AI & Soc
DOI 10.1007/s00146-013-0440-8

ORIGINAL ARTICLE

Detection of dental abnormalities using SVM and PSVM

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Received: 19 September 2012 / Accepted: 2 January 2013

Abstract Landmarks needed for detecting dental abnormalities in cephalometric analysis were selected from the digital image, and the angle values needed for dental analysis were calculated and stored in a database which is used for developing training dataset. Principal component analysis was applied for dimension reduction to get the desired feature vectors which are trained and tested using support vector machine and proximal support vector machine classifier to detect the dental abnormalities, the performance of the classifiers were also compared.

Keywords Cephalometric analysis · Principal component analysis · Support vector machine · Proximal support vector machine

1 Introduction

Cephalometry is the science of measuring the human head in living individuals to access craniofacial growth and development (Baumrind and Miller 1980). Cephalometric analysis is the study of dental and skeletal relationship in head. Certain irregularities of position of jaw can also be shown in analysis. Cephalometric analysis is generally based on set of agreed feature points called cephalometric landmarks.

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The image processing field has been used for cephalometric analysis and landmark measurement since 1986. Three modules such as filtering module, locating landmark module, measurement module were performed. Using this, angles were detected for maxillary and mandibular abnormalities (Mosleh et al. 2008). Anatomical structure tracing on cephalograms is a significant way to obtain cephalometric analysis. Edge tracking approach was introduced for extracting the desired edges in cephalometric images (Mondal et al. 2011). A finer search combines the best suitable edge (or) region-based final localization. Small search area was allocated for each landmark, and edge detection was applied. If the landmark is not on the edges, then the geometric definitions of the landmarks were used to localize the landmarks (Jain et al. 2010). Landmark identification is based on finer segmentation using template matching process followed by fuzzy wavelet edge detection which determines the true edges. Finally, the landmarks are marked on the edge on the basis of their geometric definitions (Jetwani1 et al. 2011). Study of the analytical landmark identification techniques includes nonlinear model based upon kernel principal component analysis (Romaniuk et al. 2002). Support vector machine (SVM) is used to extract landmark points for craniofacial features in cephalometric radiograph (Banumathi et al. 2011).

Principal component analysis (PCA) was first introduced by Pearson (Pearson 1901) in 1901 and later independently developed by Hotelling (Hotelling 1933) in 1933, where the name principal component first appears. In various fields, it is also known as the singular value decomposition, the Karhunen–Loeve transform, the Hotelling transform, and the empirical orthogonal function method (Fodor 2002). PCA algorithm is used to find a subspace that can be used for presentation of data with minimum error in reconstruction of original data (Weng 1996).

Published online: 23 January 2013