FORM 2

The Patent Act 1970

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The Patent Rules, 2005

COMPLETE SPECIFICATION

(SEE SECTION 10 AND RULE 13)

TITLE OF THE INVENTION

"Early Detection of Suicidal Tendencies through evaluation of Sevier Depression by Image and Video Analysis"

APPLICANTS:

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The following complete specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed: -

Field of the Invention

The present invention relates to the technical field of deep learning, more particular to an early detection of suicidal tendencies through evaluation of severe depression detection by image and video analysis.

Background of the Invention

The problem this invention addresses is the early detection of suicidal tendencies using visual data analysis through advanced computational techniques. This approach aims to overcome limitations of traditional methods like self-reporting questionnaires and clinical evaluations, as well as text-based analysis of social media posts.

Chen and colleagues (2021) developed a method for detecting suicide risk by analyzing social media images. They used advanced image processing to classify user-posted images as indicating high or low suicide risk. While innovative, this method was limited to publicly shared images and lacked real-time monitoring capabilities.

Smith and Johnson (2022) proposed combining textual and visual data from video interviews to assess suicide risk. They employed facial expression analysis and language processing to identify potential risk factors. However, their method required active participation in interviews and wasn't suitable for continuous monitoring.

Patel's team (2023) created a wearable device monitoring physical indicators like heart rate variability and sleep patterns to predict suicide risk. While providing continuous data, it didn't incorporate visual cues or environmental context.

Xinru Kong e. al. (2022), disclosed a method for automatic identification of depression using facial images with deep convolutional neural network

Michael Mesfin Tadesse et al.(2019) disclosed a method early detection of suicide ideation through deep learning and machine learning-based classification approaches applied to Reddit social media.

Patent no. WO2021104099A1, disclosed a multimodal depression detection method and system employing context awareness. The method comprises: constructing a training sample set comprising topic information, a spectrogram and corresponding text information; using a convolutional neural network in combination with multi-task learning to perform acoustic feature extraction on the spectrogram of the training sample set, and obtaining an acoustic

feature having context awareness; using a transformer model to process a word embedding on the basis the training sample set, and extracting a textual feature having context awareness; establishing, with respect to the acoustic feature having context awareness, an acoustic channel subsystem for depression detection; establishing, with respect to the textual feature having context awareness, a textual channel subsystem for depression detection; and fusing outputs of the acoustic channel subsystem and the textual channel subsystem to obtain depression classification information. The present invention can improve the accuracy of depression detection.

Patent no. US20170249437A1, discloses a method to detect the depression using a sensor, sensor data for a user and automatically detecting, using a processor, a marker for depression in the sensor data. Responsive to determining, using the processor, that a condition is satisfied based upon the marker for depression; a survey is presented using a device.

Our invention differs from these approaches in several key ways:

Comprehensive visual analysis: Unlike Chen et al.'s focus on social media images, our method analyzes a wider range of visual cues including facial expressions, body language, and environmental contexts in real-time.

Continuous monitoring: In contrast to Smith and Johnson's interview-based approach, our system provides ongoing analysis without requiring active participation from the individual.

Integration of environmental factors: While Patel et al.'s wearable device focused solely on physiological indicators, our method incorporates visual data from the individual's surroundings, offering a more holistic assessment of their mental state.

Real-time intervention potential: By utilizing advanced visual processing for real-time analysis, our approach enables more timely intervention compared to previous methods.

This invention represents a significant advancement in suicide ideation detection by offering a more comprehensive, continuous, and context-aware analysis of visual data. Its potential for early detection and intervention could significantly impact suicide prevention efforts.

Drawings

Fig.1 illustrates the process diagram

Fig.2 illustrates the product design

Detailed Description of the Invention

The following description includes the preferred best mode of one embodiment of the present invention. It will be clear from this description of the invention that the invention is not limited to these illustrated embodiments but that the invention also includes a variety of modifications and embodiments thereto. Therefore, the present description should be seen as illustrative and not limiting. While the invention is susceptible to various modifications and alternative constructions, it should be understood, that there is no intention to limit the invention to the specific form disclosed, but, on the contrary, the invention is to cover all modifications, alternative constructions, and equivalents falling within the spirit and scope of the invention as defined in the claims.

In any embodiment described herein, the open-ended terms "comprising," "comprises," and the like (which are synonymous with "including," "having" and "characterized by") may be replaced by the respective partially closed phrases "consisting essentially of," consists essentially of," and the like or the respective closed phrases "consisting of," "consists of, the like. As used herein, the singular forms "a", "an", and "the" designate both the singular and the plural, unless expressly stated to designate the singular only.

