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Information Modified K-Nearest Neighbor

Authors : Mohammad Ali Vahedifar, Azim Akhtarshenas, Maryam Sabbaghian, Mohammad Mohammadi Rafatpanah, Ramin Toosi

Abstract : The fundamental concept underlying K-Nearest Neighbors (KNN) is the classification of samples based on the majority through their nearest neighbors. Although distance and neighbors' labels are critical in KNN, traditional KNN treats all samples equally. However, some KNN variants weigh neighbors differently based on a specific rule, considering each neighbor's distance and label. Many KNN methodologies introduce complex algorithms that do not significantly outperform the traditional KNN, often leading to less satisfactory outcomes. The gap in reliably extracting information for accurately predicting true weights remains an open research challenge. In our proposed method, information-modified KNN (IMKNN), we bridge the gap by presenting a straightforward algorithm that achieves effective results. To this end, we introduce a classification method to improve the performance of the KNN algorithm. By exploiting mutual information (MI) and incorporating ideas from Shapley's values, we improve the traditional KNN performance in accuracy, precision, and recall, offering a more refined and effective solution. To evaluate the effectiveness of our method, it is compared with eight variants of KNN. We conduct experiments on 12 widely-used datasets, achieving 11.05%, 12.42%, and 12.07% in accuracy, precision, and recall performance, respectively, compared to traditional KNN. Additionally, we compared IMKNN with traditional KNN across four large-scale datasets to highlight the distinct advantages of IMKNN in the impact of monotonicity, noise, density, subclusters, and skewed distributions. Our research indicates that IMKNN consistently surpasses other methods in diverse datasets.

Keywords : KNN, classification, information modified KNN, information value, weighted KNN, mutual information
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