Abstract

Feature selection and classifier hyper-parameter optimization are important stages of any computer-aided diagnosis (CADx) system for mammography. The optimal selection for shape features, kernel parameter, and classifier regularization constant is crucial to achieve a good generalization and performance of least-squares support vector machines (LSSVMs). This paper presents a morphology-based CADx that uses a computationally attractive and unified scheme for accomplishing the model selection task. A heuristic parameter search based on particle swarm optimization (PSO) not only reduces the dimensionality of the input feature space but also optimizes hyper-parameters of the classifier. The performance of the proposed shape-based CADx including PSO-LSSVM parameter selection method is examined using 60 microcalcification clusters. Using different cross-validation procedures, the proposed PSO-LSSVM demonstrated a good generalization ability by producing classification accuracies higher than 92%. The best classification accuracy of 97% was obtained using the leave-one-out cross-validation procedure. Comparing the performance of PSO-LSSVM with PSO-SVM method that uses conventional SVM formulation, results demonstrated the attractive computational complexity and classification performance of PSO-LSSVM.


**Index Terms**

Computer Science  
Pattern Recognition

**Keywords**

Computer-aided diagnosis  
Mammography  
Microcalcification Clusters  
Particle Swarm Optimization

Least squares support vector machines