

Exploiting Vague Spatial Information in Geographic IR

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Geographic IR: local search

Search for:

e.g. restaurants, dentists,
museums

Make this my default Yahoo! location

 Search Yahoo! Local from your desktop. [Get Yahoo! Search Widget](#)

Location:

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Address, City & State, or ZIP

Search

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 **Your search matched multiple cities**

Please select the correct location:

Brussels, IL
Brussels, WI

Cancel

Select & Search

Geographic IR: local search

1. **Cascadia Restaurant** 

(206) 448-8884 2328 1st Ave, Seattle, WA 0.31 mi

[Map](#) | [Directions](#) | [Send to Phone](#) | [Save to Collection](#)

 ...most accessible. The same is true of Cascadia, his landmark **restaurant** in Belltown. The... [more](#)

See all: [All Bars, Pubs, & Clubs](#) - [Restaurants](#) - [American Restaurants](#)

www.cascadiarestaurant.com





Contact information

Geographic IR: local search

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Location information

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Description

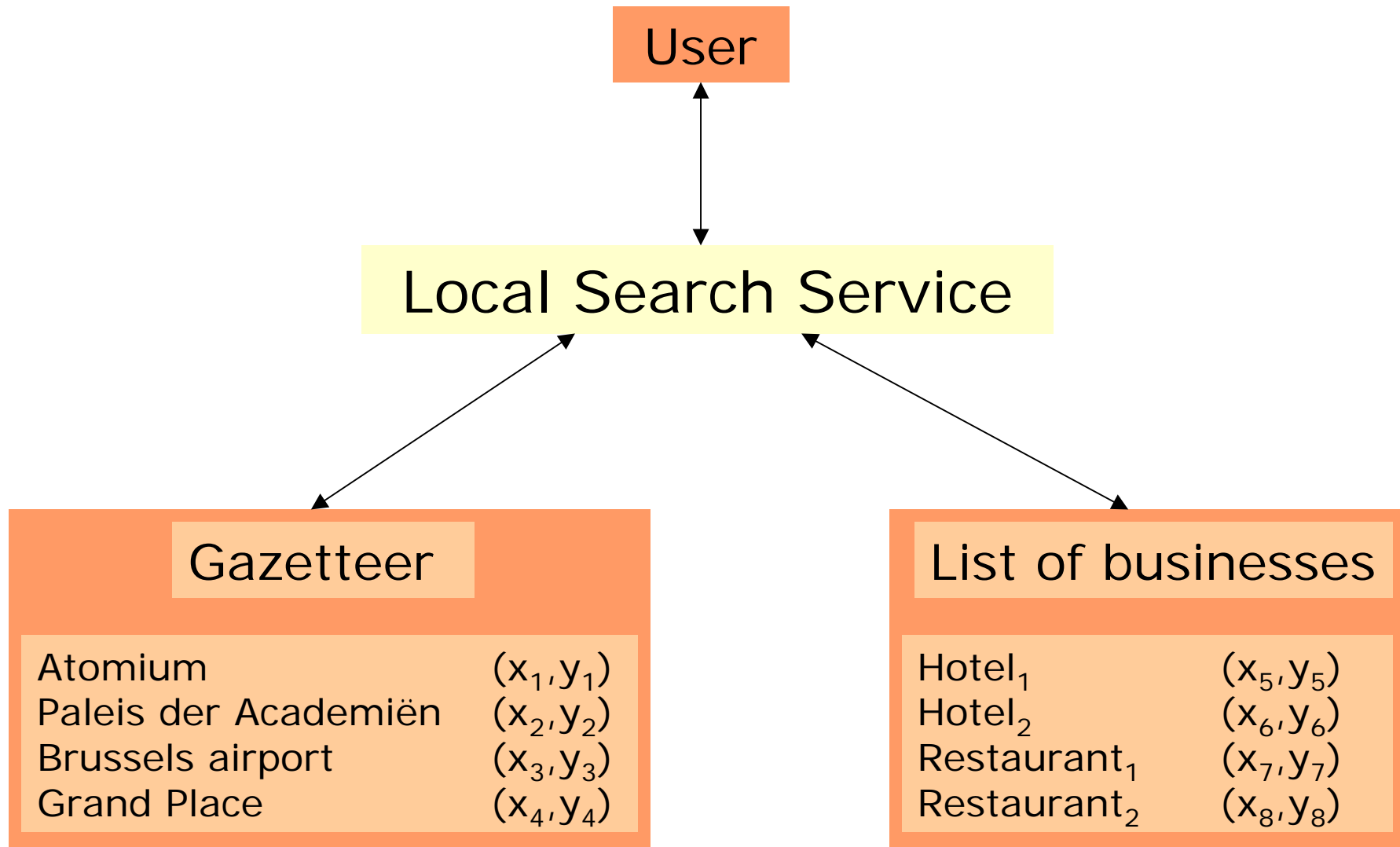
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User ratings

