

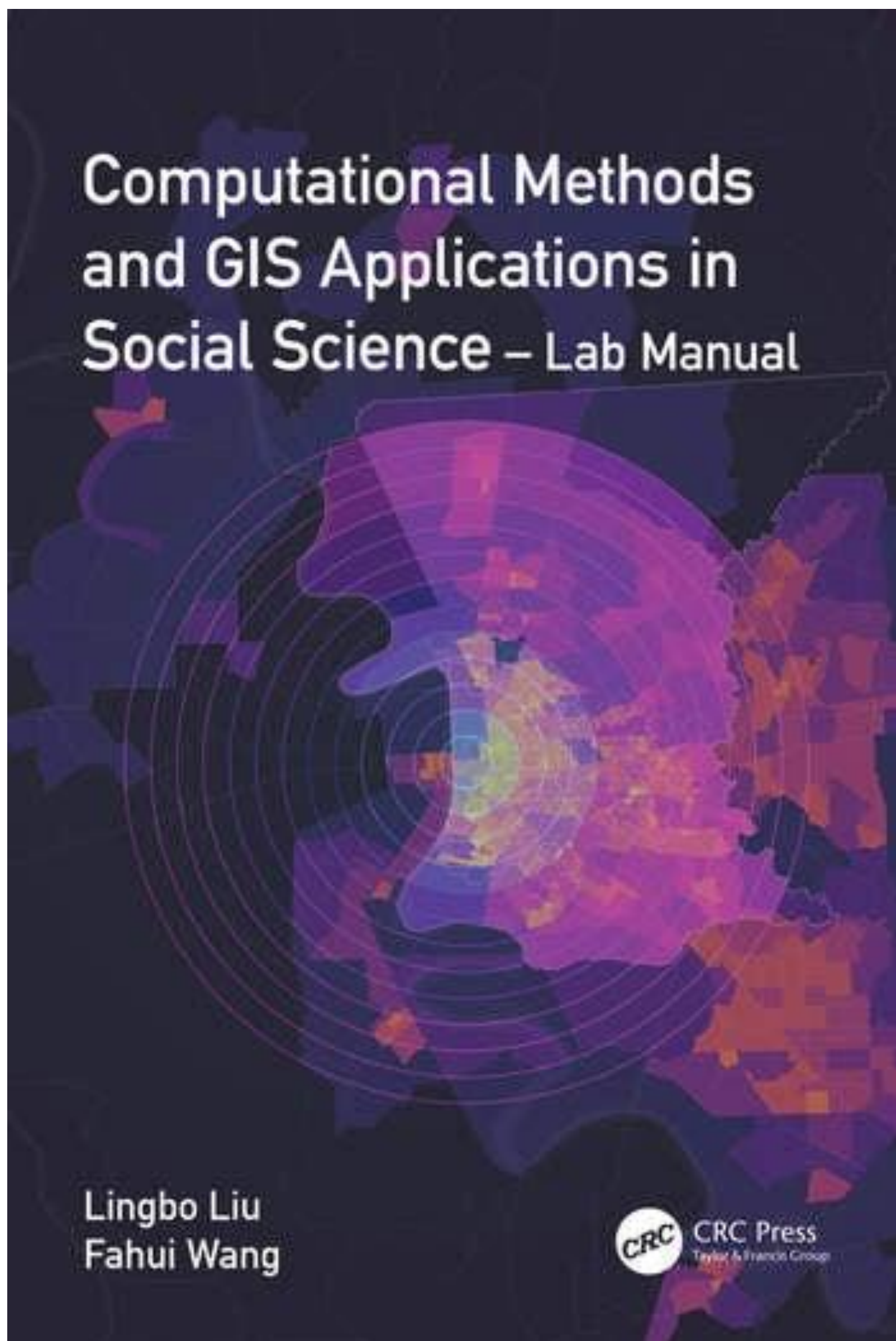
Main book: available

8/15/2023

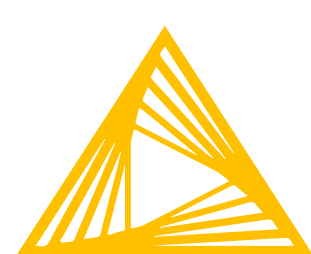
all case studies in ArcGIS
Pro 3.1



ArcGIS Pro
Version 3.1



Lab manual in KNIME:
available 10/15/2023



Open for Innovation

KNIME

Version 5.1

Book Features

Computational Methods and GIS Applications in Social Science

Third Edition

GIS与计算方法在社会科学研究中的应用（英文 第三版）

Fahui Wang, Lingbo Liu

This textbook integrates GIS, spatial analysis, and computational methods for solving real-world problems in various policy-relevant social science applications. Thoroughly updated, the third edition showcases the best practices of computational spatial social science and includes numerous case studies with step-by-step instructions in ArcGIS Pro and open-source platform KNIME.



Michael Batty
Centre for Advanced
Spatial Analysis
(CASA),
University College
