#### Drainage tree construction based on patterns in a river network

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

# Contents

- Introduction
- Related works
- Drainage tree construction
- Experiments and results
- Summary



# 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



## Introduction





# **Related works**

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





A. Horton-Strahler order scheme

B. Shreve order scheme

- Coding system for drainage basins
  - Prafstetter 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:



connect to same segment and lie on the same side



connect to a same node



### 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



# Result

 Drainage tree



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



# Result

**Multiple** representatio n of drainage trees at different levels

![](_page_14_Figure_2.jpeg)

# 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