Typical architecture



Problems

- Limited coverage
 - E.g. no businesses in Belgium
 - Some shops, restaurants, hotels are missing

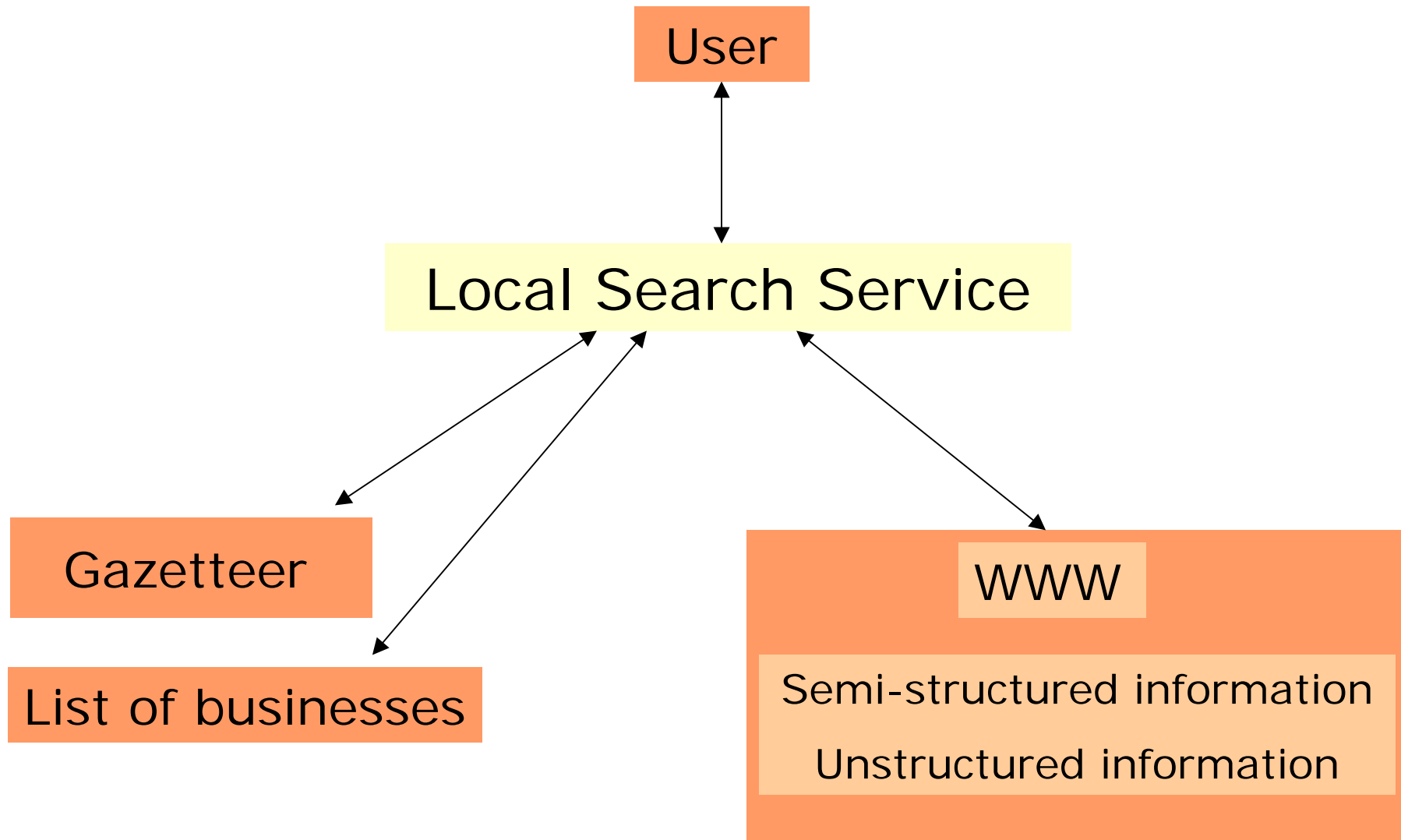
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 - Some landmarks have more than one name
 - Many landmarks are not covered by a typical gazetteer