London
London, UK

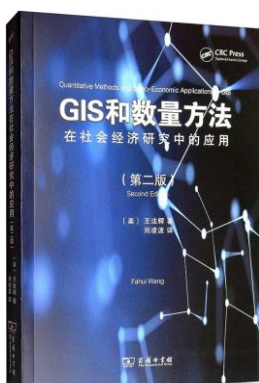
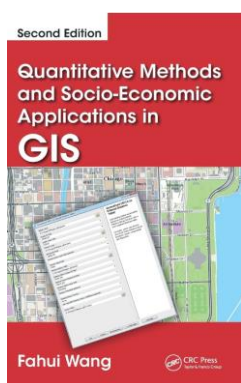
Recommendation

it is now very much a book that is a “**must-read**” for any social scientist who wishes to get a rapid but thorough exposure to GIS and the desktop software that makes it work.

Wang and Liu develop a very well-written operational guide to **the most important GIS techniques available**, and one of the great strengths of the book is that **any potential user** can pick it up and quickly adapt the techniques therein to their own problems.

This is an **important resource** for computational social science, as well as for **urban science** itself and **social physics**.

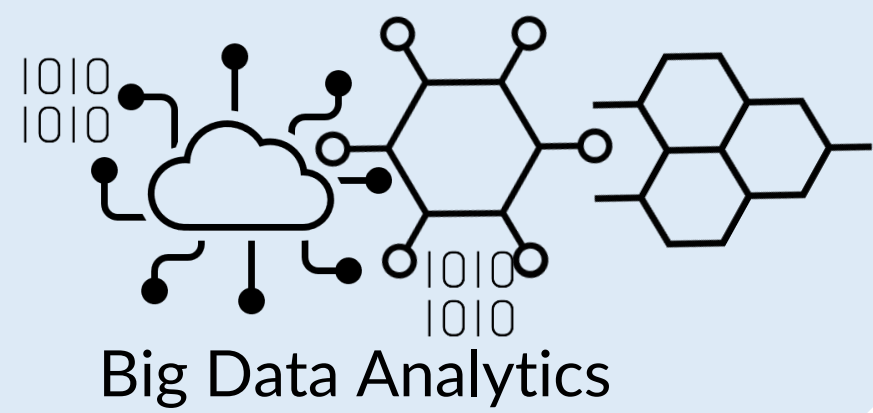
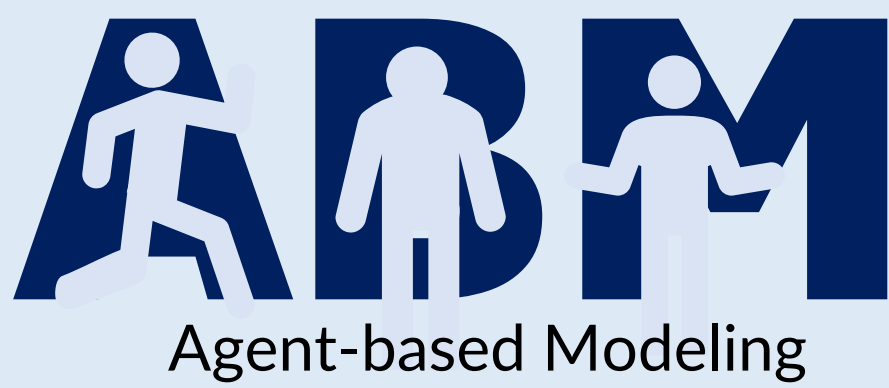
From the Foreword of
Computational Methods and GIS Applications in Social Science



