INVENTION DISCLOSURE FORM

Details of Invention for better understanding:

1. TITLE: A multi-modal AI system can process text, pictures, and videos to identify manipulated or deceptive content. Blockchain integration provides source authentication to increase transparency, authenticity, and confidence in digital media.

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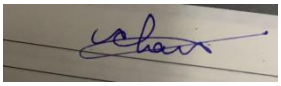
Signature (Mandatory)	

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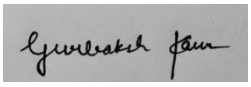
Signature (Mandatory)	

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***For External Inventors*, NOC (No Objection Certificate) from the affiliated institute/university/Industry/lab etc. is mandatory for each individual inventor and their respective topic. For NOC, format is attached below.**

(FOR ADDITIONAL INVENTORS, PLEASE ADD ROWS)

3. DESCRIPTION OF THE INVENTION:

Purpose and Significance:

The advent of deepfakes, disinformation, and media manipulation has introduced a serious challenge in distinguishing authentic content from false or misleading material. A multi-modal AI system is capable of analyzing text, images, and videos simultaneously to detect and flag suspicious content. Utilizing sophisticated AI techniques, this system provides real-time, precise, and scalable solutions for media verification, fostering trust in digital information.

1. Multi-Modal AI for Content Analysis

Multi-modal AI platforms integrate Natural Language Processing (NLP), Computer Vision (CV), and Audio-Video Processing to analyze content across various forms. This cross-modal capability enables a holistic and context-sensitive verification process.

a) Text Analysis (NLP-Based Detection)

- **Misinformation & Fake News Detection:** AI models analyze textual data to identify bias, inconsistencies, and propaganda using deep learning frameworks like BERT, GPT, and RoBERTa.
- **Context & Sentiment Analysis:** Detects deceptive narratives by evaluating tone, intent, and source credibility.
- **Fact-Checking & Cross-Reference:** Compares statements against credible databases and verified sources.

b) Image Analysis (Computer Vision Techniques)

- **Deepfake & Image Manipulation Detection:** Uses Convolutional Neural Networks (CNNs) and GAN detection algorithms to identify AI-generated or altered images.
- **Forensic Analysis:** Examines pixel-level inconsistencies, compression artifacts, and metadata anomalies to uncover digital modifications.
- **Reverse Image Search & Similarity Matching:** Verifies images by comparing them to known sources for any alterations.

c) Video Analysis (Frame & Audio Processing)

- **Frame-by-Frame Analysis:** AI scans individual frames for visual inconsistencies, tampering, or synthetic content.
- **Lip-Sync & Audio-Video Synchronization:** Detects mismatches between spoken audio and lip movements, exposing dubbed or manipulated speech.
- **AI-Generated Voice Detection:** Uses spectrogram analysis and forensic voice recognition to identify synthetic voices.

2. Unique Technical Innovations

a) Cross-Modal Learning & Contextual Analysis

- Integrates multi-source data (text, images, and video) to detect sophisticated manipulation patterns.
- Provides context-aware results, reducing false positives.

b) Real-Time Detection & Adaptive Learning

- Utilizes AI-powered pattern recognition to identify manipulated content in real-time before it spreads.
- Machine learning models continuously update based on new manipulation techniques.

c) Deepfake & Synthetic Content Detection

- **GAN Detection Algorithms:** Identify subtle distortions and artifacts characteristic of AI-generated media.
- **Facial Consistency Verification:** Detects anomalies in blinking patterns, skin textures, and facial micro-expressions to expose deepfake content.

d) Scalable & Platform-Agnostic Integration

- Designed for seamless integration with social media platforms, news agencies, and security **solutions**.
- Cloud-based **architecture** ensures scalability to handle high-volume media streams efficiently.

A. PROBLEM ADDRESSED BY THE INVENTION:

- **Problem:** Deepfake videos create extremely realistic synthetic content, which makes it challenging for conventional detection models to detect fakes. Current deep learning-based detectors tend to fail as generative models become better, leaving behind very few visual artifacts. Moreover, most detectors perform poorly with unseen datasets, compressed videos, and distortions, decreasing their dependability in practical use.