Problems

- Limited coverage
 - E.g. no businesses in Belgium
 - Some shops, restaurants, hotels are missing
- Limited support for landmarks
 - Some landmarks have more than one name
 - Many landmarks are not covered by a typical gazetteer
- Limited support for neighborhoods/regions
 - Most neighborhoods are unknown to the system
 - Some neighborhoods are reduced to their centroid

Proposed solution



Semi-structured information

The diagram illustrates the process of geocoding. It shows a flow from 'Name' and 'Address' to 'Coordinates' via 'geocoding'. The 'Name' and 'Address' boxes are connected to the 'Coordinates' box by a vertical arrow labeled 'geocoding'. Two green arrows point from the 'Name' and 'Address' boxes to the 'Alma Grand Place Hotel' entry in the screenshot, which has its name and address highlighted with a green box.

Brussels Hotels - Special Rates

Special Internet Rates - Book online or call toll free in the US or Canada: **1-800-403-4176** ... or in Europe: 0 800 032 8868
LOWEST HOTEL RATES...GUARANTEED!

Alma Grand Place Hotel Rue Des Eperonniers 42, Brussels, BE 01000	\$108.09 - 240.44 USD
Aris Grand Place Hotel Brussels Grasmarktstraat 78 80, Brussels, BE 1000 Aris Grand Place Hotel Brussels Discount Hotels	\$114.31 - 239.61 USD
Aristote Hotel Avenue De Stalingrad 7, Brussels, BE 1000 The Aristote Hotel is a townhouse with a 19th century façade, within 600 metres of the Mannekin Pis monument and Grand Place in Brussels city centre....	\$78.99 - 146.57 USD
Arlequin Grand Palace Rue De La Fourche 17/19, Brussels, BE 1000 The Brussels Arlequin is a modern hotel situated in the centre of historic Brussels, 100 metres from the impressive Grand Place....	\$101.19 - 280.40 USD
Astrid Centre Hotel 11 Place Du Samedi. Brussels. BE 1000	\$92.09 - 174.61 USD

<http://www.hotel-rates.com/belgium/brussels/>


Unstructured information

Aris Grand Place Hotel Brussels in Brussels, Belgium - Microsoft Internet Explorer

Bestand Bewerken Beeld Favorieten Extra Help

Vorige → → × ↻ ↺ Zoeken Favorieten Geschiedenis

Adres <http://www.hotel-rates.com/belgium/brussels/aris-grand-place-hotel-brussels.html> Ga naar



Aris Grand Place Hotel Brussels

Grasmarktstraat 78 80
BRUSSELS, BE 1000

The new Aris Centre Hotel is extremely well situated near the world-famous Grand Place in Brussels. It is located in the heart of the old city, next to the picturesque Rue des Bouchers and all of the city's major shopping and sightseeing opportunities.