At 60% new materials from 2nd Edition
Quantitative Methods and Socio-economic Applications in GIS
Fahui Wang

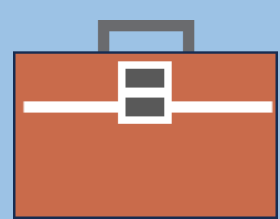
GIS与数量方法GIS在社会科学研究中的应用（第二版），商务印书馆

New Chapters on Agent-based Modeling and Big data analytics

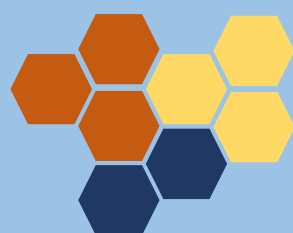


Newly Automated tools in ArcGIS Pro

Google Maps API for OD drive/transit times, Spatiotemporal KDE, 2SFCA/i2SFCA, 2SVCA, Garin-Lowry model, Waste Commute, Minimax, ... and



ArcGIS Toolbox



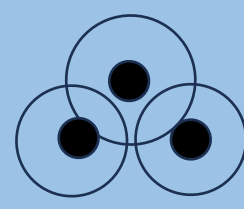
Regionalization:
REDCAP & MLR



Functional
region delineation



Functional
region delineation



Maximum
Accessibility
Equality Problem



Agent-based
crime simulation

Real-world case studies in social science, planning and public policy



Data and Tool Support for implementing all case studies

Provides a website for downloading data and programs for implementing all case studies included in the book and the KNIME lab manual

Data Support



Datasets for
Computational Methods and GIS Applications in Social Science
<https://doi.org/10.7910/DVN/4CM7V4>

Tool Support

Geospatial Analytics Extension For KNIME
<https://github.com/spatial-data-lab/knime-geospatial-extension>
GitHub for Issue support
<https://github.com/UrbanGISer/Computational-Methods-and-GIS-Applications-in-Social-Science>

KNIME Hub Support



Center for Geographic Analysis
Harvard University

<https://hub.knime.com/center%20for%20geographic%20analysis%20at%20harvard%20university>

Intended for students taking upper-level undergraduate and graduate-level courses in [quantitative geography](#), [spatial analysis](#), and [GIS applications](#), as well as researchers and professionals in fields such as geography, [city and regional planning](#), [crime analysis](#), [public health](#), and [public administration](#).

Word Cloud of Book Features



ArcGIS Pro

Handy Tools in ArcGIS Pro

Geoprocessing

Agent-Based Crime Simulation Model

Parameters Environments

Input data

Visualization, export, and animation playback

Model parameters

Police agent behaviors

Offender agent behaviors

Victim agent behaviors

Run

Input data

Base data folder

Data

Boundary of study area

ebr_boundary.shp

CTPP commuting flows for TAZs

ctpp_ebr_taz_utm_fixed.shp

Worker flows for TAZs

ebr_taz_flow_total_workers_sparse.dbf

Road network

tl_2015_22033_road_segments_utm.shp

Spatial grid

ebr_grid_500m_with_roads.shp

OD matrix for spatial grid

E:\CMS_GISV3\Case13\A8MSIM\Data\ebr_grid\vp

Activity locations

ebr_random_points_grid_500m_taz.shp

Census blockgroups

ebr_acs_2015_5yr_bg.shp

Model parameters

Simulation cycle time (minutes)

5

Total simulation cycles

288

No. of agents

500

Percent of offender agents

0.25

Percent of police agents

0.1

Min. recreate cycles

1

Max. recreate cycles

6

Min. moving speed (meters per cycle)

400

Max. moving speed (meters per cycle)

4000

Spatial index resolution for agents (meters)

500

Spatial index resolution for environment (meters)

500

Visualization, export, and animation playback

Running mode

Simulation (Normal)

Real-time visualization (simulation mode only)

Show agent home & job locations in real-time visualization (simulation mode only)

Export simulated crime incidents (simulation mode only)

Output file for crime incidents (simulation mode only)

sim_crime_incidents.csv

Export agent location history from simulation (simulation mode only)

