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Current Trends in Micro-Expression Recognition

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Abstract

The detection and recognition of micro-expressions have garnered significant attention in the field of computer vision, with applications ranging from localization to feature extraction and identification. These micro-expressions are brief, involuntary facial movements lasting only fractions of a second (typically between 0.05 to 0.2 seconds). Their rapid and subtle nature poses a considerable challenge for both human and machine analysis. Micro-expressions, often unconsciously displayed, provide an accurate glimpse into a person's subjective emotions. This paper offers a comprehensive overview of the current state of micro-expression recognition, delving into the techniques, learning methods, potential enhancements to existing approaches, available datasets, outstanding challenges, and prospective directions for future development.

Keywords: Micro-expression, recognition, facial expression, emotion, information.

INTRODUCTION

Micro-expression recognition is capability to understand and interpret subtle cues that people give off through their facial expressions. This includes both the conscious and unconscious signals that people send with their faces. There are a few things to keep in mind when trying to read micro-expressions. First, it is important to remember that not all facial expressions are conscious. People may not be aware that they are giving off certain cues. Second, it is important to be aware of the context in which the facial expression is occurring. A cue that might be interpreted as anger in one context could be interpreted as fear in another. Finally, it is important to remember that there is always some degree of interpretation involved in micro-expression recognition. This is because people

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are often not aware of the signals they are sending with their faces. As such, it isimportant to take into account the other cues that a person is giving off before making any conclusions.

Micro-expression recognition is the ability to identify emotions by analyzing facial expressions. This area of study is relatively new and continually changing as emerging technologies continue to develop. Micro expressions are a universal language that can reveal a wealth of information about a person‘s internal state. They can convey emotions such as anger, happiness, fear, sadness, and surprise. Micro-expression recognition algorithms are designed to automatically detect and interpret these emotions. They typically analyze a person‘s facial features like position of the eyebrows, the width of the eyes, and the shape of the mouth.

Review of Literature

According to Ruicong Zhi, Jing Hu and Fei Wan (2022),[1] Involuntary facial muscle movements called micro-expressions reveal a person's underlying feelings. Finding practical ways to recognise microexpressions is difficult because of how delicately and frequently the muscles in the face change. The main goal of their study is to present a framework for micro-expression recognition with supervised contrastive learning (MER-Supcon), which aims to identify key micro-expression characteristics and reduce noise from orthogonal face movements. In order to increase datasets and lessen the negative effects of micro-expression spotting, a wholly original dual-terminal micro-expression acquisition approach is first presented and implemented to get optical flow maps. To determine the most important example of microexpressions for classification, supervised contrastive learning is then introduced.

Jinsheng Wei, Guanming Lu and Jingjie Yan (2021)[2] conducted a comparative study . In line with this study, people's true feelings are visible in their microexpressions. Microexpressions are subtle movements with such a brief period, making them challenging to identify. Numerous useful features and techniques have been suggested as the study of micro-expression recognition progresses. Their paper chooses eighteen directions as well as suggests a new low-dimensional feature called the Histogram of Single Direction Gradient (HSDG) to investigate the said subject. The goal of their study was to identify which direction of movement feature is easier for differentiating micro- expressions. The study examines which direction of movement characteristic is most exclusionary in recognizing microexpressions by concatenating HSDG in all directions with LBP-TOP to create the LBP with Single Direction Gradient (LBP-SDG).Euler Video Magnification (EVM) serves as a preliminary phase. The studies conducted on the CASME II and

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SMIC-HS databases present the best and most useful directions, showing the HSDG within ideal direction is discriminative.

According to study conducted by **Radhouane Guermazi, Taoufik Ben Abdallah and Mohamed Hammami (2021)**,[3] microexpressions is extremely fleeting, spontaneous visual movements that humans make while we unknowingly hide feelings. Researchers out of a variety of fields, including computer science, security, and psychology, have become increasingly interested on developing the method permitting the autonomous detection of the facial micro-expressions from video sequences. Using the accordion spatiotemporal representation and Random Forests, the research proposed a method for the recognition of facial microexpressions.The most distinguishing characteristics were chosen using Random Forests, as well as a novel proximity metric was employed to lessen the categorization uncertainty of related microexpressions. The writer's major goal aimed to show that using fewer features can result in a powerful micro-expression recognition classifier that beats methods which depend on a large feature space. Including a prediction performance which can approach 81.38% on the Casme II dataset, the experimental findings from six micro-expression datasets demonstrate the efficiency of the suggested strategy. The potential alternative demonstrated its effectiveness in comparison to several well-known, rival approaches by virtue of both its accuracy rate and the quantity of features it employs.

