**项目名称：多源异构条件下滑坡灾害定量空间预测方法研究**

**完成人（限11人）：陈伟，赵洲，王念秦，段钊，马建全，侯恩科，魏江波，彭涛，牛超，肖乐乐**

**完成单位（所有单位）：西安科技大学**

**项目简介：**多源异构条件下滑坡灾害定量空间预测方法研究是工程地质及灾害地质领域地质灾害风险管理研究的难点课题。该项目以国家自然科学基金项目：滑坡强度定量预测方法研究（41302276），陕西省自然科学基础研究计划：面向风险管理的陕南山区堆积层滑坡危险性评价方法研究（2012JM5008）、冲击液化作用下黄土滑坡运动机理研究（2017JQ4020）、县域地质灾害风险管理系统研究与开发（2011K17-02-01），陕西省教育厅专项科研计划项目：多源变粒度条件下滑坡灾害定量空间预测研究（17JK0511）、黄土滑坡冲击下垫饱和砂层液化机理研究（17JK0515），以及陕西省地质调查院项目：府谷县地质灾害详细调查等项目为依托，以陕西省汉中市宁强县、商洛市商南县、商州区、宝鸡市太白县、陇县、陈仓区、凤县、安康市岚皋县、榆林市府谷县、四川省汉源县等县区滑坡灾害为研究基础，通过野外调查、现场监测、分析测试、室内实验和综合研究等，对多源异构条件下滑坡灾害形成机理、滑坡冲击强度的预测方法、滑坡空间预测影响因素定量优选方法、以及滑坡发生概率定量空间预测模型和多参数优化方法等关键技术问题进行了较为深入的理论研究和应用分析，取得了以下主要创新性成果：

（1）揭示了冲击作用下砂质粉土液化机理及冲击液化作用下高速远程黄土滑坡运动机理；利用颗粒流离散元理论及方法，对滑坡滑移过程中的动力学特征进行了全程跟踪和模拟分析，并得出了滑坡冲击强度的一般预测方法；

