Muchun Li

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Education

Wuhan University (Project 985) ***Sep.2020 – Jun.2022***
State Key Laboratory of Information Engineering in Surveying, Mapping, and Remote Sensing *GPA 3.59/4*
Master of Electronic Information (Computer Technique)

Taiyuan University of Technology (Project 211) ***Sep.2016 – Jun.2020***
Software Academy *GPA 4.27/5 | Ranking:2/100*
Bachelor of Software Engineering

Relevant Coursework

- Advanced Algorithm Design and Analysis
- Advanced Database Technology
- Mathematical Models and Optimization
- Digital Signal Processing
- Principles and Methods of Automated Integration of Geographic Information

Research Interest

- land use and land cover change (LUCC)
- Multi-objective optimization
- Urban sustainability
- Modeling
- Artificial Intelligence

Publication and Patent

Working papers

[1] Muchun Li, Boyan Li, Wei Wang. Automatic calibration of cellular automata based on Gaussian function to improve the simulation of land use dynamics (External Review)

- Developed an automatic calibration convolutional neural network CA (AC-CNN-CA) model with an overall accuracy of 84.12% and the figure of merit of 20.20%
- Utilized the Gaussian function to capture the micro-process and macro-evolutionary pattern of urban sprawl
- Adopted a compact convolutional neural network (CNN) to mine the land-use expansion probability
- Divided neighborhood effects into three categories: continuous increase, continuous decrease, and increase then decrease
- The neighborhood effect of ”agricultural land - urban land” in Wuhan showed a tendency to ”increase then decrease”

[2] Muchun Li, Boyan Li, Chao Wang, Wei Wang. A review of future land-use scenarios simulation in the latest 30 years (Under Review)

- Read over 200 articles about theoretical research and practical progress of LUCC scenario modeling to summarise and compare the applicable models for each LUCC scenario based on its classification
- Performed literature analysis using excel, compiled results into a literature review
- The LUCC scenario simulation study still suffers from two shortcomings: (i) the lack of research at global scales and non-monolithic models; (ii) over-reliance on historical validation leads to low credibility of validation results
- The scalability and reliability of models for scenario prediction can be improved by introducing data-driven optimization models and increasing stakeholder involvement in the model-building lifecycle

Patents

[1] Land utilization suitability probability generation method considering space partition.
CN.Patent. CN114819112A. Filed July 2022, Issued September 2022

[2] Land utilization change simulation method based on NSGA-II self-correcting cellular automaton.
CN.Patent. CN114818517A. Filed July 2022, Issued September 2022

Research Experience

[1] Land use change simulation based on CNN-MOGA: a case study in Wuhan ***Mar.2022 – Jun.2022***
Postgraduate Research program

- Investigated the consequences of neighborhood effects and spatial heterogeneity on LUCC model through a multi-objective genetic algorithm (MOGA)
- Proposed the CNN-MOGA model and examined it in Wuhan for LUCC simulations from 2005 to 2015
- Applied NSGA-II to integrate locational agreement and landscape pattern structure during model calibration
- Found the neighborhood effects in Wuhan exhibit spatial heterogeneity between main and distant urban areas, especially for "agricultural land - urban land"

[2] Remote sensing monitoring and model prediction of agricultural and forestry land changes in a giant reservoir complex ***Apr.2021 – Sep.2022***
Laboratory Open Fund of Nanjing Beidou Innovation and Application Technology Research Institute

- Conducted literature search, reviewed over 50 articles, generated study ideas, and authored research proposal
- Collected and processed datasets, including historical land-use data, socio-economic and physical-geographic drivers
- Simulated land-use changes in the Three Gorges Reservoir area using CNN-MOGA model
- Compiled study results and issued two patents

[3] Spatiotemporal coupling of vegetation changes and water resources in the Yangtze River Basin and its spatial optimization ***Feb.2021 – Sep.2022***
National Natural Science Foundation of China

- Read nearly 50 papers on synergies and trade-offs between vegetation change and water resources and mining research status and development through VOSviewer and Citespace
- Assisted in technical route design and explored the techniques for land-use optimization based on future scenarios
- Propose the AC-CNN-CA model to optimize the allocation of land resources of the revegetated areas in the Yangtze River Basin in future research

Academic Project

Coupled Neural Network and cellular automata for Land use change simulation ***Sep.2020 – Jan.2021***

- Reviewed over 50 research articles on applying artificial intelligence to traditional cellular automata
- Compared simulation accuracy between multiple hybrid models through a series of experiments
- Implemented ANN-CA with C# and examined it in Wuhan for LUCC simulations from 2003 to 2013
- Designed software based on ANN-CA model using Python and c# for further studies

Felloship and Activities

- Outstanding Participant Certificate in 2021 LIESMARS OPEN DAY ***Sep.2021***
- Scholarship of Academic Excellence (TOP 2%) ***Spring 2020***
- Scholarship of Academic Excellence (TOP 2%) ***Spring 2019***
- "Internet+" Student Innovation and Entrepreneurship Competition ***Sep.2018***

Technical Skills

- **Languages:** Python, Java,C#, SQL
- **Models:** Cellular Automata, System Dynamic, Multi-objective Optimization, Artificial Intelligence
- **Software:** ArcGIS, Vensim, Origin, SPSS
- **English level:** IELTS (6.5)