Output file for agent location history (simulation mode only)

sim_agent_location_history.csv

Output file for agent ID, type, and locations of home & job (simulation mode only)

sim_agent_type_home_work.csv

Animation file for agent location history (animation mode only)

anim_agent_location_history.csv

Animation file for agent ID, type, and locations of home & job (animation mode only)

anim_agent_type_home_work.csv

Animation file for crime incidents (animation mode only)

anim_crime_incidents.csv

Display "Activity locations" layer from "Input data" in animation (animation mode only)

Agent-Based Crime Simulator (Mode: Simulation)

No. of cycles: 1

Geoprocessing

Mixed Level: All-in-One MLR

Parameters Environments

Select the input Feature class

LAtrtOne

Name the spatial order (Peano, 0-1) field

PeanoOrd

Name the attribute order field

AttriOrd

Name the normalized attribute order (0-1) field

NAttriOrd

Name the integrated order (spatial & attribute) field

OrdVal

Select a list of attributes to determine attribute order

FACT1

FACT2

FACT3

Assign a list of weights of attributes (match the # of attributes. e.g. 0.5; 0.5 etc. Use the + sign below to add weights)

0.518

0.1178

0.0902

Assign the percent of spatial consideration (spatial + attribute = 100)

90

Select a list of clustering constraints (e.g., pop, cancer_count)

POPU

COUNT06

Assign a list of capacities (match the # of constrains, e.g. 20000, 16. Use the + sign below to add capacity values)

20000

16

Name the sub cluster membership field (in each one-level clustering)

SubClusID

Name the isolated cluster (0 or 1) field

isolate

Select the upper Geo Unit ID field (e.g., county FIPS)

COUNTY

Name the final mixed cluster type field

ClusType

Select the attribute aggregation weight field (e.g. population)

POPU

Name the final mixed cluster ID field

FIClus

Name the final mixed clusters file name (final result)

LAtrtMixFinal

Run

Mix Level Regionalization

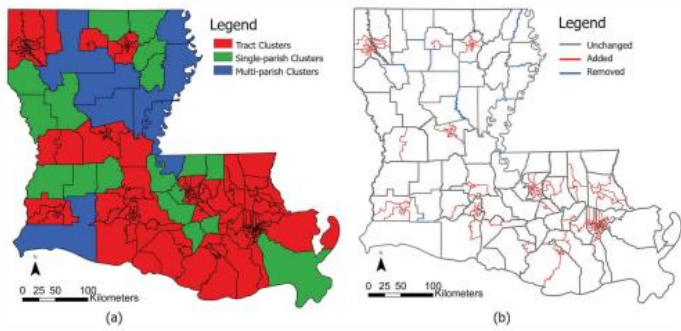


FIGURE 9.11 Constructed regions by mixed-level regionalization (MLR): (a) cluster types and (b) boundary changes between clusters and parishes.

Maximum Accessibility Equality Problem

Geoprocessing

MAEP

Parameters Environments

Input ODmatrix Table

ODdistCh

Origin ID

OriginID

Destination ID

DestinationID

Distance

Dist

Input Demand Table

Village

Demand ID

OBJECTID

Demand Population

Popu

Input Fixed Facilities Table

Hosp41

Fixed Capacity Field

CHCI

Input New Capacity Amount

7237.8

Accessibility Mode

Gravity

Beta for Gravity Model

1

Output Capacity Table

ODdistCh_MEAP

Output Accessibility Table

ODdistCh_ACC

Run

MAEP (r)

Started: Today at 3:10:07 PM

Completed: Today at 3:10:09 PM

Elapsed Time: 2 Seconds

Parameters Environments Messages (10)

Start Time: Monday, September 12, 2022 3:10:07 PM

[1] "647 demand locations with total population of 811446"

[1] "44 facilities with total capacity of 317371.823"

[1] "41 fixed facilities with total capacity of 310134.023"

[1] "A new facilities with total capacity of 7237.8"

[1] "Average Accessibility Score is 0.391118846307099"

[1] "Summary of the standard deviation of different scenarios"

[1] "Extant situation 0.18883"

[1] "Assign average to new facilities 0.18953"

[1] "MEA optimization for new facilities 0.1893"

[1] "MEA optimization for All facilities 0.19323"

