

基于信息向量机的机载激光雷达点云数据分类

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Classification of airborne LiDAR point cloud data based on information vector machine

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摘要

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摘要

针对支持向量机应用于机载激光雷达(LiDAR)点云数据分类时存在的模型稀疏性弱、预测结果缺乏概率意义、训练时间长等缺点,提出一种基于信息向量机的LiDAR点云数据分类算法。该算法采取假定密度滤波算法进行近似逼近,将分类问题转化为回归问题;以最大后验概率为依归,选择LiDAR点云数据活动子集信息向量实现模型稀疏化;最后,通过边缘似然最大化进行核函数自适应获取,选择一对余分类方法实现了点云数据多类分类。利用Niagara地区和非洲某地区点云数据进行了对比实验。结果表明:与支持向量机方法相比,基于信息向量机分类方法的分类精度分别提高到94.20%和90.78%,基向量数量分别减少到50个和90个,训练时间分别降低到5.86 s和8.03 s。实验结果验证了基于信息向量机的点云数据分类算法具有训练速度快、模型稀疏性强、分类精度高等优点。

关键词 : 激光雷达测距(LiDAR), 点云, 数据分类, 高斯过程, 信息向量机

Abstract :

When Support Vector Machines(SVMs) are applied in airborne LiDAR point data classification, their performance is limited by weak model sparseness, the prediction lack of probabilistic sense, and long training time. Therefore, a novel LiDAR point cloud data classification method was proposed based on an Informative Vector Machine (IVM). Firstly, the assumed density filtering was utilized to produce an approximation for probit classification noise model, and the classification problem was transformed into the regression problem. Then, the informative vectors of the active set in LiDAR point cloud data were chosen to achieve the model sparseness according to the largest posteriori differential entropy. Finally, in the training process, the kernel parameter was obtained by Marginal Likelihood Maximisation(MLM) and an One Against Rest (OAR) classifier was selected to realize multi-class classification. The LiDAR point cloud data from Niagara and Africa were selected for experiments in comparison with the SVM, and experimental results show that the classification accuracy of the method based on IVM increases to 94.20% and 90.78% respectively, the number of basis vectors reduce to 50 and 90 separately, and the training time decreases to 5.86 s and 8.03 s respectively. In conclusion, the classification method based on IVM has advantages in fast training speeds, strong model sparseness and high classification accuracy.

Key words : Light Detection and Ranging(LiDAR) point cloud data classification Gaussian process Informative Vector Machine (IVM)

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