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39

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Title : CHARACTERIZATION OF DIGITAL INTRA-ORAL DENTAL RADIOGRAPHS BASED ON IMAGE ENHANCEMENT ALGORITHMS (IEAs)

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The advancement in medical imaging modality has made it possible to produce many types of digital medical images. However, many of these images suffer from low contrasts and noise which make it difficult to identify disease characteristics. Furthermore, the quality and properties of the final display of medical images are often inadequate for diagnostic purposes. Currently limited work has been done in enhancing the pathological features to detect and interpret abnormalities that are required to clearly diagnose dental diseases. Low contrasts in medical image leads to disagreement and might cause misdiagnosis and differential diagnosis. Dentists come from different background in terms of experience, place of study, method of practices and emotional quotient. These are some of the factors that may cause difference of opinion among dentists. The onset of digital imaging modality has made it possible to apply image processing algorithms to overcome the short comings of medical images such as noise, blurring and low contrast. This involves changes in appearance of the original image. The acceptance of dentists towards these changes are subjective thus may result in variation of opinion. To identify the most appropriate appearance of image which is subjectively agreeable to the dentists is the initial stage towards determining the characteristic required in the objective measurement. Therefore, this research focuses on identifying objective measurements based on dentists' subjective evaluation on abnormalities in jaw area. The methodology consists of three phases; image processing experimental design, subjective evaluation and objective evaluation. Theses phases formed a new subjective-objective based image enhancement (SOIE) framework. Image processing experimental design consists of designing three sharpening and AHE based image enhancement framework namely SAHE, SMAHE and SCLAHE. The subjective evaluation involved the analysis of dentists' subjective evaluation on the images. The validation study consists of performing pilot study to validate the dentist's evaluation between two places. Then, more images are collected and produced 2464 raw evaluation of the intra-oral dental radiographs. Results from pilot study and literature review reveal the existing issue of disagreement among the dentists' evaluation. Thus, this work investigates the role of sharpening and AHE based image enhancement in reducing variability among the evaluation. New rule using existing standard deviation ($std=0$) is utilized to determine the dentists' decision on the image quality and detected abnormalities. In addition, dentists' subjective evaluation variability issues are investigated based on supervised, non-supervised method and questionnaire viewing approach; twin-view approach versus random approach. Results show SCLAHE is able to champion in reducing the variability of subjective evaluation. Supervised twin-view approach produced consistent evaluation. The objective evaluation stage measured the enhanced images using Contrast Improvement index (CII), Signal to Noise Ratio (SNR) and Root Mean Squared Error (RMSE). The final lists of images with abnormalities are presented as a new abnormality matrix in table form, to characterize the intra-oral dental radiographs abnormalities. In conclusion, this work successfully characterized the abnormalities of the intra-oral dental images in the form of abnormality matrix based on the SOIE framework.