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基于位移的滑坡临滑时刻多模型综合预测模糊积分

Title: Displacement-based fuzzy integral method for multi-model comprehensive forecast of landslide-approaching time

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关键词: 滑坡; 临滑时刻预测; 模糊积分; 多模型综合预测

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摘要: 滑坡的发生具有不确定性。针对目前基于位移的滑坡临滑时刻预测模型的预测结果之间存在较大的差异且难以选择出适合某种类型滑坡的最佳模型的问题,利用模糊积分具有较好处理客观证据和主观期望的优势,选择7个已知滑坡,分别用基于位移的滑坡临滑时刻预测的Verhulst、Verhulst反函数和福囿模型进行预测实验。通过计算各预测模型的隶属度获得模型的模糊密度,实现基于模糊积分融合方法的多模型综合预测。实验表明:模糊积分方法提高了已知滑坡的预测精度,使每个滑坡的预报时刻均在实际发生的前15天以内。

Abstract: The occurrence of landslide is uncertain. In view of the existing problems that the results of the predictions of different displacement-based landslide-approaching time models have great differences from each other and it is difficult to choose the optimal model for a certain type of landslide, this study utilizes the advantage of fuzzy integral on handling objective evidence and subjective expectation for the experiments, and selects seven occurred landslides, to do the landslide-approaching time prediction study. Three displacement-based prediction models, i.e., Verhulst, Verhulst inverse-function and f-bounded models were used respectively in the tests. First, The fuzzy

density of each predicted model was obtained through calculating the models' membership grade, and then the multi-models comprehensive prediction was realized based on the fuzzy integral fusion method. Results indicated that the fuzzy integral method improves the known landslides' prediction accuracy, and the forecast time of each landslide is within 15 days before the actual occurring time.

参考文献/REFERENCES

[1] 王念秦, 樊珂奇. 滑坡灾害稳定度综合评判模型[J]. 水文地质工程地质, 2011, 38(1): 114-118. WANG Nianqin, FAN Keqi. A comprehensive evaluation model for the stability of landslide hazard [J]. Hydrogeology and Engineering Geology. 2011, 38(1): 114-118. (in Chinese)

[2] YIN Yueping, ZHENG Wamo, LIU Yuping, et al. Integration of GPS with In SAR to monitoring of the Jiaju landslide in Sichuan, China [J]. Landslides, 2010, 7: 359-365.

[3] WONG Man Sing, Nichol Janet, Shaker. Ahmed. Data fusion using aerial photographs and satellite images for detailed landslide assessment [J]. Image and Data Fusion, 2011, 2(2): 181-190.

[4] Nefeslioglu H A, Sezer E, Gokceoglu C, et al. Assessment of landslide susceptibility by decision trees in the Metropolitan Area of Istanbul, Turkey [J]. Mathematical Problems in Engineering, 2010, 2010: 1-15.

[5] Prabu S, Ramakrishnan S S. Combined use of socio economic analysis, remote sensing and GIS data for landslide Hazard Mapping using ANN [J]. Photonirvachak, 2009, 37: 409 – 421.

[6] 刘晓, 唐辉明, 刘瑜. 基于集对分析和模糊马尔可夫链的滑坡变形预测新方法研究[J]. 岩土力学, 2009, 30(11): 3399-3405. LIU Xiao, TANG Huiming, LIU Yu. A new model for landslide displacement prediction based on set pair analysis and fuzzy-Markov chain[J]. Rock and Soil Mechanics, 2009, 30(11): 3399-3405.(in Chinese)

[7] 邓宏艳, 孔纪名. 降雨主导型库岸滑坡变形时空分布特征[J]. 自然灾害学报, 2012, 21(1): 148-154. DENG Hongyan, KONG Jiming. Spatiotemporal distribution characteristics of reservoir bank landslide deformation driven by rainfall[J]. Journal of Natural Disasters, 2012, 21(1): 148-154.(in Chinese)

[8] 缪海波, 殷坤龙, 徐峰, 等. 基于因子分析的滑坡位移多模型预测综合评判[J]. 武汉理工大学学报, 2010, 32(19): 65-70. MIAO Haibo, YIN Kunlong, X U Feng, et al. Comprehensive evaluation on multiple predictions of the landslide displacements based on component analysis[J]. Journal of Wuhan University of Technology, 2010, 32(19): 65-70.(in Chinese)

[9] 赵建华, 陈汉林, 杨树锋. 滑坡灾害危险性评价模型比较[J]. 自然灾害学报, 2006,15(1): 128-134. ZHAO Jianhua, CHEN Hanlin, YANG Shufeng. Comparison of models for hazard assessment of landslide [J]. Journal of Natural Disasters, 2006, 15(1): 128-134.(in Chinese)

[10] Malet J P, Th W J. van Asch, R van Beek1, et al. forecasting the behavior of complex landslides with aspatially distributed hydrological model [J]. Natural Hazards and Earth System Sciences, 2005, 5: 71-85.

[11] WANG Fawu, Sassa Kyoji. Landslide simulation by a geotechnical model combined with a model for apparent friction change [J]. Physics and Chemistry of the Earth, 2010, 35: 149-161.

[12] 李秀珍, 孔纪名, 王成华. 最优加权组合模型在滑坡变形预测中的应用[J]. 自然灾害学报, 2008, 17(2): 53-57. LI Xiuzhen, KONG Jiming, WANG Chenghua. Application of combined model with optimum weight in prediction of landslide deformation [J]. Journal of Natural Disasters, 2008, 17(2): 53-57.(in Chinese)

[13] 刘严岩. 多传感器数据融合中几个关键技术的研究[D]. 合肥: 中国科学技术大学, 2006. LIU Yanyan. Research on Several Key Technologies of Multi-Sensor Data Fusion[D]. Hefei: University of Science and Technology of China, 2006.(in Chinese)

[14] 翟俊海, 王熙照, 张素芳. 基于模糊积分的多模糊决策树融合[J]. 计算机研究与发展, 2009, 46(3): 470-476. ZHAI Junhai, WANG Xizhao, ZHANG Sufang. Integration of Multiple Fuzzy Decision Trees Based on Fuzzy Integral[J]. Journal of Computer Research and Development, 2009, 46(3): 470-476.(in Chinese)