN or Autoencoders for these deepfakes creation. Our method uses a LSTM based artificial neural network to process the sequential temporal analysis of the video frames and pre-trained Res-Next CNN to extract the frame level features. ResNext Convolution neural network extracts the frame-level features and these features are further used to train the Long Short Term Memory based artificial Recurrent Neural Network to classify the video as Deepfake or real. To simulate real-world conditions and enhance the model's performance on real-time data, we conducted extensive training using a diverse and balanced combination of various datasets, including Face Forensic++, the Deepfake Detection Challenge dataset, and Celeb-DF.

Further to make the ready to use for the customers, we have developed a frontend application where the user the user will upload the video. The video will be processed by the model and the output will be rendered back to the user with the classification of the video as deepfake or real and confidence of the model

2. LITERATURE SURVEY

Face Warping Artifacts [15] used the approach to detect artifacts by com paring the generated face areas and their surrounding regions with a dedicated Convolutional Neural Network model. In this study, two distinct categories of facial artifacts were identified. The research approach was rooted in the observation that contemporary deepfake algorithms can exclusively produce images with constrained resolutions. Subsequently, these images necessitate additional modifications to align with the desired criteria. Detection by Eye Blinking describes a new method for detecting the deep fakes by the eye blinking as a crucial parameter leading to classification of the videos as deepfake or pristine. The Long-term Recurrent Convolution Network (LRCN) was used for temporal analysis of the cropped frames of eye blinking. In today's landscape, the capabilities of deepfake generation algorithms have reached such a level of sophistication that relying solely on the absence of eye blinking is no longer a sufficient indicator for the detection of deepfakes. There must be certain other parameters must be considered for the detection of deep fakes like teeth enchantment, wrinkles on faces, wrong placement of eyebrows etc.

Some already exist deepfake detection web & Android application's are following :

[1]. Paper Name : Multidimensional Feature Optimization Based Eye Blink Detection Under Epileptiform Discharges
Author : Meng Wang, Jianhui Wang, Xiaonan Cui, Tianlei Wang
Publish Date : April 2022.
Information : Detecting eye blink artifacts in scalp electroencephalogram (EEG) recordings of epilepsy patients poses a significant challenge due to their waveform similarities with epileptiform discharges. Developing an accurate detection method is of utmost importance and urgency. In this paper, we introduce an innovative approach for eye blink artifact detection in EEGs containing abundant epileptiform discharges, centered on multi-dimensional feature optimization. We propose an

unsupervised clustering algorithm based on smoothed nonlinear energy operator (SNEO) and variational mode extraction (VME) to identify epileptiform discharges in the frontal leads. Subsequently, we extract multi-dimensional time/frequency EEG features from the forehead electrodes (FP1 and FP2 channels) and combine them with the improved VME (IVME) threshold to represent the EEG data.

[2]. Paper Name Eye-Blink Detection System for Virtual Keyboard
Author : . Naila Hashmi1, Jyoti Kawar2 , Shweta Kawar
Publish date : November 2021.
Information : In today's world, virtually every task necessitates the use of a computer, making computer access an essential requirement in our society. Human-Computer Interaction (HCI) has become a fundamental skill for everyone, enhancing computer literacy. HCI specifically concentrates on the interface and interaction between individuals and computers, aiming to design technology that enables unique ways for people to interact with computer systems. This becomes particularly valuable for individuals with physical disabilities, enabling them to navigate and access the internet. In this system, the use of eye blinks allows users to input special characters and alphanumeric characters, much like manual keyboard input. It empowers individuals to explore and engage with various websites using just a simple eye blink.

[3]. Paper Name : A Real-Time Blinking Reminder Supportive System for Eye Care of Computer Gamers
Author : S. M. Fahim Faisal, Asiful Haque Joarder
Publish Date : December 2021.
Information : One of the most prevalent issues afflicting people today is ocular diseases, with approximately 75% of individuals requiring eyeglasses to address vision problems. The excessive use of electronic devices is a primary contributor to this concern. When using these devices, individuals often neglect to blink their eyes regularly, especially while engrossed in activities like gaming or official work that demand prolonged screen viewing. The proposed system offers a potential solution to this issue, particularly concerning the diminished blink rates observed among computer gamers during gameplay. This study conducts a survey to establish the extent of eye blinking among computer gamers. To identify human eyes and detect eye blinks, the system employs a Haar feature-based classifier capable of recognizing both human faces and eye positions.