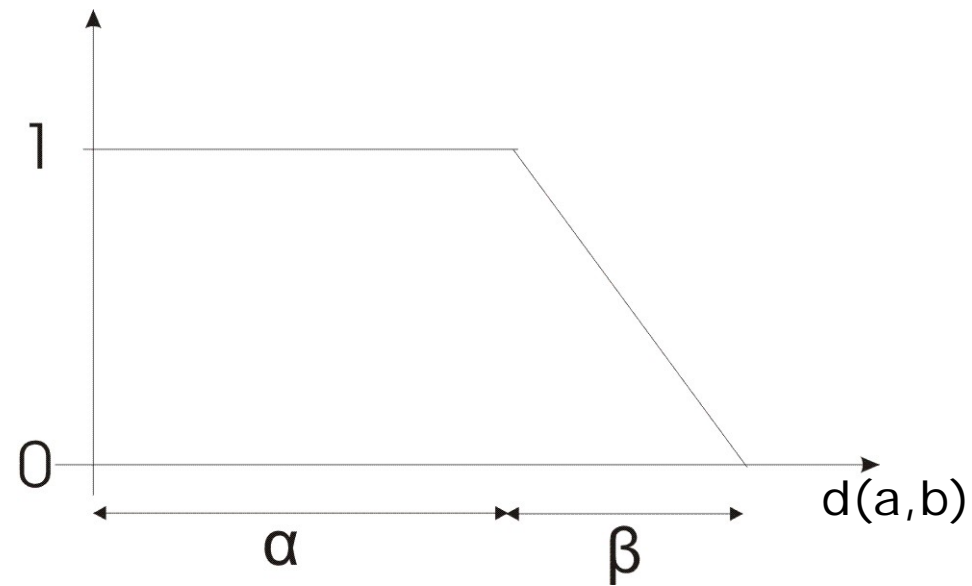
The hotel has 55 modern and large rooms, each of which is fully equipped with all new facilities including air-conditioning, television, telephone, internet and laptop connection, private safe-deposit box, work desk and a newly remodeled bathroom.

The hotel staff is eager to please and guarantees professional and multilingual service. Feel free to relax in the hotel's charming lobby. Metro and bus lines are easily accessible, and an underground car park is available 50 meters from the hotel. The Central Railway Station is 300 meters away. Whether it's business or pleasure that brings you to Brussels,

[More Hotel Photos](#)

