Georeferencing: Theory and Challenges

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AAH-DARIAH-ARDC
Thursday 28 March
Knowledge Exchange Session 2
GeoHumanities
ST Representation

<algorithm>

<references>
GIScience is an information science (Kemp, 2008)

Refers to the scientific study of geographic information (GI)

Requires understanding of
- Fields of inquiry
- Knowledge creation methods
- Shared expertise across fields (Duckham, 2017)
Epistemology
Teleology

Perspectives
Definition:

The linking between an entity and a spatial footprint

Entity must have spatial grounding
Semiotics

Ogden and Richards (1923)
Georeferencing process

General components (Goldberg, 2017)

1. Input
2. Parsing
3. Feature Matching
4. Feature Interpolation
5. Output

Reference data
Example input

1. Text
   Character
   a) Structured (e.g. address)
   b) Unstructured (e.g. toponym)

   Integer
   c) Structured (e.g. joining IDs)

2. Raster
   d) Grid (e.g. image transformation)
a) Address geocoding

Assigning an address a spatial footprint

Input: Text (char, structured)

Example: “64 Lincoln Ave Melbourne Australia”

a) Address geocoding

Reference data:
- Address file
  - G-NAF Live
  - G-NAF Open (3 months)

a) Example geocoding levels

<table>
<thead>
<tr>
<th>Address Input</th>
<th>Geocoding Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>“64 Lincoln Ave Melbourne Australia”</td>
<td>Point</td>
</tr>
<tr>
<td>“Lincoln Ave Melbourne Australia”</td>
<td>Line</td>
</tr>
<tr>
<td>“Melbourne Australia”</td>
<td>Polygon</td>
</tr>
<tr>
<td>“Australia”</td>
<td>Polygon</td>
</tr>
</tbody>
</table>
But existing tools are a black box

Google
Bing
Mapbox
PSMA
Gisgraphy
HERE
Geocode.xyz
LocationIQ
Tomtom
Geocode.farm
Yahoo BOSS
geocode.earth
SmartyStreets
...

Feature matching algorithm?
Reference datasets?
Digital methods –

How do we know that one approach is appropriate for another’s purpose?
Location vs place

Observatory Hill, SA

How might this place be represented?

What else might we need to consider?
b) Toponym resolution

Assigning a toponym (place name) a spatial footprint

Input: Text (char, unstructured)

Example: “Lake Macquarie”
b) Toponym resolution

Adapted from Goldberg (2017)
Place description: NSW 1881 Census
Source: http://hccda.ada.edu.au/
b) Toponym resolution

Reference data:

- Gazetteers
  - National (e.g. GA)
  - State (e.g. VICNAMES)

- Other
  - GeoNames (http://www.geonames.org/)
  - DBpedia (https://wiki.dbpedia.org/)
  - ANPS (http://www.anps.org.au/)
  - ...

Multiple candidates

“Lake Macquarie” – “Awaba”

What ST representation?

Base layer: Google Earth (2019)

http://www.geonames.org/search.html?q=lake+macquarie&country=AU
Ambiguity resolution ST

The process of identifying a single spatial footprint from multiple candidates

This process can be assisted using:

- Confidence scores
- Ontologies
- ST extents
- Previous research (feedback)
Places can change...
The Electoral District of Kahibah was created in 1894 ...
It was abolished in 1920 with the introduction of proportional representation.
It was recreated in 1927.
It was abolished and partly replaced by Waratah in 1930.
It was recreated in 1950
It was abolished again in 1971 and replaced by Charlestown.

Source: DBpedia.org
Historical challenges

What about bias?

Sands & McDougall Directories

Yellow Pages

Source: http://www.abc.net.au/news
External world knowledge cannot be derived from linguistic principles alone

Leidner (2017)
Thought experiment

Imagine we had a complete repository of reference data

for the entire world...
for all time...

Could we identify a location?
Could we identify a place?
c) Joining IDs

ABS SA2 Boundaries 2016

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<th>SA2_5DIG16</th>
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</table>
d) Image transformation

Software: ESRI ArcMap 10.x

Thank you

Steve Bennett, Steve McEachern, Steve Cassidy, Rob Hutton and members of the HASS DeVL team

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