[4]. Paper Name : Non-contact, real-time eye blink detection with capacitive sensing
Author : Mengxi Liu, Sizhen Bian, Paul Lukowicz
Publish Date : December 2022
Information : This research introduces an innovative non-contact, wearable, and real-time eye blink detection system utilizing capacitive sensing technology. A cost-effective, low-power capacitive sensing prototype was designed and integrated into a regular pair of eyeglasses, with a copper electrode affixed to the frame. The act of blinking the eye induces a change in capacitance between the electrode and the eyelid. By continuously monitoring the oscillating frequency shift signal resulting from this capacitance variation, eye blinks can be identified through a straightforward comparison of the raw frequency signal with a predefined threshold.

[5]. Paper Name : DEEPFAKE DETECTION USING BIOLOGICAL FEATURES: A SURVEY
Author : Kundan Patil, Shrushti Kale
Publish Date : January 2023.
Information : The emergence of deep learning techniques, particularly the deepfake technology, has significantly simplified the process of altering and manipulating images and videos. Visual evidence plays a crucial role in investigations and legal proceedings, but advancements in technology, notably deepfake, have raised concerns about the authenticity of such evidence. Edited photos and videos now appear remarkably realistic, making it challenging to distinguish them from unaltered originals. Deepfakes have been exploited for various nefarious purposes, including blackmail, planning of terrorist activities, spreading false information, character assassination, and inciting political unrest. Our study delves into the history of deepfakes to provide a comprehensive insight into this technology. Additionally, our research places emphasis on the evolution of deepfake technology and the challenges associated with its detection, particularly through physiological measurements. We elucidate the use of biological cues such as eyebrow recognition, eye blink detection, eye movement tracking, ear and mouth identification, and even heartbeat detection, offering a promising direction for further exploration in this field.

[6]. Paper Name : The Deepfake Detection Challenge (DFDC) Preview Dataset
Author : Brian Dolhansky, Russ Howes, Ben Pflaum, Nicole Baram, Cristian Canton Ferrer
Publish Date : October 2019
Information : A sneak peek into the Deepfakes Detection Challenge (DFDC) dataset reveals the presence of 5,000 videos that showcase the effects of two distinct facial modification algorithms. This extensive dataset was curated through a meticulous data collection campaign, with participating actors willingly agreeing to the use and manipulation of their likenesses for dataset creation. The dataset prioritizes diversity on multiple fronts, encompassing various factors such as gender, skin tone, and age, ensuring a broad representation. Furthermore, actors recorded videos against a backdrop of their choice, adding an extra layer of visual diversity to the dataset. To facilitate the assessment of performance, a set of specific metrics has been established, and two established models for deepfake detection have been employed to establish a reference performance baseline.

[7]. Paper Name : Face X-ray for More General Face Forgery Detection
Author : Lingzhi Li, Jianmin Bao, Ting Zhang, Hao Yang, Dong Chen, Fang Wen, Baining Guo
Publish Date : December 2019
Information : The concept of a "Face X-ray" for an input face image involves the creation of a grayscale representation that serves to unveil whether the input image can be deconstructed into a fusion of two distinct source images. It accomplishes this by delineating the boundary of blending in the case of a manipulated or forged image, while also highlighting the absence of blending in genuine images. Notably, it has been observed that a significant number of existing face manipulation techniques consistently involve a common procedure: the integration of an altered face into an existing

background image. In light of this observation, the Face X-ray technique emerges as a potent means for detecting forgery resulting from most prevalent face manipulation algorithms. The strength of Face X-ray lies in its generality, as it solely assumes the presence of a blending step, without relying on any prior knowledge of the specific artifacts associated with a particular face manipulation technique.