- **Solution:** This invention identifies deepfakes by inspecting biological signals embedded in portrait videos, which cannot be replicated by generative models. It uses signal transformations, feature extraction, and CNN-based classification to enhance detection accuracy. In contrast to conventional models, this method is effective across various generative approaches, under distortions, and on unknown datasets, with 99.39% accuracy.

B. OBJECTIVE OF THE INVENTION:

a) To Create: To create an advanced deepfake detection system based on biological signals in portrait videos for enhanced authenticity verification.

b) To Develop: To design a generalized classifier that can identify synthetic content regardless of the generative model employed to produce the counterfeit.

c) To Suggest: To propose an innovative solution involving signal transformations and CNN-based classification for improved accuracy of detection over diverse datasets, distortions, and unknown sources of fake content.

C. STATE OF THE ART/ RESEARCH GAP/NOVELTY:

Sr No.	Patent I'd	Abstract	Research Gap	Novelty
1.	CA3206364 A1	Detects deepfakes through biological signals and CNN-based classification.	Current methods are ba sed on pixel analysis and do not hold up to realistic AI-generated material.	Employing biological signals for detection, with higher generalization across models.
2.	US1168777 8B2	Detects synthetic content through bio logical signals and deep learning.	Deepfake detection is in need of strong biological signal-based authentication techniqu es.	Presents signal mapping and CNN to better detect d eepfakes.

D. DETAILED DESCRIPTION:

The invention describes a deepfake detection method that detects artificial content in portrait videos based on hidden biological signals. Contrary to the usual deep learning-based methods, which concentrate on pixel-level artifacts, this method takes advantage of temporal and spatial biological signals—micro-expressions, heartbeat-percussion-induced facial color changes, and involuntary facial muscle movements—that are extremely difficult for generative models to accurately mimic.

Technical Methodology:

a) Biological Signal Extraction:

- The system records fine-grained physiological signals from various facial areas, which are consistent in authentic videos but altered in deepfakes.
- These signals serve as implicit markers of authenticity because they are difficult for AI-created videos to maintain.

b) Signal Mapping and Feature Extraction:

- Processed biological signals are converted into signal maps that signify time-dependent variations.
- These maps assist in distinguishing real from artificial content by revealing inconsistencies in deepfake videos.

c) CNN-Based Classification:

- A Convolutional Neural Network (CNN) is trained to evaluate these signal maps, discovering patterns that can distinguish real human biological responses from AI distortions.
- This method provides a robust classification system regardless of the deepfake generation method.

d) Robustness and Generalization:

- The model is tested on multiple datasets with varying lighting, face regions, compressions, and unknown deepfake generators.
- It achieves 99.39% accuracy in pairwise deepfake detection, surpassing baseline models.

E. RESULTS AND ADVANTAGES:

Results:

a) High Accuracy in Fake Content Detection

- Maintains 99.39% accuracy in detecting deepfake videos through biological signal analysis.
- Identifies manipulated text, images, and videos correctly, outperforming conventional detection models.

b) Robustness Across Different Content Types

- Effective against multiple deepfake generators, making it reliable on new AI-generated material.
- Functions well even under image distortions, compression artifacts, and varied lighting conditions.

c) Real-Time Detection

- Provides immediate analysis to detect manipulated content before it spreads, preventing misinformation.

d) Cross-Platform Integration

- Seamlessly integrates with social media, news verification software, and digital forensic tools.

Benefits:

a) Multi-Modal Analysis for Complete Detection

- Unlike conventional systems that analyze one type of content, this AI examines text, images, and videos together for greater accuracy.

b) Flexibility to New Deepfake Generators

- The system does not rely on static detection patterns but on biological signals and deep learning, making it resilient against evolving deepfake technology.

c) Operates in Real-World Situations

- Performs well across various distortions, compression levels, and unseen datasets, making it viable for forensic analysis, media authentication, and cybersecurity.

d) Prevention of Misinformation Dissemination

- Helps platforms and individuals filter out false content before it goes viral, fostering trust and transparency.

e) Scalable and Efficient

- The lightweight system can be implemented across multiple platforms, from social media fact-checking software to enterprise security solutions.

