(Can't) Lie to ME: Using Micro Expressions for User Authentication

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ABSTRACT

In this position paper, we propose a new mechanism for user authentication using micro expression analysis in addition to face recognition. In our approach, micro expression analysis is used as a supplementary module to face recognition and is used to introduce a live element to the recognition / authentication process.

1. INTRODUCTION

Face Recognition Systems (FRS) automate what, at times, humans do best — recognize others based on facial features [1]. Face recognition, thus, has been a very popular biometric tool in law enforcement, as well as, more recently, in authentication [3]. FRS algorithms can either be geometric, involving identifying characteristic features of a face (e.g. distance between eyes, size of nose, etc.), or photometric, which is a statistical approach relying on comparison of values of the image with templates [1]. However, several researchers have explored the consequences of employing face recognition and the accuracy of systems depending on it. Some of the key challenges in face recognition include false positives as well as the ability to be able to "fake" identity by using still pictures [3].

On a different note, our daily interactions with people or situations are defined by our expressions, predominantly facial. Our expressions are determined by our internal learning process, which would have evolved uniquely for each individual, thereby contributing to unique expressions for varying situations. For example, if an emotion of surprise is elicited, the person's reaction could be surprise with a hint of anger or surprise with a hint of a smile. The response to stimulus, thus, is unique per individual, at times including a combination of subtle expressions. A limiting factor to emotion elicitation is that not all individuals are expressive about their emotions, and are often able to hide some of the key expressions at will. However, this will not prevent them from exhibiting some minimal expression that denotes a person's emotion at that instant of time. This is referred to as a micro expression, which typically lasts for a fraction of a second and can uniquely represent a person's emotion [4].

Thus, if emotions of a person were to be added as an additional dimension to face recognition, we are left with a unique set of attributes moving in a specific manner when subjected to a specific stimulus, such as displaying a picture. Our work focuses on employing micro expression analysis as a supplementary module to face recognition, as a means to achieve user authentication, because face recognition by itself can be "fooled" by similar faces and still faces (pictures).

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2. PROPOSED APPROACH

The preliminary model we have considered for this research is illustrated in Figure 1. Essential components of such a system would include emotion elicitation, micro expression capture and validation, to authenticate a user. Thus, the micro expression authentication (*μe-auth*) module serves as a means to ascertain the identity of a person.

The aspects central to our work are emotion elicitation and micro expression analysis.

Existing work has focused on identifying actions by facial muscles [8] in general and on detecting micro expressions [7] in particular. Our objective is to use existing work in a manner that suits employing micro expression assessment as an authentication metric.

Some current applications have also used contemporary smartphones to record video frames, and apply feature extraction and micro expression identification on a remote server [5]. Improvements in smartphone technology will potentially support moving much of the computation necessary for such feature identification to the smartphone itself, thereby enabling us to envision micro expression analysis as a potential user authentication mechanism.

Identifying someone's emotions and expressions is contingent on first eliciting these emotions. In an age where privacy and security are at the heart of every discussion, the use of personal artifacts (i.e. videos, images, text) might not be appropriate if employed in the presence of others. However, such personal artifacts are possibly some of the best candidates. Experiments would need to be carefully planned to evaluate the best emotion eliciting techniques for micro expression analysis, without requiring any special apparatus. Stimulus sets, such as the International Affective Picture System (IAPS) [6], have been used as means to elicit a wide range of emotions in behavioral studies.

Our approach is to consider the best practices in behavioral research as well as use techniques that employ the user's personal data for eliciting emotions for capturing micro expressions and authentication. Our work assumes that most people refrain from being expressive about their emotions in public or in their work places. This is an opportunity to elicit micro expressions, which will aid in authentication. Cohn et al. [2] found that facial expressions are sufficient to differentiate between individuals and that this factor "could be used in person identification." Though their work involved a variety of emotion eliciting techniques as

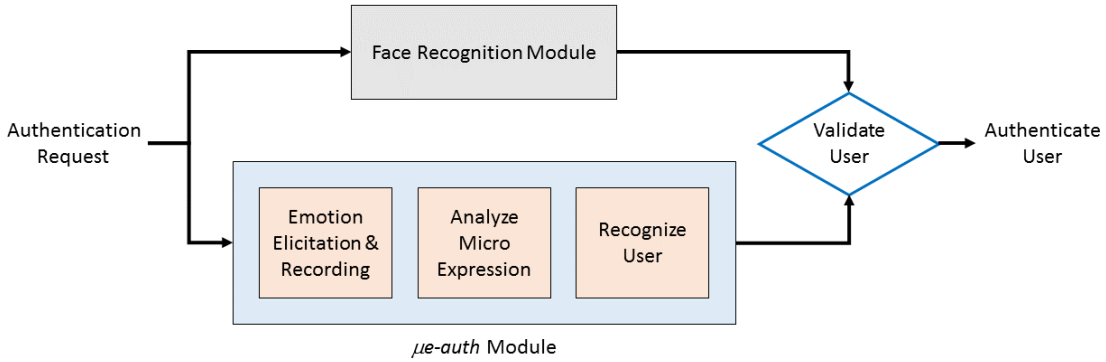

Figure 1. Preliminary model for user authentication using micro expressions.

well as self-reporting, for authentication we would need to narrow our focus on stimuli such as still images and textual content.

3. DISCUSSION

We believe that the biggest challenge in using micro expressions for authentication is user acclimatization to stimuli, resulting in habituation. Participants in our experiments could get used to the images or textual content being shown to them, since they are expected to show some emotion for authentication. We plan to include techniques, such as using large data sets that are frequently updated, or using emotion elicitation / micro expression analysis alternating with another authentication technique, to avoid such cases. Our experimental design must, therefore, include means to avoid effects of such habituation, and must take into account the fact that people could fake emotions, since they would be aware of the working of the authentication technique.

4. CONCLUDING REMARKS

Face recognition, along with a live element, may be a viable technique for non-intrusive authentication. Our approach introduces a live element by eliciting emotions and capturing the micro expressions for authenticating a person.

In this workshop, we would like to discuss the potential of the proposed approach and get feedback about its viability. We would also like to discuss how to best design appropriate user studies to validate the proposed approach for user authentication.

5. REFERENCES

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