Succeeded at Monday, September 12, 2022 3:10:08 PM (Elapsed Time: 1.41 seconds)

OBJECTID * Original Average All New

35 35 2166 2166 6922 2166

36 36 10243.4 10243.4 0 10243.4

37 37 944.7 944.7 0 944.7

38 38 2019.3 2019.3 0 2019.3

39 39 1280.2 1280.2 0 1280.2

40 40 3326.6 3326.6 0 3326.6

41 41 1213.8 1213.8 0 1213.8

42 42 0 2412.6 1580.1 2746.8

43 43 0 2412.6 1790.1 2126.1

44 44 0 2412.6 1320.8 2364.9

OBJECTID * OrigAcc AverAcc AllAcc NewAcc

1 1 0.16099 0.165425 0.221613 0.183528

2 2 0.159407 0.163909 0.21912 0.181574

3 3 0.182388 0.187209 0.256287 0.210301

4 4 0.197527 0.202571 0.281907 0.229643

5 5 0.212351 0.217579 0.307802 0.248871

6 6 0.163087 0.167563 0.224929 0.18612

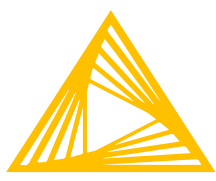
7 7 0.182114 0.186931 0.255832 0.209954

8 8 0.182205 0.187023 0.255982 0.210069