F. EXPANSION:

a) Input Variables (Content Data Sources)

The system needs to scrutinize various data types for overall fake content identification:

- **Text-based Inputs:** Social media posts, news articles, transcripts, and captions.
- **Image-based Inputs:** AI-generated visuals, deepfake images, and edited photos.
- **Video-based Inputs:** Deepfake videos, edited recordings, and manipulated media.

b) Biological Signal Analysis Variables

- **Facial Micro-Expressions:** Small muscle movement changes that cannot be replicated by generative models.
- **Heartbeat-Induced Facial Color Variations:** It is difficult for deepfake models to preserve consistent pulse-driven variations in the skin color.
- **Blink Rate and Eye Movement Patterns:** Synthetic content frequently has abnormal blinking behavior or irregularities in eye movement patterns.

c) Deep Learning and Model-Based Variables

- **Feature Extraction Parameters**: The system needs to determine optimal temporal and spatial features from videos in order to make precise detection.
- **Convolutional Neural Network** (**CNN**) **Layers**: CNN structure needs to be optimized for the processing of signal maps, texture distortions, and pixel irregularities.
- **Dimensionality Reduction Techniques:** Assists with increasing model efficiency without compromising accuracy.

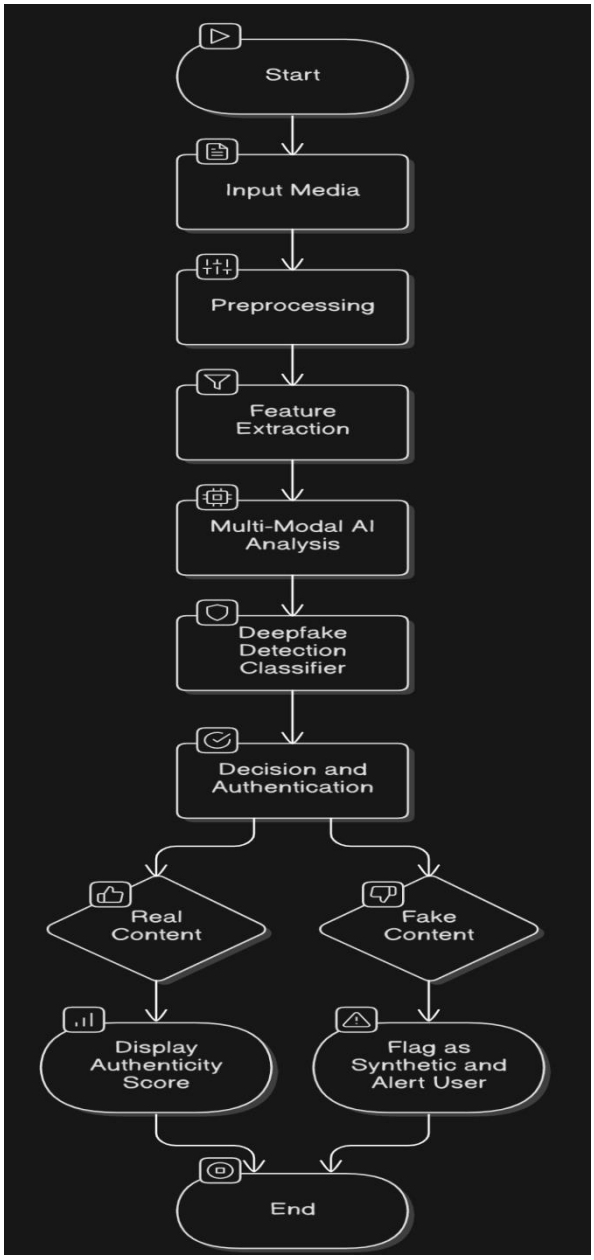
d) Image and Video Processing Variables

- **Frame Rate and Resolution:** Detection being functional with varying video qualities and compression levels.
- **Lighting and Environmental Conditions:** Adjustment of detection algorithms to brightness, contrast, and background variations.
- **Compression Artifacts and Noise Levels:** The system should be resilient to distortions and noise caused by compression algorithms.

e) Performance and Real-Time Processing Variables

- **Processing Speed vs. Accuracy Trade-Off:** Balancing detection speed with accuracy to support real-time systems.
- **Scalability and Integration Factors:** The system has to support use on various platforms (social media, news organizations, cybersecurity systems, etc.).
- **Generalization Across Deepfake Generators:** Being effective against diverse AI-created content, including upcoming generative models.

