科教融合案例

一、科研项目名称

制图类平台地图符号共享模型与方法研究

二、项目来源

国家自然科学基金面上基金

三、项目主持人基本信息

姓名：陈泰生

职称：教授

学历/学位：研究生/博士

主要研究领域：地理信息可视化、机器学习

四、案例简介

多年来，地理信息可视化中心一直坚持融研于教的应用型本科人才培养模式，以中心承担的国家自然科学基金、地方产学研项目为依托，吸纳学生参与项目的科研工作，通过项目攻关，学生能够学习国内外先进的专业知识，从而促进学生的培养。2011-2020 年，陈泰生教授以地理信息可视化研究中心为依托，共计指导本科生 74 名，其中 24 名学生先后获省部专业竞赛奖励，获批国家级大学生创新创业项目 4 项，本科毕业生中攻读硕士研究生 14 人，3 人就职于阿里巴巴、京东、字节跳动等 IT 知名企业，1 人成长为我国 GIS 领军企业——超图集团目前最年轻的技术主管。他对应用型人才培养效果显著，学生的整体专业素养与就业层次得到了较大提升。
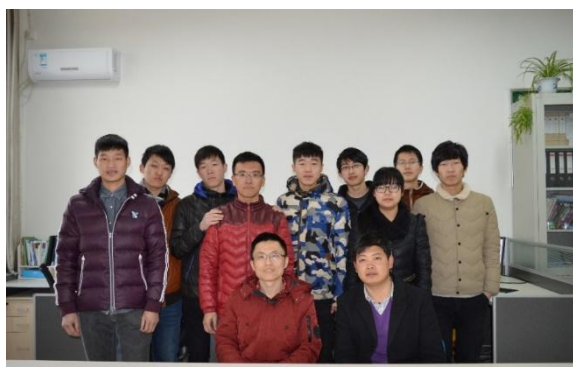
五、案例有关图片

图 1 地理信息可视化中心科学问题研讨

图 2 地理信息可视化中心团队成员

图 3 GIS 技能大赛省赛一等奖

图 4 "互联网+"大赛省赛银奖

RESEARCH ARTICLE

WILEY

Identification and formalization of knowledge for coloring qualitative geospatial data

Mingguang Wu[1,2,3] | Taisheng Chen[4,5] | Guonian Lv[1,2,3] | Menglin Chen[4,5] | Hong Wang[1,2] | Haoyu Sun[4]

[1] Key Laboratory of Virtual Geographic Environment of Ministry of Education, Nanjing Normal University, Nanjing 210023, China

[2] College of Geographic Sciences, Nanjing Normal University, Nanjing, Jiangsu 210023, China

[3] Jiangsu Center for Collaborative Innovation in Geographical Information Resource Development and Application, Nanjing 210023, China

[4] Department of Geographic Information Science, Chuzhou University, Chuzhou, China

[5] Anhui Center for Collaborative Innovation in Geographical Information Integration and Application, Chuzhou, China

Correspondence
Taisheng Chen, Department of Geographic Information Science, Chuzhou University, Chuzhou, People's Republic of China.
Email: taisheng.chen@163.com

Funding information
The National Natural Science Foundation of China, Grant/Award Number: 41571433, 41571439, 41271446, 41201485

Abstract
Creating a satisfying qualitative color scheme from scratch may be difficult for novice mapmakers and experts. A probability-based method is proposed to identify knowledge regarding qualitative color selection from readily available color schemes and formalize the discovered knowledge to assist in color creation. An unsupervised method to extract the general trends of color selection is presented, and the issue of qualitative color selection is translated into a multi-constraint optimization problem. A feasible solution for achieving the global optimum is then provided. A probability-based method is also proposed to match abstract color values with specific mapping features. This proposed approach is evaluated in a case study. The results of the case study suggest that the proposed method allows users to create qualitative color schemes more efficiently and confidently.

KEYWORDS
interaction, kernel density estimation, map color design, multi-constraint optimization, qualitative color scheme

图 5 基于专家知识的定性地图色彩
自动设计（学生参与）

RESEARCH ARTICLE

WILEY

A harmony-based approach to generating sequential color schemes for maps

Taisheng Chen[1,2] | A-Xing Zhu[3,4,5] | Mingguang Wu[4,5] | Menglin Chen[1,2] | Mingda Zhang[1] | Weixing Jiang[1] | Yue Lu[1] | Hong Wang[4,5]

[1] Department of Geographic Information Science, Chuzhou University, Chuzhou, China

[2] Anhui Center for Collaborative Innovation in Geographical Information Integration and Application, Chuzhou, China

[3] Department of Geography, University of Wisconsin-Madison, Madison, Wisconsin

[4] Key Laboratory of Virtual Geographic Environment of Ministry of Education, Nanjing Normal University, Nanjing, China

[5] College of Geographic Sciences, Nanjing Normal University, Nanjing, China

Correspondence
Mingguang Wu, Key Laboratory of Virtual Geographic Environment of Ministry of Education, Nanjing Normal University, Nanjing, Jiangsu Province, China.
Email: wmg@njnu.edu.cn

Funding information
National Natural Science Foundation of China, Grant/Award Numbers: 41571439, 41201485, 41571433

Abstract
Generating high-quality sequential color schemes for maps is challenging for most mapmakers. This article presents a harmony-based approach for automatically generating sequential color schemes for maps. The proposed approach consists of two steps: (a) color harmony quantification for sequential color schemes on maps and (b) color scheme generation using quantified color harmony factors. The approach was tested using three experimental maps, including the Chinese water body density index map, Chinese vegetation cover index map, and Chinese population density map. Effectiveness was evaluated by comparing color schemes generated by the proposed approach with those created by the probability-based method and ColorBrewer. Twenty-six participants were invited to rate each map color scheme using a 5-point scale. A t test was also used to examine the significance of the difference. The results show that the mean points of color schemes using the proposed approach are higher than those using the probability-based method, and the corresponding P-values are far lower than .05, which suggests that the proposed approach is better than the probability-based method and can improve the sequential color scheme quality in automatic ways. The mean points of color schemes created using the proposed approach are also slightly higher than or similar to those of ColorBrewer, which are well-known map color schemes manually designed by an experienced cartographer. This result further suggests that the proposed approach can meet the requirement of automatic generation for high-quality sequential color schemes on maps.

图 6 基于调和模型的顺序型地图色彩
自动设计（学生参与）