9 9 0.204555 0.209691 0.294089 0.238726

10 10 0.26263 0.26829 0.400477 0.315764

Agent-base Model



Open for Innovation

KNIME

Geospatial Analytics Extension for KNIME

Developed by Harvard CGA and KNIME

KNIME workflow as
Open Visual Programming Platform

Visualization

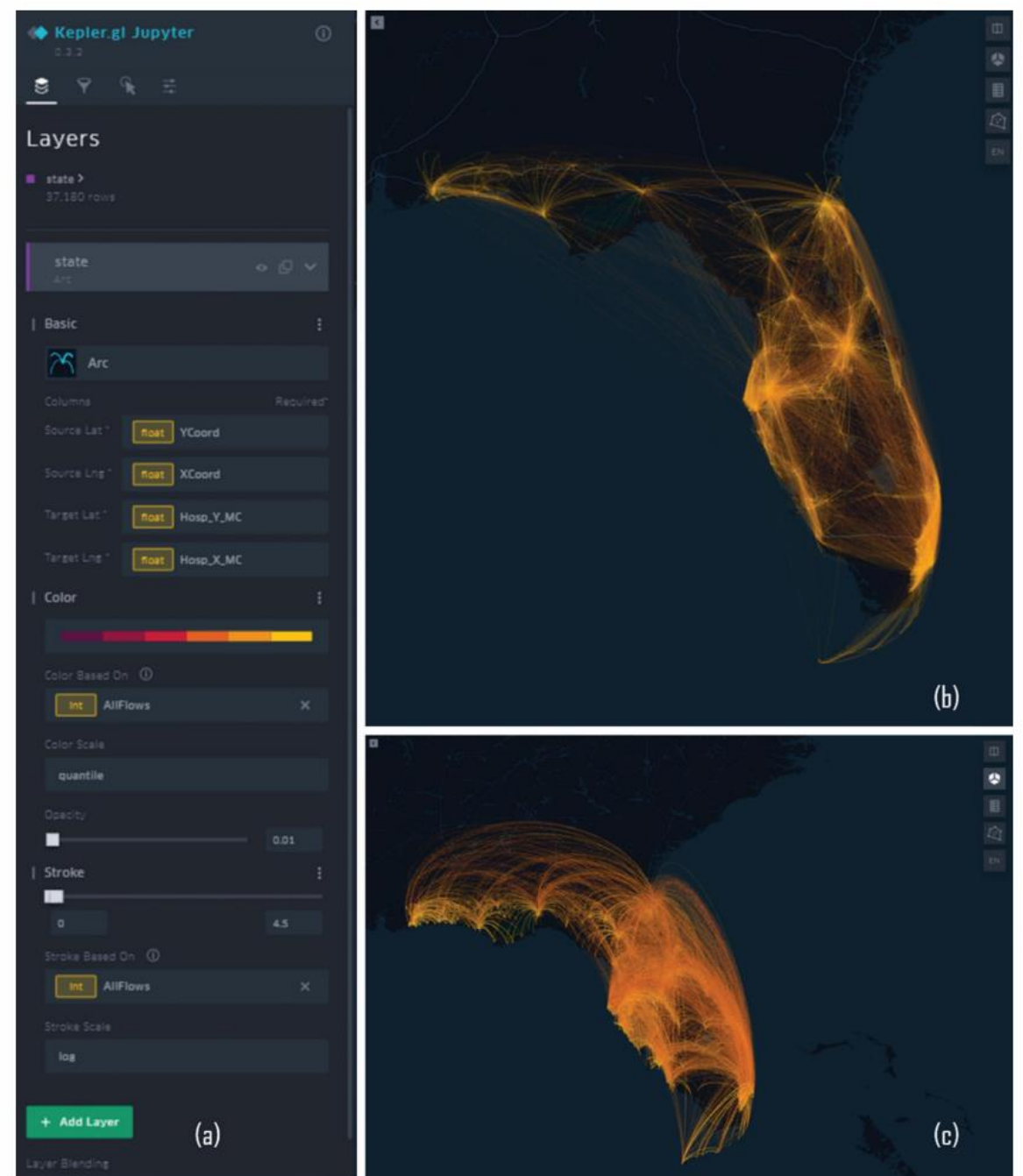
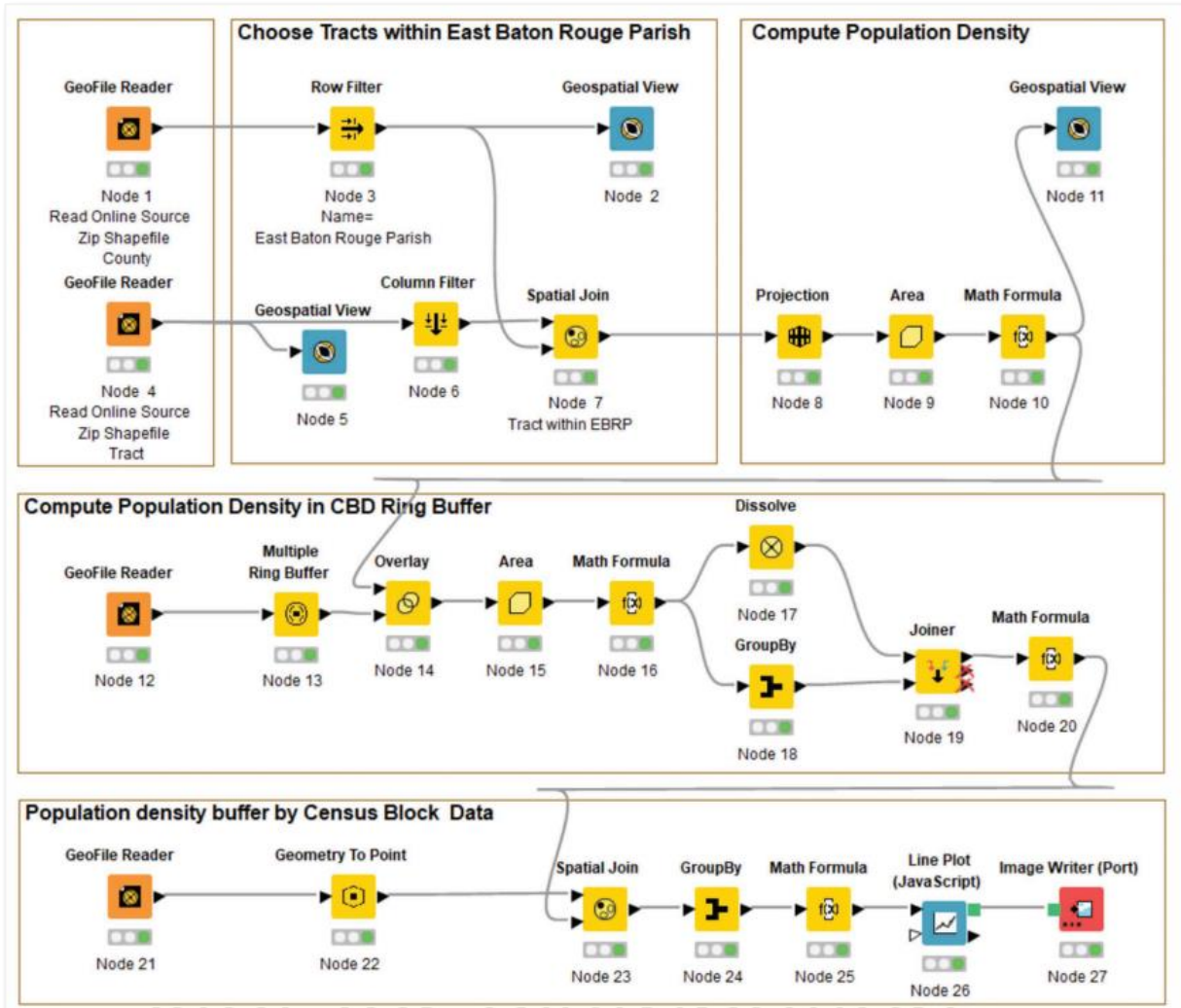
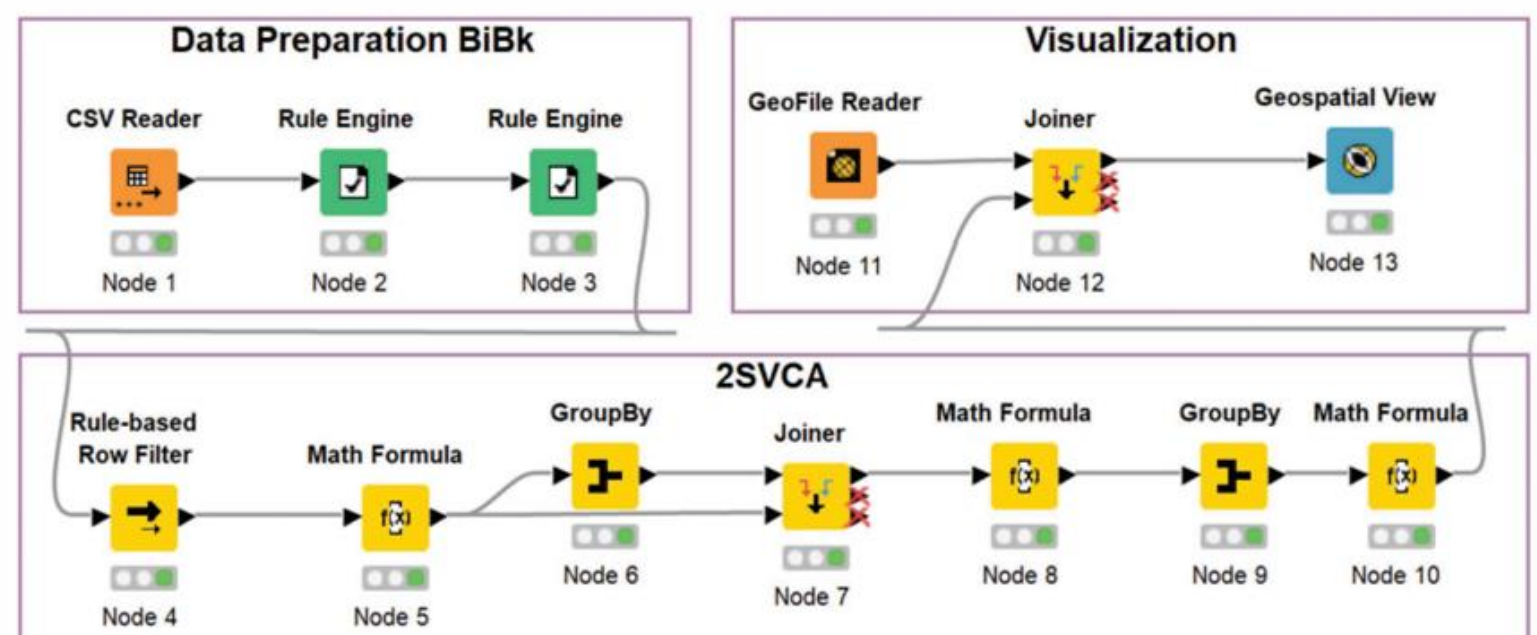


