

Statistical Shape Analysis of the Human Upper Airway

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Abstract : The main objective of this project is to develop a statistical shape model using principal component analysis that could be used for analyzing the shape of the human airway. The ultimate goal of this project is to identify geometric risk factors for diagnosis and management of Obstructive Sleep Apnoea (OSA). Anonymous CBCT scans of 25 individuals were obtained from the Otago Radiology Group. The airways were segmented between the hard-palate and the aryepiglottic fold using snake active contour segmentation. The point data cloud of the segmented images was then fitted with a bi-cubic mesh, and pseudo landmarks were placed to perform PCA on the segmented airway to analyze the shape of the airway and to find the relationship between the shape and OSA risk factors. From the PCA results, the first four modes of variation were found to be significant. Mode 1 was interpreted to be the overall length of the airway, Mode 2 was related to the anterior-posterior width of the retroglossal region, Mode 3 was related to the lateral dimension of the oropharyngeal region and Mode 4 was related to the anterior-posterior width of the oropharyngeal region. All these regions are subjected to the risk factors of OSA.

Keywords : medical imaging, image processing, FEM/BEM, statistical modelling

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