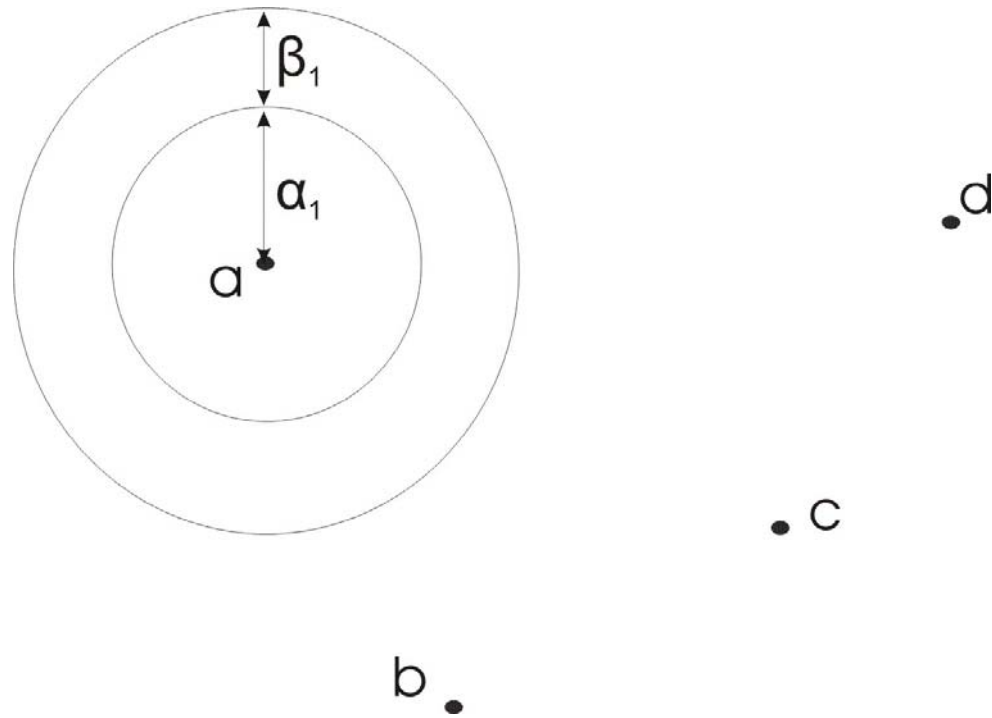
Representing closeness

a is located at walking distance from b



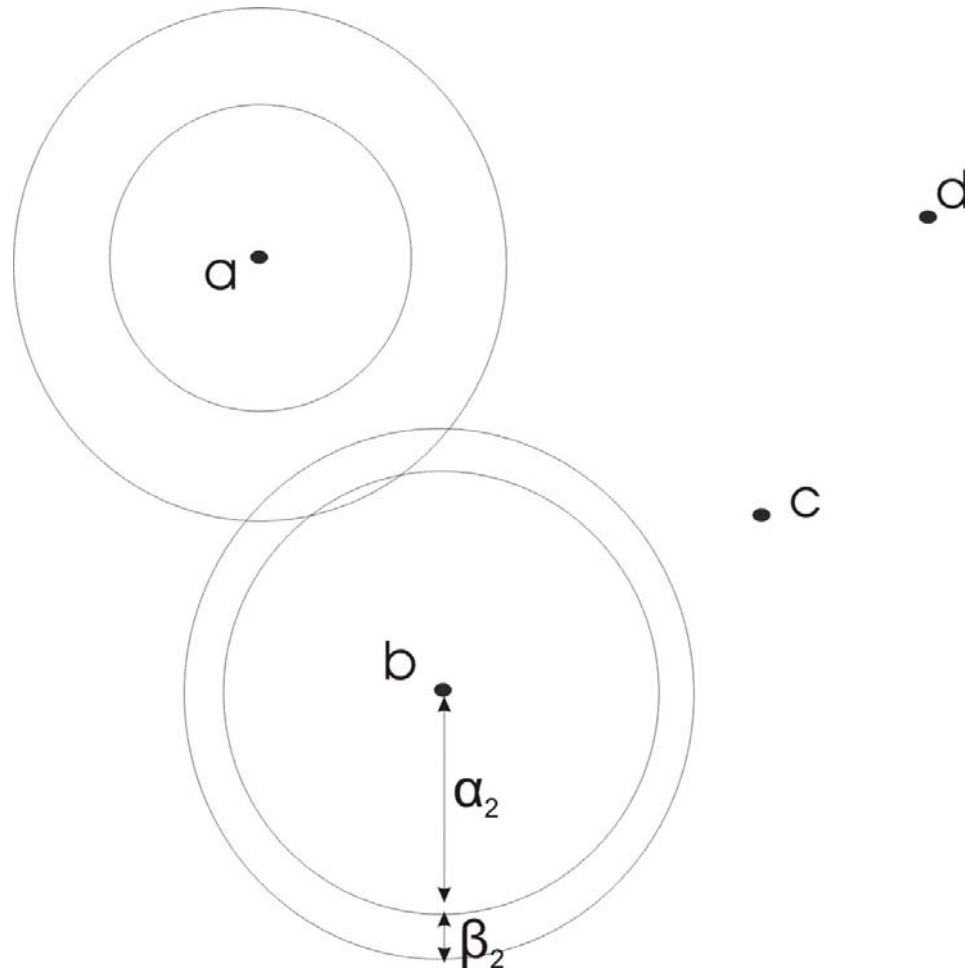
