

## **A novel investigation of the effect of iterations in sliding semi-landmarks for 3D human facial images**

### **ABSTRACT**

**Background:** Landmark-based approaches of two- or three-dimensional coordinates are the most widely used in geometric morphometrics (GM). As human face hosts the organs that act as the central interface for identification, more landmarks are needed to characterize biological shape variation. Because the use of few anatomical landmarks may not be sufficient for variability of some biological patterns and form, sliding semi-landmarks are required to quantify complex shape. **Results:** This study investigates the effect of iterations in sliding semi-landmarks and their results on the predictive ability in GM analyses of soft-tissue in 3D human face. Principal Component Analysis (PCA) is used for feature selection and the gender are predicted using Linear Discriminant Analysis (LDA) to test the effect of each relaxation state. The results show that the classification accuracy is affected by the number of iterations but not in progressive pattern. Also, there is stability at 12 relaxation state with highest accuracy of 96.43% and an unchanging decline after the 12 relaxation state. **Conclusions:** The results indicate that there is a particular number of iteration or cycle where the sliding becomes optimally relaxed. This means the higher the number of iterations is not necessarily the higher the accuracy.

**Keyword:** 3D faces; Facial landmarks; LDA; Multi-point warping; PCA; Sliding semi-landmarks