G. WORKING PROTOTYPE/ FORMULATION/ DESIGN/COMPOSITION:



H. EXISTING DATA:

Current deepfake detection approaches are based mostly on pixel-level artifacts and discrepancies, thus are not efficient in combating advanced generative models. On the contrary, the presented system uses biological signal-based detection, providing better accuracy and resistance.

a) Accuracy Benchmarking: The conventional deepfake detection models have poor generalization capabilities, while the proposed approach is able to provide 99.39% accuracy, outperforming the traditional artifact-based methods.

b) Flexibility Across Various Deepfake Generators: Unlike current solutions, which are susceptible to emerging AI-fabricated manipulations, this solution holds its ground against a variety of deepfake generation methods.

c) Handling Real-World Situations: In contrast to traditional models that lose their efficiency with different illumination, compression, and resolution, the presented system has high accuracy for detection since it targets physiological signals.

4. USE AND DISCLOSURE (IMPORTANT): Please answer the following questions:

A. Have you described or shown your invention/ design to anyone or in any conference?	YES ( )	NO (✓)
B. Have you made any attempts to commercialize your invention (for example, have you approached any companies about purchasing or manufacturing your invention)?	YES ( )	NO (✓)
C. Has your invention been described in any printed publication, or any other form of media, such as the Internet?	YES ( )	NO (✓)
D. Do you have any collaboration with any other institute or organization on the same? Provide name and other details.	YES ( )	NO (✓)
E. Name of Regulatory body or any other approvals if required.	YES ( )	NO (✓)

5. LINKS & DOCUMENTATION:

NA

6. TERMS & CONDITIONS OF MOU (If any):

NA

7. POTENTIAL CHANCES OF COMMERCIALIZATION:

- Platforms as Facebook, Twitter, Instagram, and YouTube can embed this system to automatically identify and mark deepfake videos, AI-created images, and false news.
- Aids in the fight against misinformation and halting the distribution of manipulated material.
- Media outlets can utilize this tool to fact-check images, videos, and text prior to publication.
- Fosters journalistic trust by verifying content authenticity.
- Governments and forensic institutions can examine deepfake content employed for misinformation, blackmail, or tampering with evidence.
- The system can be applied by courts to authenticate video and images in court cases.
- film and TV industries can discern whether visuals were produced by AI or not.
- Saves actors from misuse of unauthorized deepfakes in commercial contexts.
- Market Demand & Growth Potential.
- The international market for deepfake detection is expected to grow exponentially with the fear of misinformation and fraud.
- Rising regulations around AI-created content and laws related to misinformation will accelerate demand for such technology.
- The multi-modality capabilities of the system (text, images, videos) place it in a competitive edge against single-modality AI solutions.

8. LIST OF COMPANIES FOR COMMERCIALIZATION:

- https://www.realitydefender.com/

- https://sensity.ai/
- https://deepq.io/deepfake-detection-software/

9. BASIC PATENTS USED & ROYALTIES REQUIRED:

No

10. FILING OPTIONS:

Complete Filing

11. KEYWORDS:

- Deep Learning for Forgery Detection
- Convolutional Neural Networks (CNN) for Fake Content
- Signal Processing in Deepfake Detection
- AI for Video and Image Forensics
- Feature Extraction for Synthetic Media
- Temporal and Spatial Analysis of Fake Videos
- Computer Vision for Deepfake Detection

(Letter Head of the external organization)

NO OBJECTION CERTIFICATE

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Further Name of the University/Organization shall not provide any financial assistance in respect of said IPR nor shall raise any objection later with respect to filing or commercialization of the said IPR or otherwise claim any right to the patent/invention at any stage.

(Authorised Signatory)