Facial Expression Recognition With Machine Learning and Assessment of Distress in Patients With Cancer

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OBJECTIVES: To estimate the effectiveness of combining facial expression recognition and machine learning for better detection of distress.

SAMPLE & SETTING: 232 patients with cancer in Sichuan University West China Hospital in Chengdu, China.

METHODS & VARIABLES: The Distress Thermometer (DT) and Hospital Anxiety and Depression Scale (HADS) were used as instruments. The HADS included scores for anxiety (HADS-A), depression (HADS-D), and total score (HADS-T). Distressed patients were defined by the DT cutoff score of 4, the HADS-A cutoff score of 8 or 9, the HADS-D cutoff score of 8 or 9, or the HADS-T cutoff score of 14 or 15. The authors applied histogram of oriented gradients to extract facial expression features from face images, and used a support vector machine as the classifier.

RESULTS: The facial expression features showed feasible differentiation ability on cases classified by DT and HADS.

IMPLICATIONS FOR NURSING: Facial expression recognition could serve as a supplementary screening tool for improving the accuracy of distress assessment and guide strategies for treatment and nursing.

KEYWORDS distress; cancer; face recognition; facial expression recognition; machine learning

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Distress is a continuous process of unpleasant experience, which could be a normal emotional response of sadness, fear, and fatigue, but it may also deteriorate into depression, anxiety, panic, and other mental crises without early diagnosis and intervention (Riba et al., 2019). Many factors, such as psychological, social, and spiritual environment, are involved in the pathogenesis of distress (Alfonsson et al., 2016). Distress is common in patients with cancer, and it was estimated in Zabora et al. (2001) that 35% of 4,496 patients with cancer had significant distress, particularly those with lung (43%) and brain (43%) cancer. In addition, distress has serious negative effects on treatment adherence, symptom severity, therapeutic effect, quality of life, and prognosis in patients with cancer (Batty et al., 2017; Grassi et al., 2015; Mitchell et al., 2011). Therefore, prompt screening and diagnosis of distress is of essential interest for enhancing multiple aspects of quality of life for patients with cancer (Carlson et al., 2010).

Assessment for distress consist of contact and non-contact approaches (Gavrilescu & Vizireanu, 2019). The contact-based methods use specific sensors to contact the body to measure different parameters, such as electroencephalogram (Li et al., 2019) and electrodermal activity (Sarchiapone et al., 2018), which are more precise but require more cost and effort. Because oncologists are often less sensitive and efficient in detecting patient distress during busy clinical work (Hedström et al., 2006; Söllner et al., 2001), rapid and effective screening tools are needed to improve the efficiency of diagnosing distress. The non-contact measurements include questionnaires, facial analysis, and speech analysis. For example, the National Comprehensive Cancer Network (NCCN, 2020) Distress Thermometer (DT), a single-item