

Modeling Structure and Patterns in Road Network Generalization

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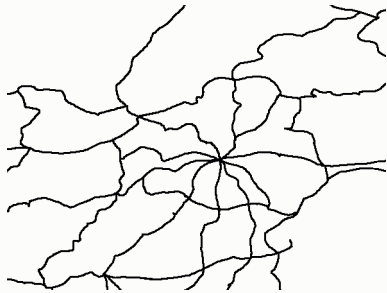
Zhongshan University



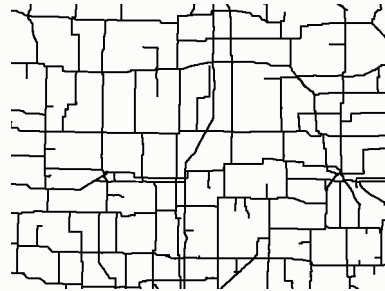
Lund University

Spatial patterns in road networks

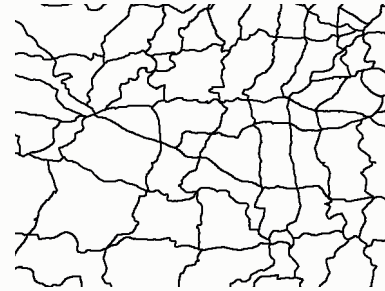
□ star-like, grid-like and irregular network



Star-like pattern
Beijing, China



Grid-like pattern
North Iowa, USA



Irregular pattern
North China



Density differences
Lund, Sweden

Data source: accessed from ...

□ density differences

Salient components / properties

Star-like (radial) patterns

- A hub-like junction
 - * with proportionately high degree
- A group of roads cross the hub-like junction, or converge at it.
- (optional, repeatable) Circular roads surrounding the hub junction

Salient components / properties

Grid-like (Manhattan-style) patterns

- ❑ A group of roughly parallel roads.
- ❑ Another group of roughly parallel roads, which intersect the first group of roads with roughly perpendicular angles.

Irregular patterns

- ❑ No components are repeated regularly.

Density differences

- ❑ Obvious density differences in a road network.

Identify salient components

- star-like pattern



Identified radial roads



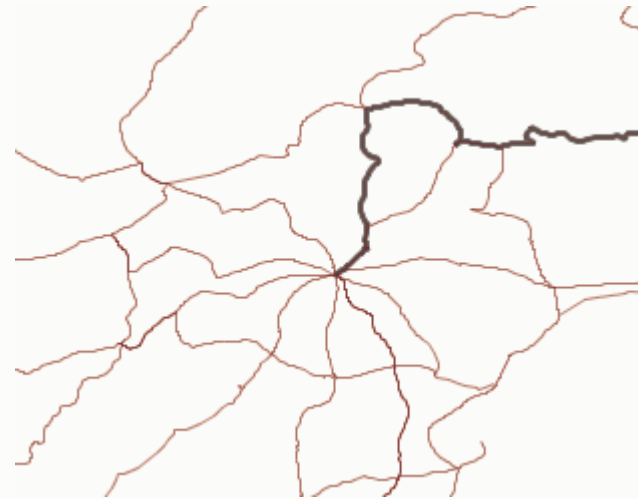
Wrongly combined radial roads

Identify salient components

- star-like pattern



Identified circular roads



Wrongly combined circular roads

Identify salient components

– star-like pattern

Method – create “stroke” from segments

- ❑ Radial roads can be roughly identified.
- ❑ A few circular roads are identified.

Problem:

- ❑ Both radial and circular roads may be wrongly combined.

Solution:

- ❑ Test clean data.
- ❑ Considering hub-like junction.
 - Radial should touch or cross the hub.
 - Circular roads should surrounding the hub.

