A View from **Emerging Technology from the arXiv**

Machine Vision Algorithm Learns to Recognize Hidden Facial Expressions

Microexpressions reveal your deepest emotions, even when you are trying to hide them. Now a machine vision algorithm has learned to spot them, with wide-ranging applications from law enforcement to psychological analysis.

November 13, 2015

Most people are good at recognizing the ordinary emotions on other people's faces. But there are another set of facial expression that most people are almost entirely unaware of. In the late 1960s, psychologists discovered that when humans try to hide their emotions, they often display their real feelings in "microexpressions" that appear and disappear in the blink of an eye.

These fleeting facial expressions have fascinated psychologists and the general public ever since. It turns out that while most people are entirely oblivious to microexpressions, a tiny subset of individuals can spot them accurately and use them to tell when people are hiding their true feelings or when they are downright lying.

A significant industry has grown up that focuses on training people to be better at recognizing microexpressions. Law enforcement officials and anti-terrorist agents are often trained in this way in the hope that it can help them spot individuals who are up to no good. Whether this training works is the subject of much debate—it may be that most people do not have the sensory and cognitive skills to catch microexpressions, regardless of the training they receive.

But there is another way to spot microexpressions. In recent years, machine vision has improved at a rate so rapid that it has surprised even experts in the field. Today, machines equipped with the best artificial intelligence algorithms can routinely outperformed humans at object recognition and facial recognition, and have begun to match them in recognizing expressions and the emotional charge they carry.

That raises an interesting prospect. Could machines soon become better

at recognizing microexpressions than humans? Today we get an answer thanks to the work of Xiaobai Li at the University of Oulu in Finland and few pals. These guys have built and tested the first machine vision system capable of spotting and recognizing microexpressions and they say that it is already better than humans at the task.

The 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.

So the first task for Li and co was to create a database of videos showing microexpressions in realistic conditions. This is easier said than done. Microexpressions tend to occur when individuals hide their feelings under conditions of relatively high stakes.

That's not easy to reproduce. Indeed, much previous work has focused on posed expressions, but various psychologists have pointed out the limitations of this method, not least of which is that microexpressions look significantly different to posed expressions.

Li and co tackled this problem by asking a group of 20 individuals to watch a series of videos designed to invoke strong emotions among them. These people were given a strong incentive to avoid showing any emotion during the task: they were told that that they would have to fill in a long, boring questionnaire explaining any emotions they did display.

As a result, 16 of the 20 individuals produced 164 microexpressions between them, which 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, giving them a gold-standard database

with which to train their machine-learning algorithm.

The task of recognizing microexpressions falls into two parts. The first is to pick out the fleeting change in facial features that characterize a microexpression. The second is to identify the emotion this displays.

The team tackled the first problem by using 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 microexpression, and these images set aside for further analysis.

Recognizing expressions is generally harder because microexpressions tend to be less pronounced than ordinary expressions. "One major challenge for microexpression recognition is that the intensity levels of facial movements are too low to be distinguishable," say Li and co.

The team solved this using an algorithm that "magnifies" expressions. This works by identifying the parts of the face in motion when an expression changes and distorting the face to move them further.

This process has to be carefully applied. For example, Li and co say they cannot use it for spotting microexpressions because the algorithm magnifies all movement, such as head turning, not just the expressions. So it is only applied to the frames identified by the spotting process described above.

Finally, the algorithm classifies the emotion on display as positive, negative or surprise, a process it learns from the training database.

An interesting question is how well this approach works compared to human performance. To find out, the team asked 15 people to identify

the expression displayed in videos containing just the microexpressions (so they didn't need to pick out the microexpressions from longer sequences). Another 15 people watched the entire videos and had to spot each microexpression as well as identify it.

The results make for interesting reading. Li and co's machine matched human ability to spot and recognize microexpressions and significantly outperformed humans at the recognition task alone.

"Our method is the first system that has ever been tested on a hard spontaneous microexpression data set, containing natural microexpressions," say the team. "It outperforms humans at microexpression recognition by a significant margin, and performs comparably to humans at the combined microexpression spotting and recognition task."

That's not bad for first try, and these machines are clearly going to improve quickly.

It's not hard to come up with applications. Li and co pick out lie detection, law enforcement, and psychotherapy, but it's easy to imagine this being used in job interviews and assessments and even in Google Glass-type devices in everyday life.

Soon, there will be nowhere to hide.

Ref: arxiv.org/abs/1511.00423 : Reading Hidden Emotions: Spontaneous Microexpression Spotting and Recognition

Couldn't make it to EmTech Next to meet experts in AI, Robotics and the Economy?

Go behind the scenes and check out our video

Related Video

More videos

Intelligent Machines

Next-Generation Robots Need Your Help
27:36

Intelligent Machines

AI's Economic Impact
35:20

Intelligent Machines

Autonomous Vehicles and Urban Transportation 28:38

More from Intelligent Machines

Artificial intelligence and robots are transforming how we work and live.

01 The Artificial Intelligence Imperative: Unlocking Data Insights to Fuel Business Growth and Innovation

In all industries across the globe, senior leaders believe that future growth hinges on intelligent use of data. But the difficulty of doing this—particularly with sparse resources, highdata volumes, and the speed of conducting business today—has fueled interest in artificial intelligence (AI) technologies. The overwhelmingly positive attitude toward AI and its promised benefits became clear in a recent survey of 2,300 global business and IT leaders by MIT Technology Review Insights, in association with Pure Storage, a leading enterprise flash storage company. At the same time, the survey revealed that senior leaders must begin now to address the practical challenges of AI adoption and assuage concerns about balancing the human-AI equation.

by MIT Technology Review Insights

02 This AI program could beat you in an argument—but it doesn't know what it's saying

The latest human-versus-machine matchup involves an argumentative AI system.

by Will Knight

Want more award-winning journalism?
Subscribe to Insider Online Only.

Insider Online Only

See details+

See international prices