Measuring user-defined facial features for supporting scientific long-term care
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Purpose Japan is facing a super-aged society. The number of elderly people who need care is increasing, which leads to a chronic lack of care resources. Under this circumstance, the Japanese Government has declared the practice of "scientific long-term care" as a national policy. It aims an optimal use of care resources by corroborating the effect of the care by scientific evidence (Headquarters for Japan's Economic Revitalization, 2017). In order to achieve the scientific long-term care, it is essential to evaluate the effect of the care objectively and quantitatively. As an objective metric to quantify the care effect, we focus on "facial expressions". The facial expressions give useful hints to interpret emotions of a person under care. As a practical example, there is a systematic methodology called facial expression analysis (Ekman & Friesen, 1975). To analyze one's face and emotion automatically, we can use emerging image processing technologies. Especially in recent years, owing to powerful machine learning technologies, various companies provide "face APIs", which automatically recognize and analyze faces within a given picture. These APIs produces values of typical emotions such as happiness and sadness, which would be helpful for the evaluation of care effect. In actual medical and care scenes, we have to detect subtle changes of face that may not be covered by the existing APIs. This is because the facial expressions of elderly people under care tend to be weakened due to functional and/or cognitive impairment. Also, the emotion analysis conducted by the existing API is a black box. Therefore, it is difficult for caregivers to understand why and how the value of the emotion is measured. **Method** We propose the "facial expression sensing service". The proposed service allows a user to define custom facial features, so as to capture subtle changes of facial expression. Once the features are defined, the service automatically measures and records the values from real-time media stream obtained from a camera. To define the custom facial features, a user first selects some points on facial landmarks, such as eyes and nose. The user then defines a feature by the distance between the points. In the operation, the service recognizes a face of a target person within a media stream, and measures the distance between every pair of the selected points. Simultaneously, the service attaches a timestamp to each data, and records the data in a database. The user can retrieve the time-series data, and use the data for various analyses. Thus, the proposed service enables to obtain custom facial features efficiently. Moreover, cooperated with user's expertise of emotion analysis, the analysis of subtle facial changes and the explainable emotion analysis become possible. **Results & Discussion** We have designed and implemented the proposed facial expression sensing service. We have also conducted a preliminary experiment. We confirmed that the service worked as designed, and that the service can measure and accumulate custom facial feature values in real-time. We are currently cooperating with a hospital and a care facility, where we ask care workers to use our service. We then evaluate how the proposed service can contribute to quantitative care evaluation in the scientific long-term care.

References
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Headquarters for Japan's Economic Revitalization. (2017). Future investment strategy (No. 26)

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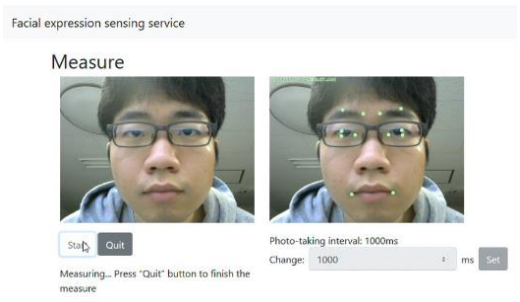

Figure 1. Measuring screen

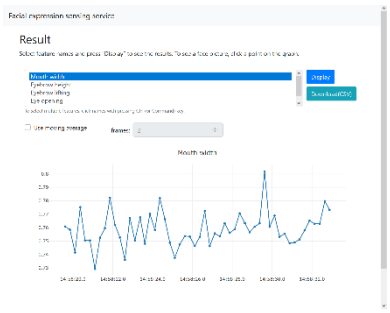

Figure 2. Result view screen