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Forensic Aspects of Voice Analysis in India

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Abstract: ***The area of forensic speech and audio analysis encompasses a vast range of operations, the much more prominent of which is, without the need of a doubt, speaker identification. In addition, comprehensibility improvement of the recorded voice signal, analysis of disputed speech, and assessment of the legitimacy of audio recordings are also activities in the field. Using voice analysis, the examiner has two ideas about how to make an identification. Initially, he or she might compare the accent, conversational habits, breathing rhythms, and intonations of the evidence sample with the suspicious samples. After then, the corresponding voiceprints are compared. Voice parametrization is the process of converting a voice signal into a set of selected features that emphasize the speaker unique characteristics. The goal of this modification is to establish a new depiction that is more concise and more appropriate to speaker characterization. While evaluating deteriorated acoustic situations, recognizing voice parts becomes challenging. Time interval measure, zero-crossing rate, pitched spectrum analysis, higher cognitive statistics in the LPC residual domain, and fusions of various characteristics are among the Voice Activity Detection (VAD) approaches employed.***

Keywords: Voice, analysis, crime, Forensic, India.

I. INTRODUCTION

Forensic science involves the application and principle of scientific discipline that deal with various aspects of physical evidence to aid the criminal justice administration. In the criminal justice system, the forensic science plays a vital role by providing tool by evaluation of evidences in the hand of law enforcement agencies for solving the criminal cases. As the crime exits into various forms the evidence recovered from the crime scene also present into various forms such as fingerprints, blood, footprints, documents and audio recordings etc. Which is examined under different domain of forensic science.The various aspects of voice analysis is studied under the branch of forensic science known as Audio Forensics The audio recordings are one such evidence that involves an audio recording either it may be in analog or digital form rather then linguistic it is also useful in speaker voice recognition. This type of audio evidence is recovered from different crime scenario such as kidnapping where ransom money is demanded and in case of making obscene phone call etc.The voice analysis also done in trap cases for the identification of authenticity of recording in all such cases the identification of speaker's voice is important for the apprehension of offender. By following this voice analysis also plays prominent for speaker profiling, analysis of disputed utterance, and authenticity of evaluated audio recordings [1-5].

The speech production or voice produced with a human anatomical function that is encompassed with phonation and articulation where expiratory energy involved to produce noise or with movement of vocal cords which generates voice sounds. For voice analysis the acoustic analysis instrument is used which obtained a voice print in a graphical pattern. Voice prints are also unique as fingerprints therefore certain human physiological and socio-environmental factors affected the phonation and articulation mechanism but the voiceprints are unlikely to be found identical between two individuals. Rather than this, the frequency range of speech is also specifically based on gender. which is also taken as prominently consideration during analysis [6,7]. Any attempt has been made to dispute the voice although the features of prints have never been altered. During the voice analysis, the graphical pattern of voiceprints along with other features of frequency range and time interval is considered for a side-by-side comparison of known voices with suspicious voice recording. Which emphasize the unique characteristics of individuals by providing a successful comparison. With the legal aspects, the audio evidence is admissible in the court for law under the provision of section 65 B of the Indian evidence act.

II. FORENSIC INSTRUMENTATION USED IN VOICE ANALYSIS:

Nowadays, audio analysis has evolved into a comprehensive identification method that employs the most cutting-edge science has to offer. The research, which is still ongoing, shows that the method is legitimate and reliable when carried out by a qualified and certified examiner following defined, standardized protocols. Experts in voice recognition may be found all around the world. The evaluation of vocalizations is no longer confined to a visual comparison of a few phrases; it now includes every element of the words uttered, including the words themselves, the way the sentences flow together, and the gaps among them [8-11].

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Although many courts have denied admission to voice identification evidence, none of the courts excluding the spectrographic evidence have found the technique unreliable. Exclusion has always been based on the fact that the evidence presented did not present a clear picture of the technique's acceptance in the scientific community and as such, the court was reluctant to rely on that evidence. The majority of courts hearing the issue have admitted spectrographic voice identification evidence.

A. Sound Spectrograph

The sound spectrograph, also referred as an automated vibration analyzer, is a fundamental research technique utilized in many organizations for sound, music, and speech research. This one has been extensively utilized to analyses and classify speech perception sounds, as well as to diagnose and treat voice and hearing problems [12]. The device provides a dramatic representation of a group of sounds using duration, amplitude, and intensity parameters.

