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Offline music symbol recognition using Daisy feature and quantum Grey wolf optimization based feature selection

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Abstract
Handwritten music symbol recognition is considered by the research fraternity as a critical research problem. It becomes more critical when the symbols are collected from handwritten music sheets in offline mode. Most of the research findings, available in the literature, have tried to recognize the said symbols using various shape based features. But this approach limits system performance when we dealt with lookalike symbols such as half note, eight note and quarter note. To encounter this, in the present work we have used a texture based feature descriptor, called Daisy, for the said purpose. Though Daisy descriptor yields reasonably good recognition accuracy, but it generates a high dimensional feature vector. Hence, in this work, Quantum concept inspired Grey Wolf Optimization, named as QGWO, has been applied to select optimal feature subset from this high dimensional feature vector. We have applied the proposed method on six different standard music symbol datasets that include HOMUS, Capitan_score_uniform, Capitan_score_non-uniform, Fornés, Rebelo_real and Rebelo_synthetic datasets. On these datasets we have achieved recognition accuracies 93.07%, 99.22%, 99.20%, 99.49% and 100.00% respectively with 39.63%, 49.75%, 42.50%, 67.62%, 54.37% and 71.25% of actual feature dimension (i.e., 800) respectively. Additionally, we have compared our results with some state-of-the-art methods along with two recent deep learning based models, and it has been found that the present approach outperforms those.

Keywords Music symbol recognition · Daisy descriptor · Quantum Grey wolf optimization · Feature selection

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Offline hand-drawn circuit component recognition using texture and shape-based features

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Abstract
Circuit diagram is the very foundation of electrical and electronic sciences. A circuit diagram consists of various symbols called circuit components that specify the functionality of that circuit. Every day-to-day gadgets that we use are made up with a number of electrical/electronic circuits to play out their particular tasks. Till date circuit designers have to physically enter all data from the hand-drawn circuits into computers, and this procedure requires some investment in terms of time and carries mistakes with high likelihood. To this end, in this paper, we propose a method that relaxes this constraint by introducing a method for recognition of hand-drawn electrical and electronic circuit components, with both analog and digital components included. In the proposed method, the pre-processed images of circuit components are used for training and testing a recognition model using a feature set consisting of a texture based feature descriptor, called histogram of oriented gradients (HOG), and shape based features that include centroid distance, tangent angle, and chain code histogram. In addition, the texture based feature, being large in number compared to others is optimized using a feature selection algorithm called ReliefF. Classification of components is done by using sequential minimal optimization (SMO) classifier. The proposed method has been evaluated on a dataset of 20 different circuit components with 150 samples in each class. The experimental outcome shows that the proposed approach provides average 93.83% accuracy on the present database. We also compare our method with some of the state-of-the-art methods and we see that our method outperforms these methods.

Keywords Hand-drawn circuit components · Texture based feature · Shape based feature · Sequential minimal optimization · Feature selection

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