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基于t-SNE的晋北矿区地下水水质评价

Groundwater quality assessment based on the t-SNE method in the north coal field of Shanxi

关键词：晋北矿区|地下水|水质评价|t-SNE

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摘要：将t-Distributed Stochastic Neighbor Embedding (t-SNE)技术引入水质评价领域,探讨了基于t-SNE的水质评价方法,并对晋北矿区地下水水质进行评价.结果发现,相对于传统水质评价方法,基于t-SNE的水质评价方法降低了评价过程对经验值的依赖.地下水水质标准中某些指标(如氨氮、锰、挥发性酚类和大肠杆菌等)对不同的水质类别采用了相同的阈值,这导致采用传统方法评价时产生不确定性,而新方法基于"距离"概念识别不同水样在这些指标上的差异,从而提高了评价结果的精确度.此外,新方法通过高维数据向量可视化直观地表达数据间的内在分类特点.评价结果表明,晋北矿区开采排水和生活排污引起了地下水水质恶化,主要超标项目有硫酸盐、总硬度、细菌总数和大肠杆菌群数等.水质恶化影响的深度局限在200 m以浅,在空间上主要局限在靠近左云县和山阴县的部分地区,深层岩溶水水质未见明显改变.

Abstract：The t-distributed Stochastic Neighbor Embedding (t-SNE) method is introduced to water quality assessments.The process of assessment based on t-SNE is explored.Groundwater quality in the north coal field of Shanxi is evaluated using the new method.Compared to traditional water quality evaluation methods,the new method decreases the dependence on empirical values.The same threshold value is applied for different water quality levels with respect to some water quality indexes (e.g.,ammonia nitrogen,manganese,volatile phenols and coli-form) in the quality standard of groundwater,which causes uncertainty by using traditional water quality evaluation methods.The new method can identify the difference in those indexes between samples using distance and offer an improved result.Besides,the new method presents the clustering of data points by high-dimensional vector visualization.The assessment results show that mine drainage and domestic sewage discharge induce water quality degradation.The major contaminants include sulfate,total hardness,bacteria count and coli-forms number.Water degradation appears within the depth of 200 m underground in some areas close to Zuoyun County and Shanyin County.Water in the deep karstic aquifer is not obviously influenced.

Key words：the north coal field of Shanxi|groundwater|water quality assessment|t-SNE