[8]. Paper Name Deepfake Detection: A Systematic Literature Review.
Author : Md Shohel Rana, Mohammad Nur Nobi, Beddhu Murali, Andrew H. Sung
Publish Date : January 2022
Information : The term "Deepfake" is a fusion of "Deep Learning (DL)" and "Fake," and it denotes the creation of highly realistic video or image content through the application of deep learning techniques. This term was coined in late 2017 by an anonymous Reddit user who leveraged deep learning methods to replace a person's face in explicit videos with the face of another individual, resulting in the production of astonishingly lifelike counterfeit videos. The process of generating these deceptive videos involves the use of two neural networks: (i) a generative network and (ii) a discriminative network, employing a FaceSwap technique. The generative network is responsible for generating fabricated images through the utilization of an encoder and a decoder, while the discriminative network assesses the authenticity of the newly produced content. The amalgamation of these two networks is collectively referred to as Generative Adversarial Networks (GANs), a concept initially proposed by Ian Goodfellow.

[9]. Paper Name : Deep Learning for Deepfakes Creation and Detection: A Survey
Author : Thanh Thi Nguyen, Quoc Viet Hung Nguyen, Dung Tien Nguyen, Duc Thanh Nguyen, Thien Huynh-The, Saeid Nahavandi, Thanh Tam Nguyen, Quoc-Viet Pham, Cuong M. Nguyen
Publish Date : August 2022
Information : Deep learning has undeniably found success in addressing a myriad of intricate challenges, spanning domains as diverse as big data analytics, computer vision, and even achieving human-level control in various applications. However, the very advancements in deep learning that have yielded these achievements have also been harnessed to develop software solutions that hold the potential to jeopardize individual privacy, democratic processes, and national security. Among the latest applications to emerge from deep learning technologies, deepfakes have emerged as a particularly noteworthy and concerning development.

[10]. Paper Name : DeepFake Detection: Current Challenges and Next Steps
Author : Siwei Lyu
Publish Date : March 2020
Information : While DeepFake videos can undoubtedly offer intriguing and imaginative applications, their potential for misuse is a significant concern. Given the strong connection between faces and individual identity, these sophisticated fabrications can be weaponized with dire consequences. Meticulously crafted DeepFake videos can craft illusions of a person's presence and actions that never occurred in reality, giving rise to grave political, social, financial, and legal ramifications. The spectrum of potential threats spans from vengeful creation of pornographic content by synthesizing a victim's face, to convincingly lifelike videos of state leaders making false, incendiary statements, high-level executives manipulating global stock markets with fabricated corporate comments, or online predators posing as family members or friends during video chats.

3.PROBLEM STATEMENT

The task is to build a top-notch deepfake detection system that can effectively distinguish between authentic and manipulated videos or images. We aim to create an automated tool with high accuracy, focusing on analyzing eye-blinking patterns as a key feature. To achieve this, we'll start by gathering a diverse dataset covering various individuals, backgrounds, and facial expressions. Then, we'll use advanced computer vision techniques to extract facial features, particularly focusing on eye-blinking dynamics. This involves pinpointing facial landmarks and analyzing blink frequency, duration, and variability over time. Using deep learning, we'll train a model on this dataset, employing techniques like data augmentation for robustness. Validation will ensure the model's accuracy and reliability in detecting deepfakes. Ultimately, our system aims to combat the spread of manipulated media by leveraging the subtleties of eye-blinking patterns for detection.