The analogous spectrograph is comprised of four main components:

1) A magnetic tape-recording device,
2) A tape scanner device with a drum that transfers the paper to only be labeled,
3) An electronic variable filter, and
4) An electronic pen that transmits the processed data to the paper

The analogue sound spectrograph captures levels of energy from a magnetic recorded conversation in a limited frequency range and records them on electronically sensitive paper.to the paper. The analogue sound spectrograph captures levels of energy from a magnetic recorded conversation in a limited frequency range and records them on electronically sensitive paper. After then, the equipment examines the next tiny range of frequencies and captures and notes the levels of energy at that instant. This technique is continued until the whole target resonant frequency for that segment of the recording has been examined.

The final output is a spectrogram, which is a visual representation of the patterns of auditory events in the form of bands or linear prediction during the time period studied. In around 80 seconds, the system will construct a spectrogram. The spectrogram is an X, Y plot with the X axis indicating the time dimension (about 2.4 seconds) and the Y axis indicating the range of frequencies (often 0 to 4000 or 8000 Hz). The comparative magnitude of the energy present at a given frequency and duration is shown by the degree of blackness of the lines.

III. THE VOICE IDENTIFICATION INTUITIVE METHOD:

The very first stage is to assess the unidentified voice recording, ensuring that there is enough voice to work with and also that the clarity of the audio is clear enough in the range of frequencies essential for analysis. The captured speech signal must have a loudness that is substantially greater than the ambient noise. The longer the sample of speech should be, the more concealing events, such as noises, music, and other speakers, there will be. Some auditors claim that they decline up to 60% of the cases they receive, with poor quality of the unidentified audio recording being among the most common reasons for rejection.

The most comprehensive auditory comparison is conducted once the examiner has found the portions to be used for the analysis. This evaluation has been expressed in a variety of approaches. Rerecording a speech sound sample of the unidentified accompanied by a rerecording of the identical voices sound of the suspected is one of the most widely utilized auditory comparison procedures [13].

A. Voice Stress Analysis

Voice stress analysis (VSA) and computer voice stress analysis (CVSA) are two pseudo - scientific techniques for inferring dishonesty from voice stress measurements. The CVSA utilizes a sensor to capture the person's voice, and the technique is premised on the idea that the non-verbal, low-frequency content of the speaker's voice communicates data about the speaker's psychophysiological condition.

IV. EMPIRICAL FINDINGS

It's debatable whether or not vocal stress analysis (VSA) can be used to identify deceit. Justifying the use of VSA have centered about whether the technique can accurately detect stress and, if so, whether this stress will be used to infer duplicity. Opponents argue that, even if tension could be consistently detected from the voice, it would be very similar to, say, assessing stress with a psychometric, and that all of the criticisms expressed against polygraph testing also applicable to VSA [14-16].

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A. Forensic Voice Analysis Software's

1) ACU Expert

a) SPEAKER VOICE IDENTIFICATION is a digital audio assessment that looks into the audio tapes for persons equitably.

b) Assessment OF AUTHENTICITY Verification of recorded media or investigation of interfering Authentication and confirmation of recording devices.

c) SPEECH NORMALIZATION and PRE-PROCESSING studies on the appropriateness of speech for authentication, speaker segregation, audio normalizing, and speech enhancement

d) TEXT DECODING provides the basis for recovering the contents of low-quality recorded conversations, such as through the evaluation of "black boxes," telephone, radio, and other evidence.

2) Tangible Benefits

a) Speaker formant analysis is one of the most in-depth and thorough analytic methods available (waveforms, spectrograms, LPC-spectrograms, and cepstrograms).

b) Speech analysis programs that are simple to use but extensive (energy, pitch, formants, user marks and notes overlay).

c) Flipping between modes and windows is instantaneous. Adjusting the frame shape and amount on the fly, as well as conducting spectrum normalization.

B. Sestek Forensic Voice Analysis

Sestek Forensic Vocal Analysis is a biometric identification software used for crime detection and enforcement agencies. It accurately analyses recorded evidence by using voice biometrics technologies that essentially makes with audio evidence simpler. It aids forensics researchers and government organizations in effectively performing voice remediation and speech recognition operations [17,18]. Forensic Voice Analysis aids in the criminal investigating and prosecuting of criminals by providing simple identification.

V. CONCLUSION

Voice determination is an application ofscience to resolve the problems in disputable cases, include identification of the doubtful speaker in the criminal investigation system. In present days speaker recognition systems became the preferred biostatistics authentication techniqueto establish an identity based on the analysis of the disputable voice and sample voice recording, it is carried out by experts. Sound is a fundamental requirement for voice production, initiated by a normal disturbance of air molecules generated by the movement of specific body organs such as the vocal cord, chest muscles, lips, teeth, tongue etc. A Voice signal is a multidimensional acoustic wave that provides information about the words or contents it being spoken, language spoken, speaker identity, physical and mental health condition, race, sex, age and background of an individual.

