Drainage tree construction based on patterns in a river network

Ling Zhang, Nanjing Normal University, China
Eric Guilbert, Laval University, Canada
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Introduction

- Map generalization
  - “generalization is not a mere reduction of information – the challenge is one of preserving the geographic meaning” (Bard & Ruas, 2005)

- River network generalization
  - Drainage patterns
    - Topography, soil type, bedrock type, climate, vegetation cover

Dendritic  Parallel  Trellis  Rectangular  Reticulate  Radial  Centripetal
Introduction

Order scheme

Drainage patterns

Rivers → River networks → Drainage tree → Generalization

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Related works

- Ordering scheme for river tributaries
  - Horton–Strahler scheme
  - Shreve scheme

- Coding system for drainage basins
  - Praestetter codification

No consideration of drainage patterns
Construction methods

- Identify reticulate patterns
- Build a drainage tree of sub-networks
- Characterize drainage patterns
- Merge adjacent pattern of same type
Identify reticulate patterns
- Bridge-finding algorithm
- Remove and replace as nodes
Build a drainage tree of sub-networks
- Horton–Strahler scheme (Strahler, 1957)
- Main stream represents each sub-network
- From upstream to downstream
Characterize drainage patterns

- Geometric indicators (Junction angle, sinuosity, length ratio, catchment elongation)
- Fuzzy logic

Zhang & Guilbert, 2013
- Merge adjacent pattern of same type
  - From the root to leaves
  - If **adjacent** sub-networks are same pattern, they can be merged
  - Adjacent: If connect to same segment and lie on the same side, or connect to a same node

Adjacent sub-networks:
A river stream can be split in sections forming different drainage patterns.
Experiments

- Experimental data
  - Russian river, California, USA, 1:24000 scale

- Drainage tree result

- Multiple representation of drainage tree at different levels
Result

- Drainage tree

Sub-networks starting from order 4
Sub-networks starting from order 3
Sub-networks starting from order 2

Dendritic
Parallel
Trellis
Rectangular
Result

- Drainage tree

Sub-networks starting from order 4
Sub-networks starting from order 3
Sub-networks starting from order 2

Legend:
- Reticulate
- Dendritic
- Parallel
- Trellis
- Rectangular
Multiple representation of drainage trees at different levels
Summary

- Drainage pattern hierarchy
- A recursive method, implement easily
- Provide a qualitative description of terrain
- Used for generalization

Future work
- Influence of scale
- More application