4.PROPOSED SYSTEM

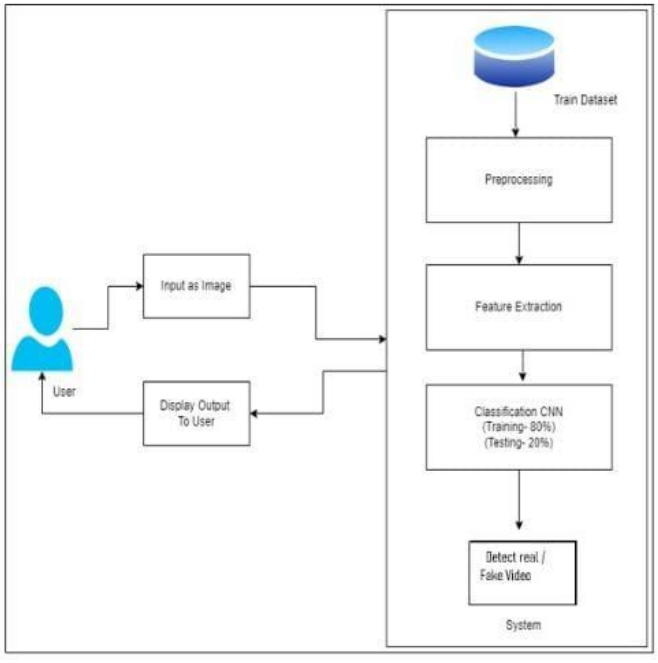


Figure 1. System Architecture Diagram

With the proposed methodology, it's feasible to develop a deepfake detection system capable of discerning synthetic media from authentic content. For the testing phase's deepfake detection, input the suspect images or video frames. Begin by applying preprocessing techniques to standardize the input, including grayscale conversion and median filtering to remove noise.

Utilize advanced machine learning algorithms like Convolutional Neural Networks (CNNs) to classify the media as genuine or manipulated based on the extracted features. Train the model on a diverse dataset containing both authentic and deepfake examples to effectively differentiate between the two categories.

5.ALGORITHMS

Convolutional Neural Networks

CNN is a most famous machine learning algorithm in which we can take an image as a input, assign importance (learnable weights and biases) for various aspects in an image, and can able to differentiate one image from other the other image. Convolutional neural network is the most used algorithm in deep neural networks.CNN main aim is to extract important features from images. Any CNN consists of the following:

• The grayscale image is a input layer.

• The Output layer that is a binary or multi-class labels

• Hidden layers consist of convolution layers, ReLU (rectified linear unit) layers, the pooling layers, and a fully connected Neural Network

When dealing with images having multiple color channels we have huge volumes of data to work with which makes the process computationally intensive. Think of it like a complicated process where any machine learning algorithm or the Neural Network has to work with three different data (R-G-B values in this case) to extract features of the images and classify them into their appropriate categories. The main aim of the CNN is converting images into such a form which is easier to process without loosing important features which are critical for a good prediction. This is important when we have to make the algorithm scalable to massive datasets.

6.MODULES

The proposed system undergoes following modules :-

1. Preprocessing

2. Feature Extraction

3. Classification

• Data preprocessing: It is a technique used in data mining that involves transforming raw data into an understandable format. The data is cleansed through processes such as filling in missing values, smoothing the noisy data, or resolving the inconsistencies in the data. As it contains some missing value, the dataset is cleaned, and decimal values are converted into proper float value Preprocessing is defined as the method of transforming raw data into an easy to understand format which is used in data mining. The data is cleaned through processes such as smoothing the noisy data, or resolving the inconsistencies in the data, filling in missing values. As the dataset contains some missing value, it is cleaned, and decimal values are converted into proper float values.

• Data splitting: - Data splitting can be defined as dividing new dataset into training and testing dataset. The

splitting is carried out in an 80-20 ratio. 80% of the dataset is taken as the Training Set which is used to train the model. The remaining 20% becomes the Test Set which is used to test the model, to analyze its accuracy. The testing set is never used for training, which could otherwise lead to overfitting the mode.

• Feature Selection: - The data features have a huge influence on the performance of the model which used to train machine learning models. Incorrect or partially correct features can impact model performance negatively.

• Classification: - Trained the model by fitting the training set to the classifier model. The classifier model upon testing, classifies the air quality into good or bad. The classifications are nearly close to the testing set.

