

A Computer-Aided System for Tooth Shade Matching

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Abstract : Shade matching and reproduction is the most important element of success in prosthetic dentistry. Until recently, shade matching procedure was implemented by dentists visual perception with the help of shade guides. Since many factors influence visual perception; tooth shade matching using visual devices (shade guides) is highly subjective and inconsistent. Subjective nature of this process has led to the development of instrumental devices. Nowadays, colorimeters, spectrophotometers, spectroradiometers and digital image analysing systems are used for instrumental shade selection. Instrumental devices have advantages that readings are quantifiable, can obtain more rapidly and simply, objectively and precisely. However, these devices have noticeable drawbacks. For example, translucent structure and irregular surfaces of teeth lead to defects on measurement with these devices. Also between the results acquired by devices with different measurement principles may make inconsistencies. So, its obligatory to search for new methods for dental shade matching process. A computer-aided system device; digital camera has developed rapidly upon today. Currently, advances in image processing and computing have resulted in the extensive use of digital cameras for color imaging. This procedure has a much cheaper process than the use of traditional contact-type color measurement devices. Digital cameras can be taken by the place of contact-type instruments for shade selection and overcome their disadvantages. Images taken from teeth show morphology and color texture of teeth. In last decades, a new method was recommended to compare the color of shade tabs taken by a digital camera using color features. This method showed that visual and computer-aided shade matching systems should be used as concatenated. Recently using methods of feature extraction techniques are based on shape description and not used color information. However, color is mostly experienced as an essential property in depicting and extracting features from objects in the world around us. When local feature descriptors with color information are extended by concatenating color descriptor with the shape descriptor, that descriptor will be effective on visual object recognition and classification task. Therefore, the color descriptor is to be used in combination with a shape descriptor it does not need to contain any spatial information, which leads us to use local histograms. This local color histogram method is remain reliable under variation of photometric changes, geometrical changes and variation of image quality. So, coloring local feature extraction methods are used to extract features, and also the Scale Invariant Feature Transform (SIFT) descriptor used to for shape description in the proposed method. After the combination of these descriptors, the state-of-art descriptor named by Color-SIFT will be used in this study. Finally, the image feature vectors obtained from quantization algorithm are fed to classifiers such as Nearest Neighbor (KNN), Naive Bayes or Support Vector Machines (SVM) to determine label(s) of the visual object category or matching. In this study, SVM are used as classifiers for color determination and shade matching. Finally, experimental results of this method will be compared with other recent studies. It is concluded from the study that the proposed method is remarkable development on computer aided tooth shade determination system.

Keywords : classifiers, color determination, computer-aided system, tooth shade matching, feature extraction

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