Beware, poker face: Automatic system spots micro-expressions

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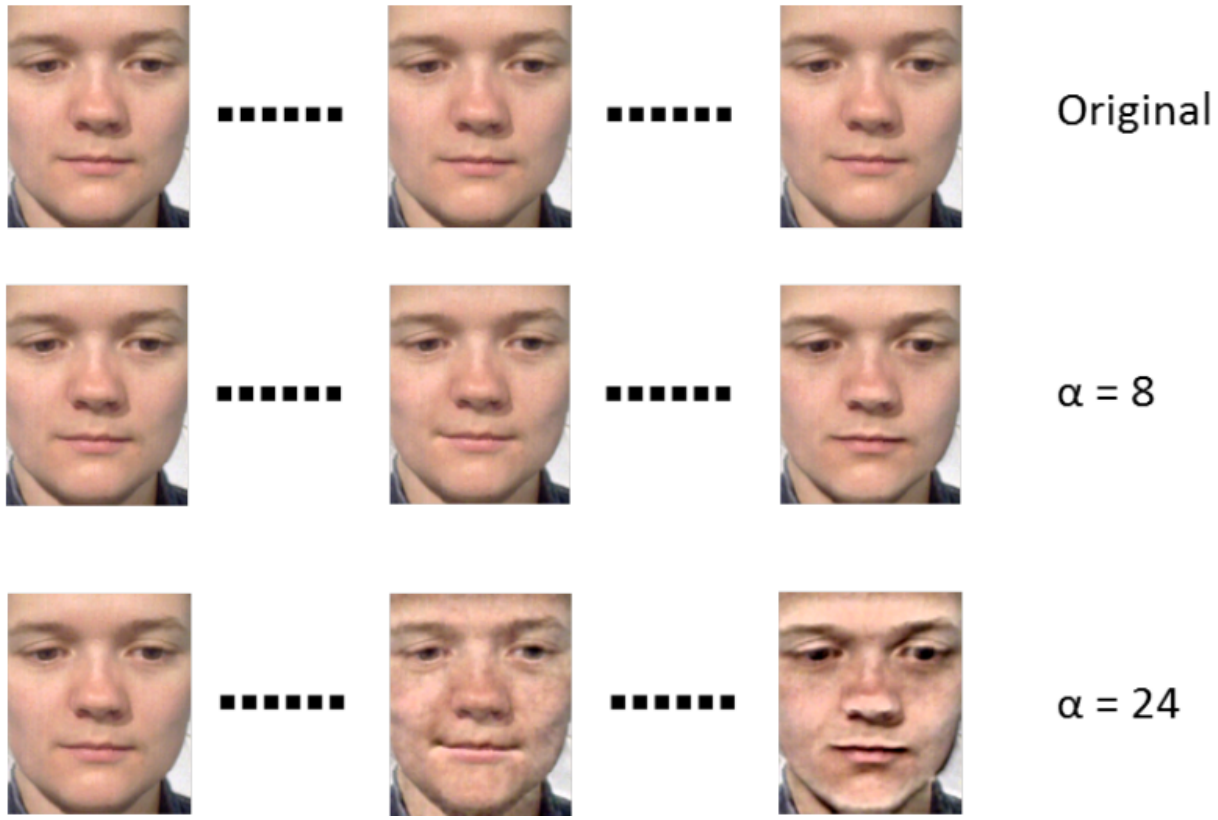

A ME clip magnified at different α levels. Credit: arXiv:1511.00423 [cs.CV]

Humans have a tough enough time figuring out one another. We actually use two languages to communicate, through words and through facial expressions and sometimes they don't match.

What is tough is knowing what the other person is really feeling when such a mismatch takes place. ("I'm fine, don't bother. Just a little ache. I'm sure it will go away.")

Now that we have made advances in machine learning and AI, how are software engineers doing in coming up with programs that can look at a face and tell what the person is feeling?

There was recent news about Microsoft's solution for rating someone's face based on eight different emotion metrics.