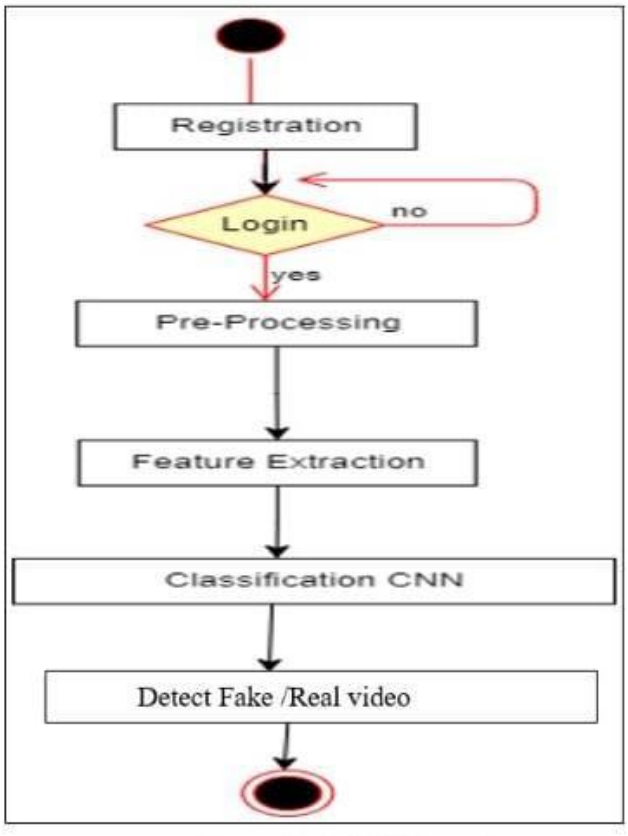


Figure 2. Activity Diagram

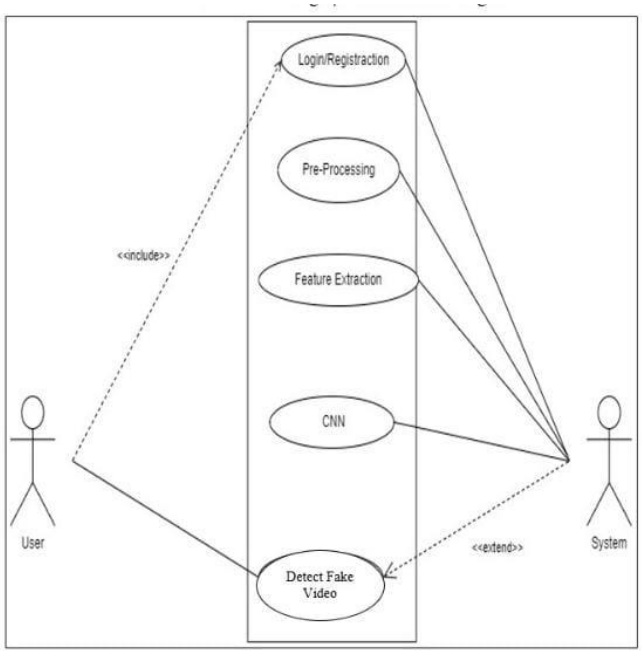
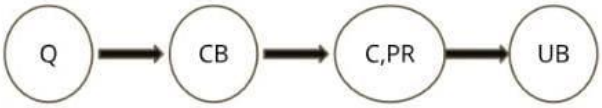


Figure 3. Use Case Diagram

7.METHEDOLOGY

A] MATHEMATICAL MODEL



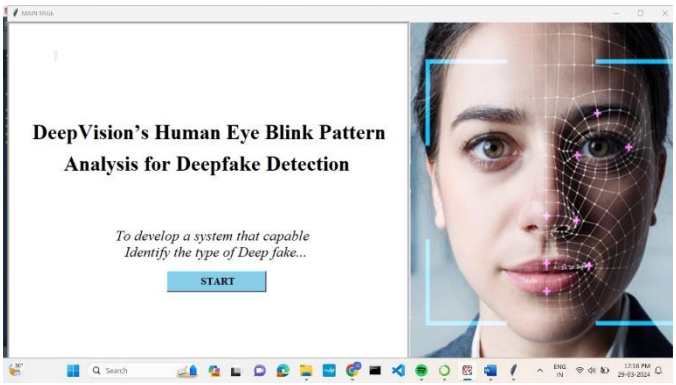
Where,
1. Q = Input Image
2. CB = Pre-processing
3. C = Feature Extraction
4. PR = Classification
5. UB = Output

