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Okayama University research: Studying Parkinson's disease with face-recognition software

(Okayama, 28 March) **Researchers at Okayama University report in *Brain Supplement* that artificial-intelligence technology can detect facial characteristics of Parkinson's disease. The faces of patients were systematically found to look older and expressionless.**

Parkinson's disease is a brain disorder leading to motor symptoms including shaking, stiffness and difficulty with walking, as well as mental symptoms such as depression, memory problems and fatigue. Usually, the syndrome also includes facial abnormalities known as 'facial masking' — an affected person's face has a mask-like expression. Given the recent progress in face-recognition tools based on artificial intelligence (AI), Professor ABE Koji and colleagues from Okayama University explored whether AI technology can be used to detect facial changes in patients with Parkinson's disease.

The researchers worked with 96 healthy (control) subjects and 97 patients with Parkinson's disease. The face of each participant was photographed and then analyzed with AI software. For each facial photograph, the program produced a set of attributes such as age, gender and emotion.

By looking at the 'age gap', defined as the appearance age (as determined by the AI software) minus the real age, the scientists found that the appearance of patients with Parkinson's disease made them look older by an average of 2.4 years. For male patients, the average age gap was even 3.4 years. Another observation was that elder patients tended to have a smaller age gap than younger patients.

Regarding emotions, Abe and colleagues found that for the patients with Parkinson's disease, expressionless faces were significantly more frequent than for the healthy control subjects (89% vs. 77%, respectively), and that happy faces were significantly less frequent (5% vs. 19%, respectively). Other emotions, such as contempt, surprise, disgust, anger and fear were not found to differ between the two groups.

The condition of the participants' facial skin was also analyzed based on photographs, with the aim of taking skin features such as stains, wrinkles and eye shadow into account. No significant differences between the skin of healthy subjects and Parkinson's disease patients were found, though. The scientists believe that the employed smartphone application did not focus on the oiliness of facial skin.

The overall conclusion of Professor ABE and colleagues is that "Parkinson's disease patients looked older and expressionless using publically available AI face recognition software". They point out, however, that the accuracy of facial recognition software depends on gender and

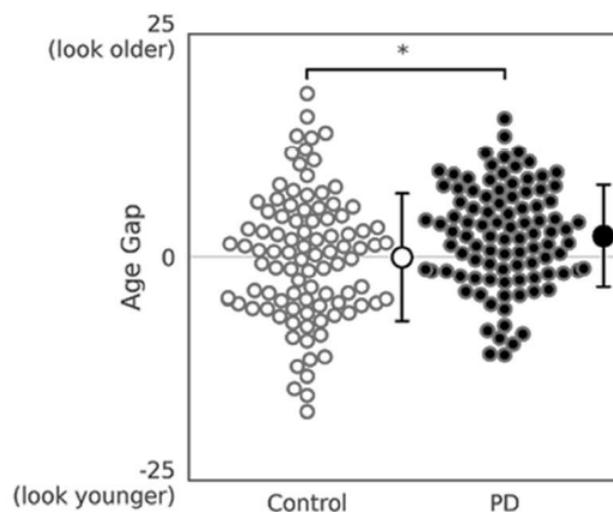
skin color, which leads to ethical concerns. Quoting the scientists: “Although face recognition is a remarkable technology, its ethical risk should also be resolved for clinical application.”

## Background

**Parkinson’s disease** : In patients suffering from Parkinson’s disease, the progressive loss of the function or structure of neurons (brain cells) leads to a disorder of the central nervous system, affecting its motor system. Tremor, slowness of movement and difficulties with walking are among the main symptoms in the early stages of Parkinson’s, with dementia being common at more advanced stages.

Another symptom often associated with Parkinson’s disease is the loss of facial expressions, known as hypomimia. It refers to a patient often having a fixed, mask-like expression. Hypomimia is a consequence of the progressive loss of motor control extending to the facial muscles. The condition often estranges acquaintances, and can make it difficult for care partners to interact with the patient, as they cannot always properly assess the latter’s mood.

Now, Professor ABE Koji and colleagues from Okayama University have shown that artificial-intelligence applications can characterize the faces of Parkinson’s disease patients as looking older and expressionless.



## Caption

Age gap for 96 healthy control subjects (left) and 97 patients with Parkinson’s disease (right).

## Reference

Koh Tadokoro, Toru Yamashita, Yusuke Fukui, Zhihong Bian, Xinran Hu, Mami Takemoto, Ryo Sasaki, Namiko Matsumoto, Emi Nomura, Ryuta Morihara, Yoshio Omote, Nozomi Hishikawa, Koji Abe. Detecting facial characteristics of Parkinson’s disease by novel artificial intelligence (AI) softwares. *Brain Supplement*, 2021;3:1-7.

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**Reference (Okayama Univ. e-Bulletin): Professor ABE's team**

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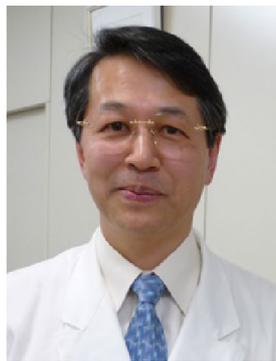
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Okayama University is located in the heart of Japan approximately 3 hours west of Tokyo by Shinkansen.

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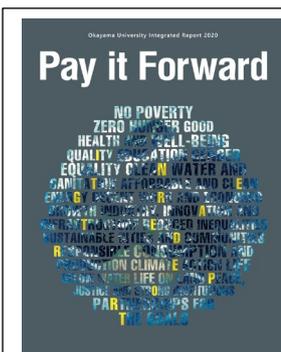
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