Jinsheng Wei, Guanming Lu, Jingjie Yan and Yuan Zong (2022)[4] opined that while micro-expressions contain limited movement & brief length, recognising them like a subfield of affective computing and machine learning is more challenging then recognising them in macro-expressions. Feature extraction would be an important area of study because there are so many properties as well as techniques that are suggested. Feature fusion, a technique which combines multiple sets of characteristics to boost efficiency, particularly useful because the various sets of attributes typically vary on terms in making specific, dispersion, and dimension. Additionally, the retrieved features frequently contain unnecessary or incorrect feature information. The approach which can learn from data and choose discriminative features from several sets of different features is thus required prior feature fusion.Using 2 sets input features, a kernelized two-groups sparse learning (KTGSL) model is suggested throughout this research to autonomously train additional discriminative features. The research marks the first to choose discriminative characteristics for micro-expression identification from two categories of features. Three datasets are used in the studies (CASME II, SMIC and SAMM).

According to the study conducted by **Chongyang Wang, Min Peng,Tao Bi and Tong Chen (2020)**,[5] Micro-expression is now a viable medium for

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emotional computation due to its great accuracy with emotion recognition. Deep learning techniques have recently been effectively used in the field of micro-expression recognition. Despite the improved recognition accuracy, there are still significant obstacles in micro-expression recognition. The availability of small-local microexpressions on the face as well as the complexity of said datasets may restrict overall identification precision of such emotional facial activity. Throughout the study, an unique learning algorithm dubbed micro-attention working alongside recurrent neural network to address these problems is suggested. This network can adapt to concentrate on face regions of significance that cover various action units thanks to micro-attention.Additionally, to deal with tiny samples, the micro-attention is created but without addition of observable variables, and the overfitting risk is reduced by combining this using straightforward but effective transfer learning strategy. Researchers illustrate that efficacy of such suggested micro-attention and push the envelope of automated detection of micro-expression by thorough experiments performed on 3 datasets (CASMEII, SAMM, and SMIC).

Ling Zhou, Xiuyan Shao, and Qirong Mao (2021) [6] highlighted a persistent issue related to the recognition of micro-expressions, characterized by their subtle and rapid motion changes. This issue poses a distinct challenge not only for expression recognition systems but also for human observers. Micro-expressions have received relatively less attention in research compared to macro-expressions. Nevertheless, the recognition of micro-expressions (MER) is crucial for fully harnessing the potential of expression recognition in practical applications.

In their paper, the authors conducted a comprehensive survey of MER, addressing the inherent challenges involved. They began by introducing commonly used datasets in the field, shedding light on the scarcity of training data and its impact on overfitting. They also discussed the issue of imbalanced sample distributions and the importance of robust features to enhance recognition accuracy within recent MER systems.

Furthermore, the authors categorized current cutting-edge algorithms into six distinct tasks based on class types and research protocols. They provided detailed insights into experiment setups and the competitive performance of these algorithms across these tasks. In conclusion, the authors outlined the remaining challenges and the associated opportunities within the field of MER, along with prospective directions for the development of robust MER systems.

Hang Pan, Lun Xie(2021) [7] asserted that facial micro-expressions are brief and subtle facial displays that involuntarily expose an individual's genuine emotions, which they may be trying to suppress, conceal, or mask. These

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micro-expressions serve as authentic indicators of a person's inner feelings and hold significant potential for applications in areas such as public safety and clinical diagnosis. Analyzing facial micro-expressions within video sequences using computer vision techniques is a relatively emerging field. In this study, they conducted an all-encompassing examination of the recognition and identification of micro-expressions, delving into the databases and methodologies employed in this domain. They also provided an overview of advanced technologies in this field. Furthermore, the paper addresses persisting challenges in micro-expression analysis and outlines the forthcoming research that needs to be undertaken in this field.

Nikhil Singh and Rajiv Kapoor (2022) [8] stated that AI platforms like roboticsystems must be able to recognise emotions via face movements in order to communicate with people. Furthermore, as in reality, it is much more challenging to discern between face micro-expressions (FMEs) as it is to identify facial general-expressions containing nuanced expressions. It is a type of facial expression that is brief, of small size, and typically local in movement. However, getting ME data is difficult due to these characteristics of MEs (micro-expressions), which is a limitation when utilising deep learning algorithms to identify FMEs. These FMEs can also be encoded by the facial action coding system (FACS), indicating that there is some connection between action units (AU) and FMEs.

Current trends in Micro-expression Recognition

Micro-expression recognition technology is being used in a variety of applications, including security, marketing, and healthcare. For example, it can be used to detect emotions in security footage, to understand customer sentiment in real-time, or to screen patients for depression and anxiety. In recent years, there has been a consistent enhancement in the precision of algorithms for recognizing micro-expressions, yet numerous unresolved challenges persist. For instance, the algorithms often struggle to identify facial expressions in low-lightconditions or when a person‘s face is partially obscured.