Identify salient components

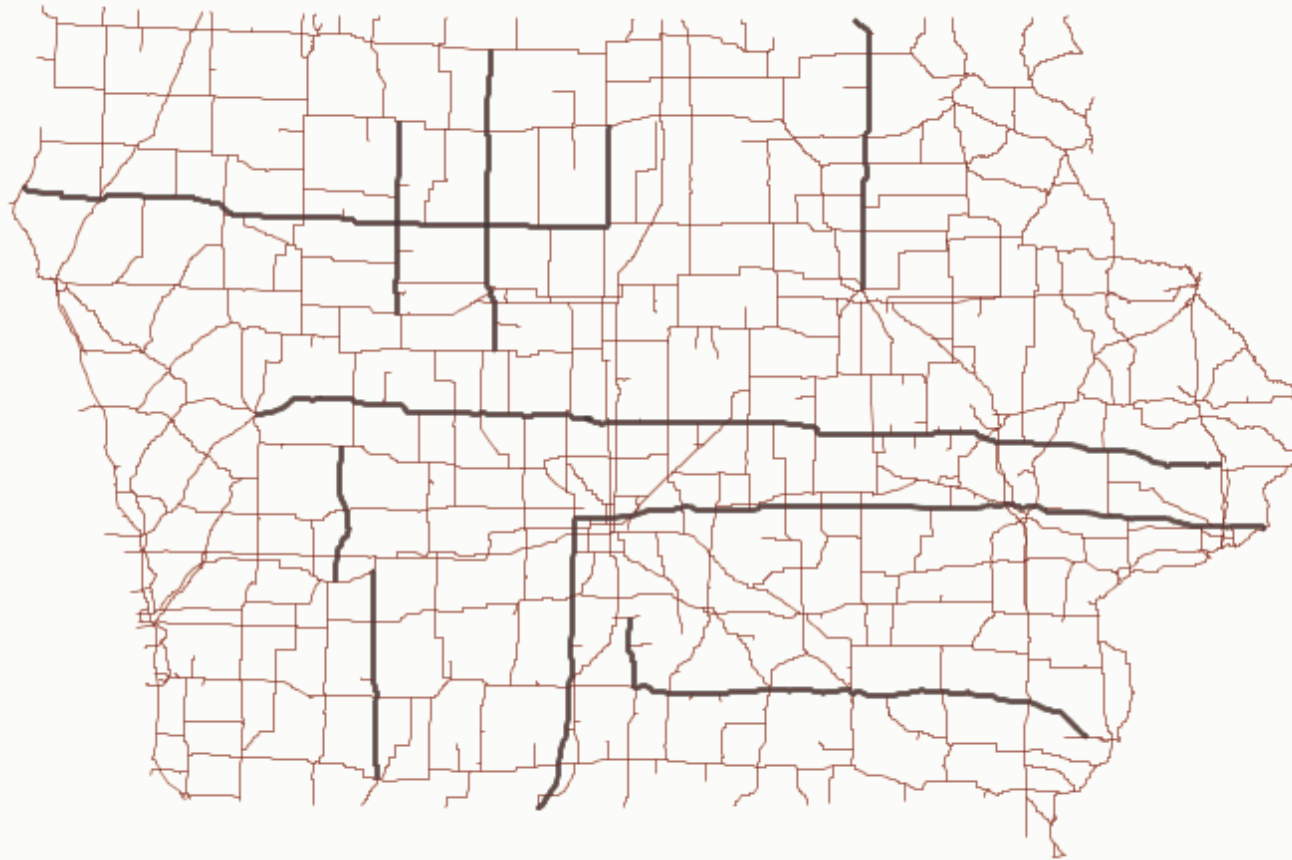
- star-like pattern



Original data errors: wrongly shaped, repeated digitized, ...

Identify salient components

- grid-like pattern



Identify salient components

– grid-like pattern

Method – create "stroke" from segments

- ❑ Two groups of roads can be roughly identified.
- ❑ Each group consists of parallel roads.

Problem:

- ❑ Segments with different directions may be combined into one "stroke".

Solution:

- ❑ Consider direction deviation.
- ❑ Only segments with similar direction will be combined.
 - good continuation.
 - similar direction.

Generalize Patterns

Star-like (radial) patterns

- ❑ Selectively omit the radial roads.
- ❑ Retain or omit the rings surrounding the hub.

