This paper proposes automated identification and classification of various stages of focal liver lesions based on the Multi-Support Vector Machine (Multi-SVM). The proposed system can be used to discriminate focal liver diseases such as Cyst, Hemangioma, and Hepatocellular carcinoma along with normal liver. The multi-class scenario is a composition of a series of two-class problems, using one-against-all which is the earliest and one of the most widely used implementations. We formulate the discrimination between cysts, cavernous hemangioma, hepatocellular carcinoma, and normal tissue as a supervised learning problem, and apply Multi-SVM to classify the diseases using Haralick local texture descriptors and histogram based features calculated from Regions Of Interest (ROIs), as input. Selection of ROI significantly impact the classification performances, thus we proposes an automatic ROI selection using Fuzzy c-means initialized by level set technique. For multi-class classification, we adopt the One-Against-All (OAA) method. The proposed Multi-SVM based CAD system using 10-fold cross validation yielded classification accuracy of 96.11% with the individual class accuracy of 97.78%, 95.56%, 93.33% and 97.78% for NOR, Cyst, HEM and HCC cases respectively. The proposed Multi-SVM based system is compared with the K-Nearest Neighbor (KNN) based
approaches. Experimental results have demonstrated that the Multi-SVM based system greatly outperforms KNN-based approaches and other methods in the literature. The good performance of the proposed method shows a reliable indicator that can improve the information in the staging of focal liver lesion diseases.

References

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