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A Feature Clustering-Based Sequential Selection Approach for Color Texture Classification

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Abstract : Color and texture are highly discriminant visual cues that provide an essential information in many types of images. Color texture representation and classification is therefore one of the most challenging problems in computer vision and image processing applications. Color textures can be represented in different color spaces by using multiple image descriptors which generate a high dimensional set of texture features. In order to reduce the dimensionality of the feature set, feature selection techniques can be used. The goal of feature selection is to find a relevant subset from an original feature space that can improve the accuracy and efficiency of a classification algorithm. Traditionally, feature selection is focused on removing irrelevant features, neglecting the possible redundancy between relevant ones. This is why some feature selection approaches prefer to use feature clustering analysis to aid and guide the search. These techniques can be divided into two categories. i) Feature clustering-based ranking algorithm uses feature clustering as an analysis that comes before feature ranking. Indeed, after dividing the feature set into groups, these approaches perform a feature ranking in order to select the most discriminant feature of each group. ii) Feature clustering-based subset search algorithms can use feature clustering following one of three strategies; as an initial step that comes before the search, binded and combined with the search or as the search alternative and replacement. In this paper, we propose a new feature clustering-based sequential selection approach for the purpose of color texture representation and classification. Our approach is a three step algorithm. First, irrelevant features are removed from the feature set thanks to a class-correlation measure. Then, introducing a new automatic feature clustering algorithm, the feature set is divided into several feature clusters. Finally, a sequential search algorithm, based on a filter model and a separability measure, builds a relevant and non redundant feature subset: at each step, a feature is selected and features of the same cluster are removed and thus not considered thereafter. This allows to significantly speed up the selection process since large number of redundant features are eliminated at each step. The proposed algorithm uses the clustering algorithm binded and combined with the search. Experiments using a combination of two well known texture descriptors, namely Haralick features extracted from Reduced Size Chromatic Co-occurence Matrices (RSCCMs) and features extracted from Local Binary patterns (LBP) image histograms, on five color texture data sets, Outex, NewBarktex, Parquet, Stex and USPtex demonstrate the efficiency of our method compared to seven of the state of the art methods in terms of accuracy and computation time.

Keywords : feature selection, color texture classification, feature clustering, color LBP, chromatic cooccurrence matrix
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