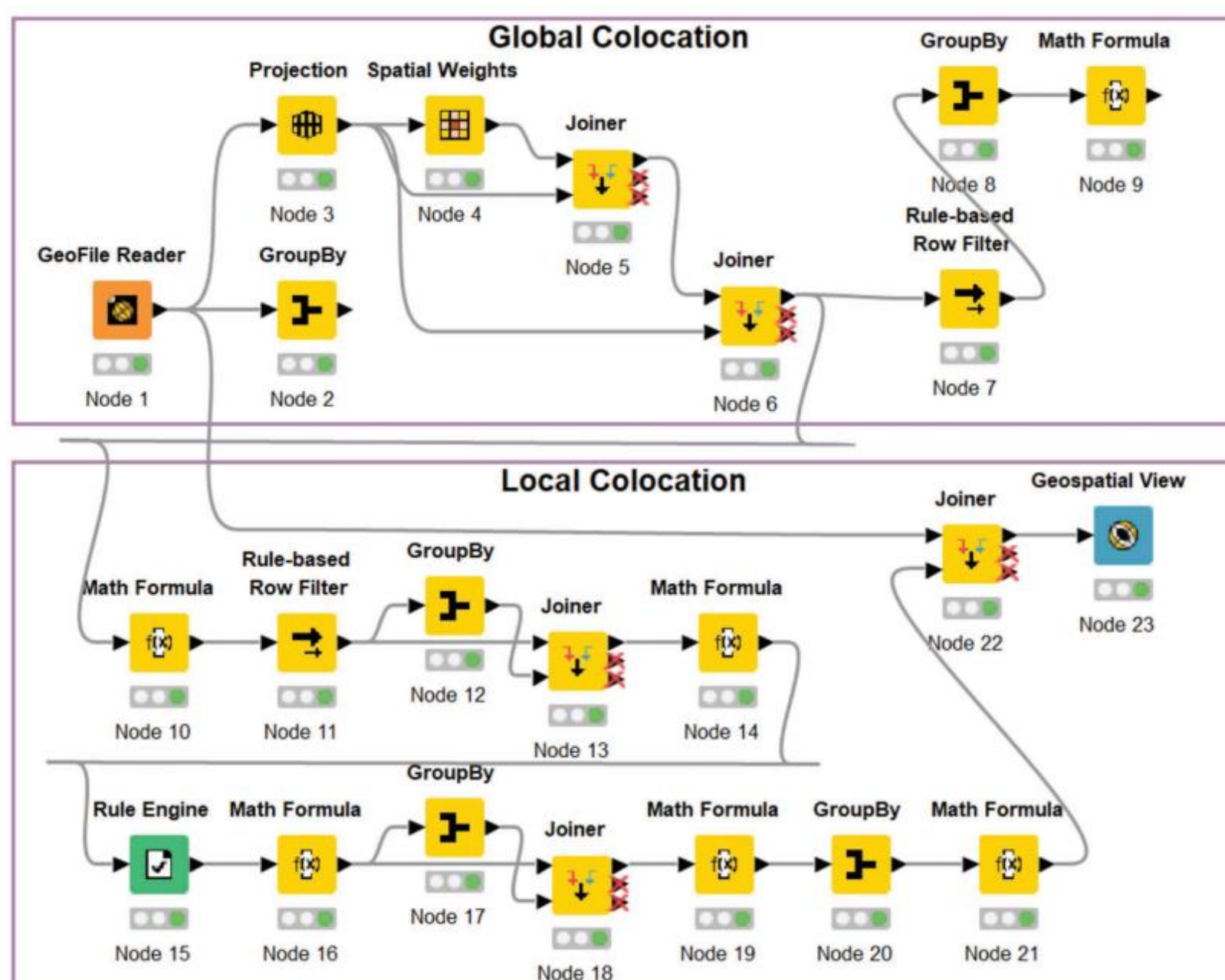
FIGURE 4.6 Visualization of OD flow between residential areas and hospitals: (a) Parameter pane, (b) 2D Map, and (c) 3D Map

User Interface
Created by KNIME Component

2SVCA Model nodes



Colocation Model nodes



A
Replicable
Reproducible
Extendable
Framework
GIS