Micro-expression training tools are designed to help people learn to read and understand micro-expressions. They are often very subtle and can be easily missed if you're not looking for them. Micro-expression training tools can be helpful for people who want to learn to read micro-expressions for a variety of reasons. For example, law enforcement officers and security professionals can use micro-expression training to help them spot when someone is lying or under duress. Counselors and therapists can use micro-expression training to better understand their clients' emotions. And, salespeople can use micro-expression training to better understand their customers' needs and wants. There

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are a number of different micro-expression training tools available. Some are more expensive than others, but all of them can be effective if used correctly. One micro-expression training tool that is gaining popularity is the Micro Expression Training Tool (METT). The METT is a software program that uses facial recognition technology to help you learn to read micro-expressions. The program shows you a series of faces and asks you to identify the emotions that the person is feeling. As you progress, the program becomes more difficult, showing you faces that are more subtle and harder to read. The METT is just one example of a micro-expression training tool. There are many others available, both online and offline. If you're interested in learning to read micro- expressions, there's sure to be a training tool that's right for you.

Micro-expressions were first studied by psychologists in the 1970s, but it was not until the early 2000s that they began to receive widespread attention. This is primarily attributed to advancements in high-speed camera technology and facial recognition software, enabling more precise capture and analysis of micro-expressions. Today, micro-expressions are being used in a variety of fields, including law enforcement, medicine, and business. For example, police officers and security personnel are using micro-expression training to improve their ability to detect deception. Doctors are using micro-expressions to better understand their patients‘ pain levels, and businesses are using them to train employees to read customers‘ emotions.

Micro-expression theory posits that there are telltale signs of concealed emotions that can be read in a person‘s face. The theory has its roots in research by American psychologist Paul Ekman, who conducted pioneering studies on facial expressions in the 1960s.

Ekman‘s work showed that emotions are universally expressed in the same way across cultures, and that even very brief expressions can be read with accuracy. He also found that people are often unaware of their own micro-expressions, which occur when an emotion is briefly displayed before being quickly hidden. Ekman‘s research has been influential in the development of lie detection techniques, as well as in the fields of psychology and criminology. It has also been used in popular culture, most notably in the 2009 film The Hurt Locker, in which a character uses micro-expression theory to detect when a bomb disposal expert is lying about his feelings of fear. While micro-expression theory has been extensively studied and has been found to be reliable, there are some limitations to its accuracy. For example, research has shown that people from different cultures may interpret micro-expressions differently. Additionally, some expressions may be difficult to read, particularly if they are very brief or occur in rapid succession. Overall, micro-expression theory provides a valuable tool for understanding the hidden emotions of others. It is

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important to remember, however, that interpretation of micro-expressions is not always accurate, and should be used in conjunction with other information whentrying to understand someone‘s true feelings.

Micro-expressions occur for a variety of reasons. They may be caused by strong emotions, such as fear, anger, or happiness. They can also be the result ofa person trying to suppress an emotion. Micro-expressions are universal and canbe found in all cultures. They are different from facial expressions, which are deliberate and controlled. However, they can give clues about a person's inner emotions. There are seven universal micro-expressions: anger, fear, disgust, happiness, sadness, surprise, and contempt. Each micro-expression corresponds to a specific emotion. Micro-expressions can be helpful in many situations. For example, law enforcement officers can use them to gauge whether a suspect is telling the truth. Counsellors can use them to understand a client's hidden emotions. And, lie detectors can use them to detect when someone is lying. Micro-expressions are a valuable tool for anyone who wants to understand the hidden emotions of others.

Micro-expression tools have been shown to be successful in a number of studies. The most famous of these is the Facial Action Coding System (FACS), which has been used in a number of research studies to show that micro-expressions can be detected and interpreted with a high degree of accuracy. Other micro-expression tools, such as the Emotion Recognition Toolbox, have also been shown to be successful in a number of studies.

Conclusion

The difficulty in identifying micro-expressions is exacerbated by their quick and subtle changes, and the task is made more difficult by the small and unbalanced dataset. In this study, we present a current overview of the literature on micro-expression identification, identify the difficulties, and discuss methodological concerns of importance to researchers on automated micro-expression analysis. In the beginning, typical issues with microexpression recognition procedures are identified and pertinent remedies are linked to them. Numerous low level strategies have been put forth for feature extraction, however the outcomes have not proven sufficient. The traits and restrictions of publically accessible micro-expression datasets are emphasised, and common performance methodologies for evaluation are defined. Additionally, various ways to get around problems were offered along with a clearer picture of performance comparison.

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