Grid-like (Manhattan-style) patterns

- ❑ Selectively omit parallel roads.

Irregular patterns

- ❑ No special patterns need to be considered.

Density differences

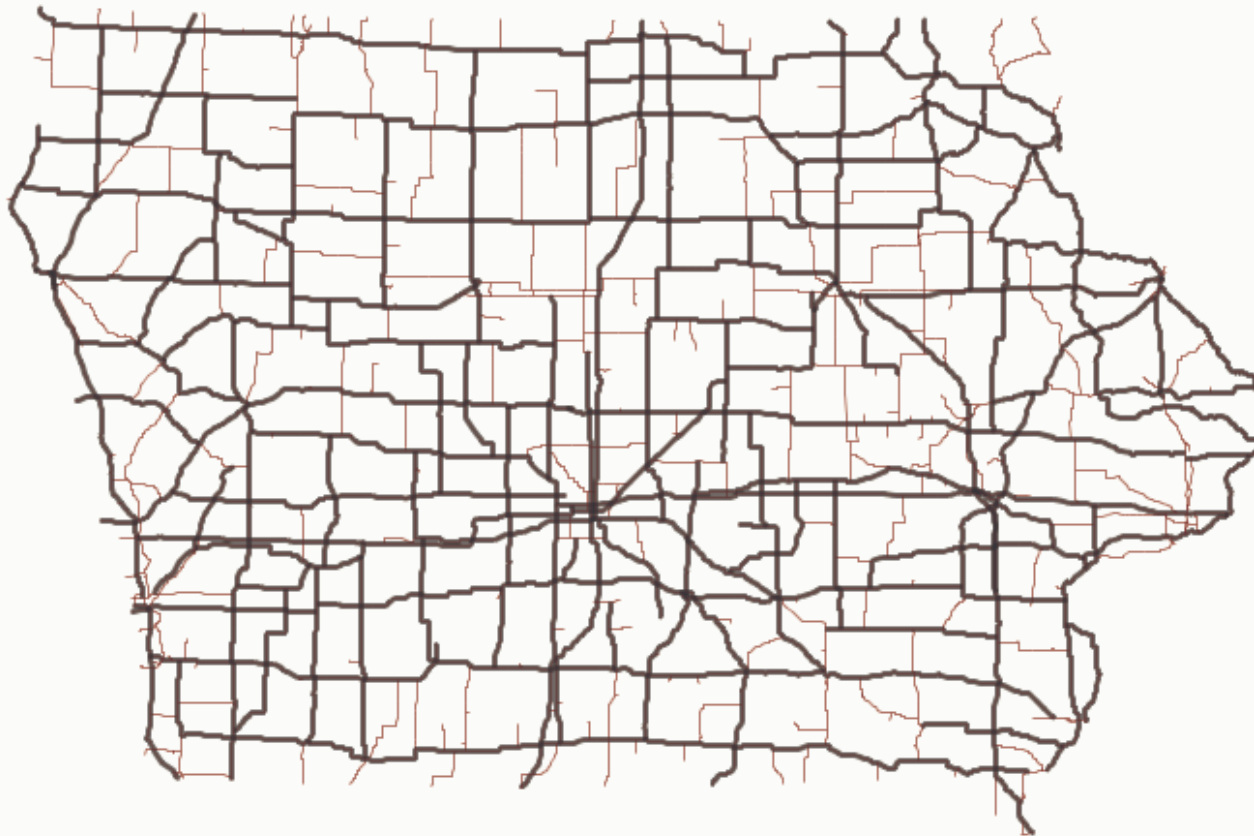
- ❑ Identify density differences by number of connections.
- ❑ Generalize density differences by number of connections.

Generalize by length



Bad selection, star-like pattern destroyed

Generalize by length



Bad selection, grid-like pattern damaged

Generalize density differences



Original data



Generalized
by length
30%
reduced



Generalized
by number of
connection
and length
30%
reduced



Generalized
by the
production of
length and
connection-
ratio
30%
reduced