Expert systematically uses the typical procedure and techniques to analyze the voice. Voice stress analysis (VSA) and computer voice stress analysis (CVSA) are inclusively pseudo scientific techniques, measure voice stress and predict dishonesty. Some basic software used by experts for speaker voice identification are (1) ACU-EXPERT which is dedicated to comprehensive media file structure analysis and (2) Sestek Forensic Voice Analysis aid forensic experts and security agencies with complete voice treatment and speaker identification.

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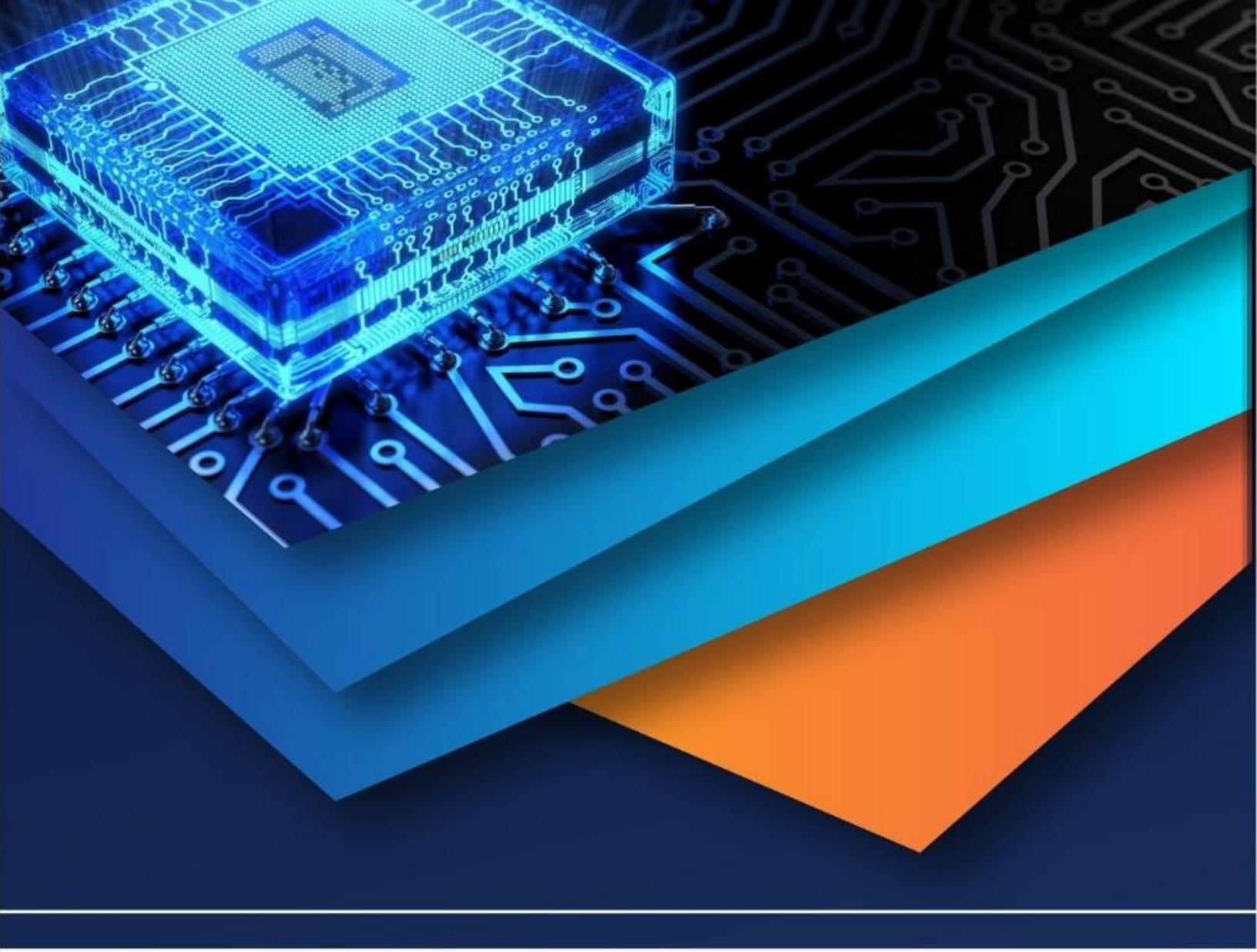
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