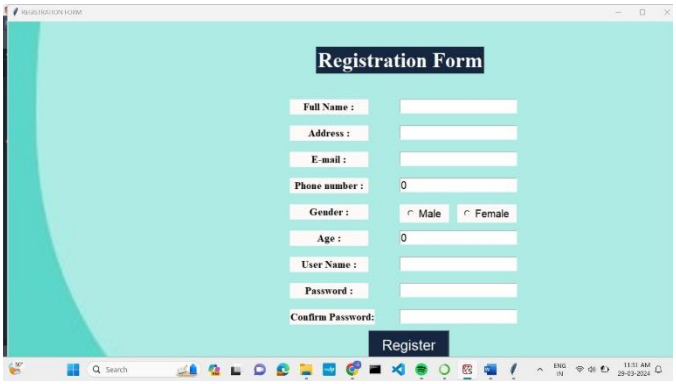
Q = Input Image
Let S be as system which allow users to Identify Deepfake Videos
S = {In, P, op,θ}
Identify Input In as
In = {Q}
Where,
Q=Input Image
Identify Process P as
P = CB, C, PR
Where,
CB = Pre-processing
c = Feature Extraction
PR = Classification
Identify Output Op as
Op = {UB}
Where,
UB = Output

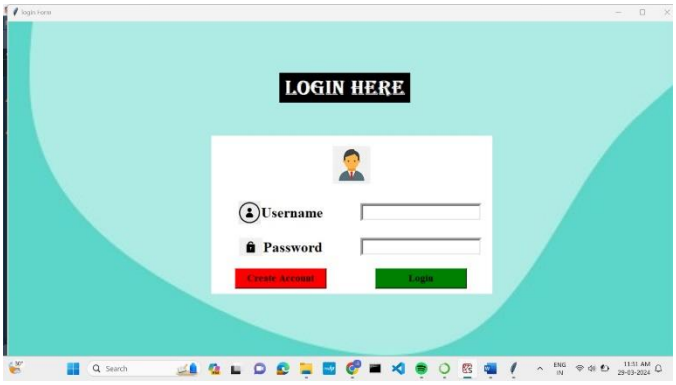
Failures: Possible failures in deepfake detection include false positives, false negatives, and susceptibility to adversarial attacks.

Success: Deepfake detection success relies on accurately identifying manipulated media through robust training, diverse datasets, and effective algorithms.

8.OUTPUT







9. CONCLUSION

In conclusion, using human eye blinking patterns for deepfake detection is a promising but challenging approach. While it offers several advantages, such as being a non-intrusive and interpretable feature, there are also significant limitations to consider. Blinking pattern analysis is just one piece of the puzzle in the broader field of deepfake detection. While this research represents a significant advancement in deepfake detection, it is important to acknowledge that deepfake technology continues to evolve. Therefore, further research and development are essential to stay ahead of malicious actors. Future work in this field may involve expanding the dataset, optimizing the model for real-time applications, and addressing emerging challenges.

10. FUTURE SCOPE

Deepfakes are a growing concern in the digital world, and detecting them is a challenging task. deepfake detection using human eye blinking patterns holds significant promise in enhancing security and trust in digital content. Leveraging this unique biometric feature has the potential to provide an added layer of defense against the growing threat of deepfake technology. As deepfakes become increasingly sophisticated, novel approaches like blink pattern analysis offer a promising means to differentiate between real and synthetic content. This technology may find applications in diverse fields, from user authentication and access control to content verification on social media platforms and even in health monitoring. The key lies in further research and development to improve the accuracy and reliability of blink pattern detection, address privacy and ethical concerns, and ensure compliance with regulatory standards. With advancements in machine learning and computer vision, the integration of blink pattern analysis into various devices and applications may play a crucial role in countering the challenges posed by deepfakes while offering a non-intrusive and user-friendly experience.

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