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Microexpressions: A Chance for Computers to Beat Humans at Detecting Hidden Emotions?

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Johnny English, the British MI7 spy portrayed on film by Rowan Atkinson, has already experienced the treacherous nature of microexpression (ME) analysis: in *Johnny English Reborn*, one movie in the blockbuster series, a high-frame-rate moving image of the spy's face, significantly slowed down, reveals his genuine feelings, otherwise professionally hidden. But in our world, where are such computers that automatically and reliably retrieve and interpret facial expressions?

In the recent Finish–British contribution "Towards Reading Hidden Emotions: A Comparative Study of Spontaneous Micro-Expression Spotting and Recognition Methods" (*IEEE Transactions on Affective Computing*, vol. 9, no. 4, 2018, pp. 563–577), Xiaobai Li, Xiaopeng Hong, Antti Moilanen, Xiaohua Huang, Tomas Pfister, Guoying Zhao, and Matti Pietikäinen discuss automatic computational analysis of "rapid, involuntary facial expressions which reveal emotions that people do not intend to show."

According to the authors, automatic ME analysis has so far been attempted on posed videos only, and reported ME recognition performance is low. As a step forward in this promising discipline, the authors introduce spotting of spontaneous MEs even in arbitrary long video recordings without the need of training. As to recognition, their suggested framework surpasses previous efforts significantly on two demanding standard spontaneous ME databases. In additional tests, their techniques for automatic ME recognition significantly outperform humans at ME recognition and match human skills in combined ME spotting and recognition.

In the authors' framework, the ability to spot MEs relies on appearance-based feature descriptors. The two inner eye corners and a nasal spine point are located first and then tracked by the Kanade–Lucas–Tomasi algorithm. The points also serve for in-plane rotation and face-size normalization, but 3D head rotation is ignored. The points further serve to fix a 6×6 grid. Calculations are made of local binary pattern (LBP) histograms and, alternatively, histograms of optical flow per block. ME spotting is based on analyses of differences between the features of a current frame and the average facial features over a time window with thresholding and peak detection. Once MEs are spotted, features extracted are fed into linear-support vector machines for subject-independent classification into positive, negative, or surprised MEs. The authors compare LPB-type histograms of oriented gradients with those of image-gradient orientation features based on near-infrared and RGB-color images. They also compare the effects of different temporal interpolation and motion magnification to counter the low intensity of ME methods after face alignment. In their final system, they recommend LBP features for spotting. For recognition, they recommend four and 10 as parameters for magnification and temporal interpolation and HIGO-type features.

The task of analyzing spontaneous MEs is challenging as they tend to be brief and low in intensity. Nonetheless, computer systems should be able to match or surpass the human ability to read and interpret facial expressions. Thus, many expected applications for automatic ME recognition and analysis will soon appear in many fields, including forensics and psychotherapy. However, further efforts are needed to ensure that technologies for spotting MEs are not easily fooled by, for example, literal blinks of an eye. Also, advances are needed to make such technologies practical and reliable in real-world settings. Advances in deep learning may be useful in helping to achieve these goals sooner rather than later.

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