（2）研究提出了多源异构条件下空间数据提取分析及优选方法，建立了基于数据集和单个属性的多源变粒度条件下滑坡灾害影响因素定量优选方法；

（3）提出了多源空间信息下基于基模型与提升模型，以及基于集成二变量统计学模型、多变量统计学模型与机器学习模型的区域滑坡空间概率定量预测模型和多参数优化方法。

**主要知识产权目录：**

1. **文章（限15篇）（文章的第一作者、通讯作者必须为奖励申报完成人，否则须出具知情同意书）**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 文章题目 | 期刊名称 | 作者（所有人） | 发表时间 | 完成单位（所有） |
| A comparative study of logistic model tree, random forest, and classification and regression tree models for spatial prediction of landslide susceptibility（ESI热点论文） | CATENA | Chen Wei, Xie Xiaoshen, Wang Jiale, Pradhan Biswajeet, Hong Haoyuan, Tien Bui Dieu, Duan Zhao, Ma Jianquan  | 2017 | Xi'an University of Science and Technology；University Putra Malaysia；Sejong University；Jiangxi Meteorological Bureau；University College of Southeast Norway |
| A GIS-based comparative study of Dempster-Shafer, logistic regression and artificial neural network models for landslide susceptibility mapping（ESI高被引论文） | Geocarto International | Chen Wei, Pourghasemi Hamid Reza, Zhao Zhou  | 2017 | Xi’an University of Science and Technology；Shiraz University |
| Performance evaluation of GIS-based new ensemble data mining techniques of adaptive neuro-fuzzy inference system (ANFIS) with genetic algorithm (GA), differential evolution (DE), and particle swarm optimization (PSO) for landslide spatial modelling（ESI热点论文） | CATENA | Chen Wei, Panahi Mahdi,Pourghasemi Hamid Reza  | 2017 | Xi'an University of Science and Technology；Islamic Azad University；Shiraz University |
| Landslide spatial modeling: Introducing new ensembles of ANN, MaxEnt, and SVM machine learning techniques（ESI热点论文） | Geoderma | Chen Wei, Pourghasemi Hamid Reza,Kornejady Aiding, Zhang Ning  | 2017 | Xi'an University of Science and Technology；Shiraz University；Gorgan University of Agricultural Sciences and Natural Resources |
| Spatial prediction of landslide susceptibility using an adaptive neuro-fuzzy inference system combined with frequency ratio, generalized additive model, and support vector machine techniques（ESI热点论文） | Geomorphology | Chen Wei, Pourghasemi Hamid Reza,Panahi Mahdi, Kornejady Aiding, Wang Jiale, Xie Xiaoshen, Cao Shubo  | 2017 | Xi'an University of Science and Technology；Shandong University of Science and Technology；Shiraz University；Islamic Azad University；Gorgan University of Agricultural Sciences and Natural Resources；Sichuan Institute of Nuclear Geology |
| GIS-based landslide susceptibility modelling: a comparative assessment of kernel logistic regression, Naïve-Bayes tree, and alternating decision tree models（ESI高被引论文） | Geomatics, Natural Hazards and Risk | Chen Wei, Xie Xiaoshen, Peng Jianbing, Wang Jiale, Duan Zhao, Hong Haoyuan  | 2017 | Xi’an University of Science and Technology；Chang’an University；Nanjing Normal University |
| A novel hybrid artificial intelligence approach based on the rotation forest ensemble and naïve Bayes tree classifiers for a landslide susceptibility assessment in Langao County, China（ESI高被引论文） | Geomatics, Natural Hazards and Risk | Chen Wei, Shirzadi Ataollah, Shahabi Himan, Bin Ahmad Baharin, Zhang Shuai, Hong Haoyuan, Zhang Ning  | 2017 | Xi’an University of Science and Technology；Shandong University of Science and Technology；University of Kurdistan； Universiti Teknologi Malaysia；Nanjing Normal University |
| GIS-based groundwater potential analysis using novel ensemble weights-of-evidence with logistic regression and functional tree models（ESI高被引论文） | Science of The Total Environment | Chen Wei, Li Hui, Hou Enke, Wang Shengquan, Wang Guirong, Panahi Mahdi, Li Tao, Tao Peng,Guo Chen, Niu Chao, Xiao Lele, Wang Jiale, Xie Xiaoshen, Bin Ahmad Baharin | 2018 | Xi'an University of Science and Technology；Shaanxi Institute of Geo-Environment Monitoring； Key Laboratory of Coal Resources Exploration and Comprehensive Utilization, Ministry of Land and Resources, China；Islamic Azad University, Tehran；Liupanshui Normal University；Universiti Teknologi Malaysia |
| GIS-based landslide susceptibility evaluation using a novel hybrid integration approach of bivariate statistical based random forest method（ESI热点论文） | CATENA | Chen Wei, Xie Xiaoshen, Peng Jianbing, Shahabi Himan, Hong Haoyuan, Tien Bui Dieu, Duan Zhao, Li Shaojun, Zhu A-Xing  | 2018 | Xi'an University of Science and Technology；Chang'an University；University of Kurdistan；Nanjing Normal University；University College of Southeast Norway；Chengdu University of Technology；Chinese Academy of Sciences |
| Prioritization of landslide conditioning factors and its spatial modeling in Shangnan County, China using GIS-based data mining algorithms（ESI高被引论文） | Bulletin of Engineering Geology and the Environment | Chen Wei, Pourghasemi Hamid Reza, Naghibi Seyed Amir  | 2018 | Xi’an University of Science and Technology；Shiraz University；Tarbiat Modares University |
| A comparative study of landslide susceptibility maps produced using support vector machine with different kernel functions and entropy data mining models in China（ESI热点论文） | Bulletin of Engineering Geology and the Environment | Chen Wei, Pourghasemi Hamid Reza, Naghibi Seyed Amir  | 2018 | Xi’an University of Science and Technology；Tarbiat Modares University |
| Performance evaluation of the GIS-based data mining techniques of best-first decision tree, random forest, and naïve Bayes tree for landslide susceptibility modeling（ESI热点论文） | Science of The Total Environment | Chen Wei, Zhang Shuai, Li Renwei, Shahabi Himan  | 2018 | Xi'an University of Science and Technology；University of Kurdistan |
| Applying population-based evolutionary algorithms and a neuro-fuzzy system for modeling landslide susceptibility（ESI热点论文） | CATENA | Chen Wei, Panahi Mandi, Tsangaratos Paraskevas,Shahabi Himan, Ilia Ioanna, Panahi Somayeh, Li Shaojun, Jaafari Abolfazl, Bin Ahmad Baharin | 2018 | Xi'an University of Science and Technology；Islamic Azad University；National Technical University of Athens；University of Kurdistan；Chinese Academy of Sciences；Islamic Azad University；Universiti Teknologi Malaysia |
| A novel ensemble approach of bivariate statistical-based logistic model tree classifier for landslide susceptibility assessment（ESI热点论文） | Geocarto International | Chen Wei, Shahabi Himan,Shirzadi Ataollah, Li Tao, Guo Chen, Hong Haoyuan, Li Wei, Pan Di, Hui Jiarui, Ma Mingzhe, Xi Manna, Bin Ahmad, Baharin  | 2018 | Xi’an University of Science and Technology；Shandong University of Science and Technology；University of Kurdistan；Nanjing Normal University；Universiti Teknologi Malaysia |
| 基于颗粒流方法的滑坡破坏机理与强度分析 | 西安科技大学学报 | 赵洲，魏江波 | 2018 | 西安科技大学 |

1. **专利&软著**

|  |  |  |  |
| --- | --- | --- | --- |
| 专利（软著）名称 | 完成人 | 权人 | 专利（软著）号 |
| 发明专利：一种非饱和土多功能渗透仪及其测试方法 | 王念秦，刘晓玲，彭建兵，王庆涛，焦旭鹏，刘博涛，李绍兵，韩波，薛瑶琼，冯鑫，李明，庞琦，魏精锐 | 西安科技大学 | ZL201310254956.X |
| 发明专利：一种冲击液化试验设备及试验方法 | 段钊 | 西安科技大学 | ZL201611183220.8 |
| 实用新型专利：一种滑坡冲击力测试实验装置 | 赵洲，魏江波 | 西安科技大学 | ZL201820219235.3 |
| 实用新型专利：坡体倾斜快速测量装置 | 王念秦，乔德京，杨盼盼，杜睿智，冯班统，张坤，张帅，郭有金，张宁，刘鹏 | 西安科技大学 | ZL201720125203.2 |

1. **专著等**

|  |  |  |  |
| --- | --- | --- | --- |
| 名称 | 作者 | 出版社 | 出版时间 |
| 工程地质技术 | 王念秦，杨德智，方世跃，马建全 | 中国矿业大学出版社 | 2014 |