The present method aims to leverage advanced computer vision and deep learning techniques to analyse visual data, specifically images, for the detection of suicide ideation. The approach involves collecting and preprocessing a diverse dataset of images, followed by training, and deploying deep neural networks for automated analysis and risk assessment.

Data Collection and Preprocessing

Image data is collected from various sources, including publicly available datasets, online forums, and social media platforms, with proper consent and privacy measures in place. The collected images will encompass a wide range of scenarios, such as facial expressions, body language, and environmental contexts, to capture potential visual cues related to suicidal ideation. To check the standard and consistency of the dataset, several preprocessing steps will be performed. First, image normalization techniques, such as contrast adjustment and histogram equalization, will be applied to enhance the visual features and minimize variations in lighting conditions and image quality. Additionally, we have used data augmentation, scaling, flipping and rotation which increases the heterogeneity of dataset, improve the robustness and generalization capabilities of the trained models.

Deep Learning Techniques

The core of the proposed methodology involves leveraging advanced deep learning approaches (i.e. recurrent neural networks (RNNs) and convolutional neural networks (CNNs)), to analyse the pre-processed data. CNNs will be employed to extract and learn hierarchical visual features from the image data, enabling the identification of patterns and cues related to suicidal ideation. These models will be trained on a large dataset of labelled images, with the goal of accurately classifying individuals as either at risk or not at risk for suicidal ideation based on their visual cues. To capture temporal and contextual information from sequences of images, such as video frames or time-series data, RNNs, especially LSTM networks, will be utilized. These models can effectively learn and model temporal dependencies, allowing for the analysis of dynamic visual cues that may be indicative of suicidal ideation over time.

Novel Aspects

A key novel aspect of the proposed approach is the integration of multi-modal data analysis, combining both static image data and dynamic video or time-series data. By fusing the outputs of CNNs and RNNs, the methodology aims to leverage the complementary strengths of these deep learning architectures, enabling a more comprehensive and accurate assessment of suicidal ideation risk. Additionally, the methodology will explore the use of attention mechanisms and interpretable machine learning techniques to enhance the explainability and transparency of the trained models. This will not only improve system reliability and trustworthiness but also extract valuable insights from the visual cues and patterns that contribute to the detection of suicidal ideation. Furthermore, the proposed approach will investigate the incorporation of contextual information, such as demographic data, medical history, and environmental factors, to further refine the risk assessment process. This multi-faceted approach aims to provide a holistic and personalized evaluation of suicidal ideation risk, enabling more targeted and effective intervention strategies (see. Fig. 1).

The proposed method aims to leverage advanced computer vision and deep learning techniques to analyse visual data, specifically images, for the detection of suicide ideation. The approach involves collecting and preprocessing a diverse dataset of images, followed by training, and deploying deep neural networks for automated analysis and risk assessment.

- The proposed method's novelty lies in its integration of computer vision and deep learning techniques for the specific task of suicide ideation detection using image data. By leveraging hierarchical visual feature learning through CNNs and modeling

temporal dependencies with RNNs, the method aims to lay out a more extensive and accurate assessment of suicide ideation risk compared to existing approaches.

- The proposed method aims to leverage advanced computer vision and deep learning techniques to analyse visual data, specifically images, for the detection of suicide ideation. The approach involves collecting and preprocessing a diverse dataset of images, followed by training, and deploying deep neural networks for automated analysis and risk assessment.

- A key novel aspect of the proposed approach is the integration of multi-modal data analysis, combining both static image data and dynamic video or time-series data.

The key features and innovative aspects of this suicide ideation detection system include:

1. Image-based analysis: The invention uses advanced computational methods to examine visual information, specifically images, to identify signs of suicide risk. This marks a departure from conventional text-based or self-reported assessment techniques.

2. Multi-faceted visual assessment: The technology scrutinizes an array of visual clues, from facial expressions to body language and surroundings. This comprehensive approach yields a fuller understanding of a person's mental state.

3. Swift data processing: By employing sophisticated algorithms and visual recognition techniques, the system can analyze information quickly, allowing for timely detection and response.

4. Unobtrusive ongoing evaluation: In contrast to traditional methods requiring active participation, this system can perform continuous assessment without directly engaging the individual.

5. Consideration of environmental context: By factoring in surroundings, the analysis provides a more detailed picture of a person's circumstances, an aspect often neglected in other approaches.

6. Addressing self-reporting shortcomings: The focus on visual indicators helps overcome the inherent flaws in self-reported data, which can be skewed or incomplete due to reluctance in expressing suicidal thoughts.

7. Recognition of non-verbal signs: The system is particularly adept at spotting non-verbal indicators that might suggest suicidal tendencies, often missed by text-focused analysis methods.

8. Enhanced early identification: The ongoing and thorough nature of the analysis improves the chances of detecting suicidal tendencies in their early stages.