In quick tests from *Hot Hardware*, they said they found the detection to be "very accurate," while *CBC News* reported that while "Some of the images we tested pulled a pretty accurate reading," they said others were "way off."

(A useful note here taken from *MIT Technology Review* is that "rapid developments in artificial intelligence in recent years have come about partly because of improved methods of computing. But these machines are useless without vast and accurate databases to train them.")

Now, a big step up in emotion-detection software deals with yet another language—the facial expression that is really a "micro-expression," real feelings that appear and disappear in the blink of an eye ("Oh, thank you, Auntie. A scented candle! How thoughtful." [Where am I going to put this crap. This is the third scented candle I have got and I don't like any of them.])

MIT Technology Review reports that scientists at the University of Oulu in Finland have both built and tested "the first machine vision system capable of spotting and recognizing micro-expressions and they say that it is already better than humans at the task."

The researchers have posted their paper on arXiv. "Reading Hidden Emotions: Spontaneous Micro-expression Spotting and Recognition" is by seven authors from the University of Oulu in Finland (X. Li, X. Hong, A. Moilanen, X. Huang, G. Zhao and M. Pietikainen) and from (T. Pfister) University of Oxford in the UK. The research was supported by the Academy of Finland, Tekes and Infotech Oulu.

How the authors defined micro-expression: "An ME is a very brief, involuntary FE which shows the emotion that people try to conceal. In contrast to ordinary FEs, MEs are very short (1/3 to 1/25 second), the precise length definition varies, and the intensities of involved muscle movements are subtle."

How they worked: Li and team created a database of videos showing micro-expressions in realistic conditions; this was not trivial because posed expressions don't cover the real-life scenario when the person is trying to hide an emotion at high stakes. As the authors stated, "In this work we focused on the study of spontaneous MEs, which are much more difficult to analyze than posed expressions explored in previous work. We proposed novel methods for both ME spotting and ME recognition."

They asked 20 individuals to watch a series of videos designed to invoke strong emotions. They were given a strong incentive to avoid showing emotion: they were told that that they would have to fill in a long, boring questionnaire explaining any emotions they did display.

Also, the team recorded on a high-speed camera at 100 frames per second. The team linked the emotions on display to the emotional content of the videos, said *MIT Technology Review*. This gave them a database with which to train their machine-learning algorithm.

The team used "a single frame showing the subject's face as a standard

and comparing all subsequent frames against it to determine how the expression changed. Any change beyond a certain threshold was defined as a micro-expression, and these images set aside for further analysis," said the *MIT Technology Review* report.

Results? They make for interesting reading, said *MIT Technology Review*. "Li and co's machine matched human ability to spot and recognize microexpressions and significantly outperformed humans at the recognition task alone."

Of what practical value is their research? The authors wrote that "This method has many high-impact applications, particularly in lie detection, law enforcement and psychotherapy."

More information: Reading Hidden Emotions: Spontaneous Micro-expression Spotting and Recognition, arXiv:1511.00423 [cs.CV] arxiv.org/abs/1511.00423

Abstract
Micro-expressions (MEs) are rapid, involuntary facial expressions which reveal emotions that people do not intend to show. Studying MEs is valuable as recognizing them has many important applications, particularly in forensic science and psychotherapy. However, analyzing spontaneous MEs is very challenging due to their short duration and low intensity. Automatic ME analysis includes two tasks: ME spotting and ME recognition.For ME spotting, previous studies have focused on posed rather than spontaneous videos. For ME recognition, the performance of previous studies is low. To address these challenges, we make the following contributions: (i) We propose the first method for spotting spontaneous MEs in long videos (by exploiting feature difference contrast). This method is training free and works on arbitrary unseen videos. (ii) We present an advanced ME recognition framework, which outperforms previous work by a large margin on two challenging

spontaneous ME databases (SMIC and CASMEII). (iii) We propose the first automatic ME analysis system (MESR), which can spot and recognize MEs from spontaneous video data. Finally, we show that our method achieves comparable performance to humans at this very challenging task, and outperforms humans in the ME recognition task by a large margin.

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