9. Reduced subjective influence: By leveraging advanced computational techniques, the invention may minimize the subjective biases often present in traditional clinical assessments.

10. Versatile application: The automated nature of the system indicates it could be deployed in various settings, potentially expanding access to suicide risk evaluation.

These elements converge to form a cutting-edge approach to suicide ideation detection, addressing numerous limitations of current methods while offering the potential for more prompt and effective interventions.

The present invention offers several key advantages and technical breakthroughs:

- Instant Visual Processing: Our system swiftly examines visual information, enabling quick identification and response to potential risks.

- Uninterrupted Observation: This method allows for constant assessment without requiring active involvement from the individual being monitored.

- Thorough Visual Evaluation: The technology considers a broad spectrum of visual indicators, from facial cues to body movement and surroundings, offering a comprehensive view.

- Bypassing Self-Disclosure Issues: By focusing on visual cues, we overcome the limitations of self-reporting, which can be unreliable due to individuals' hesitancy to express their thoughts.

- Recognizing Unspoken Signals: Our approach is particularly adept at spotting non-verbal signs of distress that text-based methods might overlook.

- Enhanced Precision: Utilizing rich visual data potentially leads to more precise evaluations of a person's psychological state.

- Proactive Identification: The ongoing and thorough nature of our analysis improves the chances of identifying suicidal tendencies early.

- Swift Support: Quicker detection allows for more rapid intervention and assistance for those at risk.

- Reduced Bias: Employing advanced computational techniques may help minimize the subjective biases often present in traditional evaluations.

- Broad Reach: Our automated approach can efficiently monitor larger groups compared to conventional methods.

- Contextual Awareness: Including environmental factors in the analysis provides a more rounded understanding of an individual's circumstances.

- Tailored Interventions: Detailed visual analysis could inform more personalized and effective intervention strategies.

- Resource Efficiency: Once operational, the system could reduce the need for constant human oversight, potentially leading to long-term cost reductions.

- Widespread Applicability: The technology could be implemented across various settings, expanding access to risk assessment.

- Empirical Insights: Analyzing visual data may unveil new understandings about suicidal behavior and risk factors.

- Synergistic Potential: This method could complement existing monitoring systems for more comprehensive suicide prevention.

- Data Protection Possibilities: Depending on its implementation, the system could assess risk while minimizing the storage of sensitive information.

- Continuous Improvement: The underlying algorithms can be refined over time, potentially enhancing the system's effectiveness as more data becomes available.

The present method addresses the critical need for early detection of suicidal tendencies, enabling timely intervention and support for at-risk individuals. By analyzing visual cues, including facial expressions, body language, and environmental contexts, the method can potentially identify individuals at risk who may not express their suicidal thoughts explicitly through self-reporting or written communication.

While existing methods have explored suicide ideation detection through textual data analysis or limited visual cue analysis, the proposed method's combination of techniques, including unsupervised label correction, multi-modal data analysis (static and dynamic visual cues),

and the incorporation of contextual information, is not obvious based on prior art. The specific implementation and integration of these techniques for the suicide ideation detection task using image data represent a non-trivial advancement over existing methods.

We Claim

1. A method for early detection suicide tendencies, comprising:

A. Data collection module:

- Image data is collected from various sources, including publicly available datasets, online forums, and social media platforms, with proper consent and privacy measures in place; and
- Collected images encompass a wide range of scenarios, such as facial expressions, body language, and environmental contexts, to capture potential visual cues related to suicidal ideation;

B. Data pre-processing dataset:

- First, image normalization techniques, such as contrast adjustment and histogram equalization, applied to enhance the visual features and minimize variations in lighting conditions and image quality; and
- Data augmentation, scaling, flipping and rotation which increases the heterogeneity of dataset, improve the robustness and generalization capabilities of the trained models.

C. **Machine learning model:**

Leveraging advanced deep learning approaches (i.e. recurrent neural networks (RNNs) and convolutional neural networks (CNNs)), to analyse the pre-processed data; CNNs will be employed to extract and learn hierarchical visual features from the image data, enabling the identification of patterns and cues related to suicidal ideation and RNNs, especially LSTM networks utilised to capture temporal and contextual information from sequences of images, such as video frames or time-series data. These models can effectively learn and model temporal dependencies, allowing for the analysis of dynamic visual cues that may be indicative of suicidal ideation over time.

Wherein method includes both static image data and dynamic video or time-series data.

2. The method for early detection suicide tendencies as claimed in the claim 1, wherein method further use of attention mechanisms and interpretable machine learning techniques to enhance the explainability and transparency of the trained models.

3. The method for early detection suicide tendencies as claimed in the claim 1, wherein method investigates the incorporation of contextual information, such as demographic data, medical history, and environmental factors, to further refine the risk assessment process.

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