Location approximation

x is located at walking distance from a



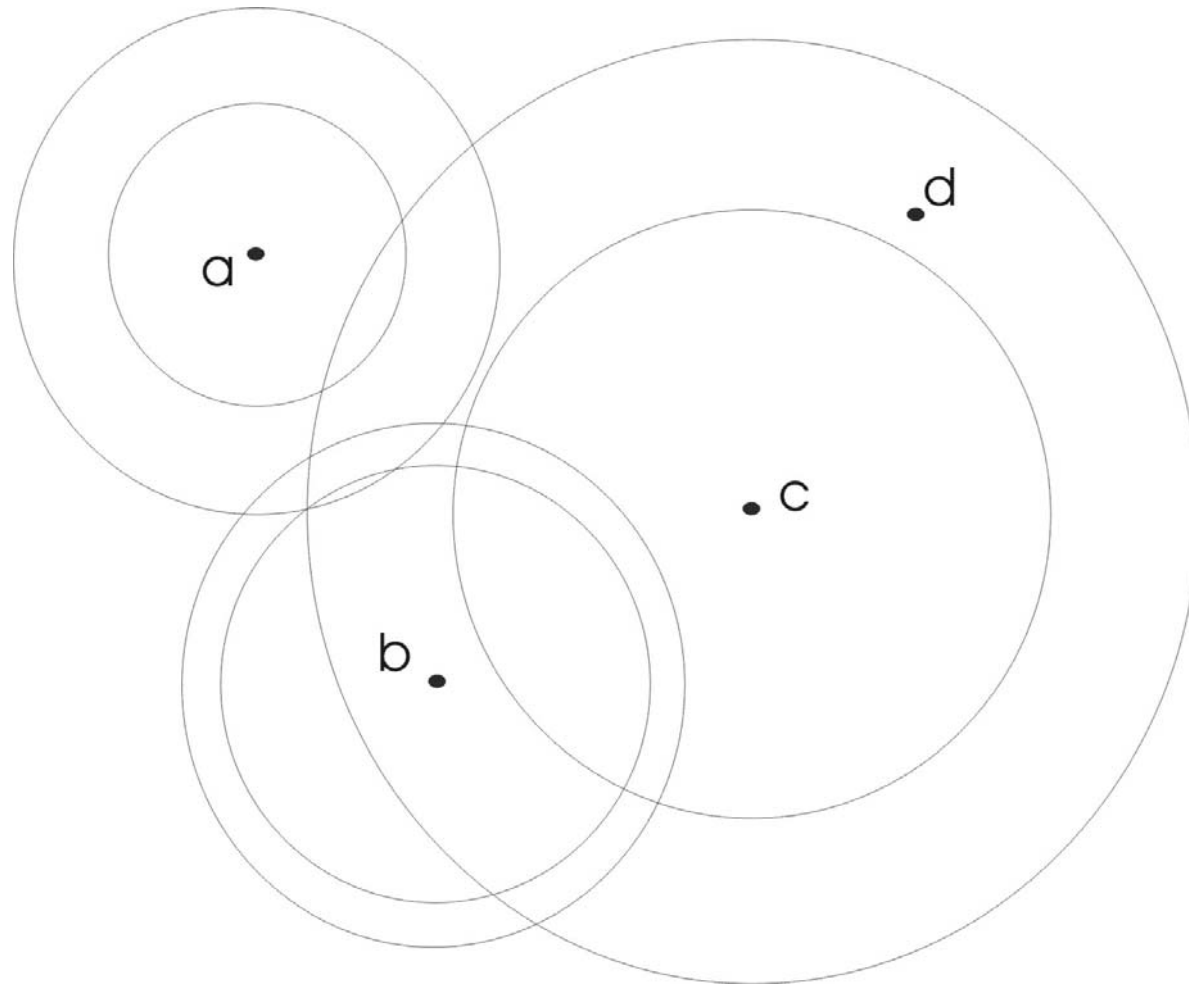
Location approximation

x is located two kilometers from b

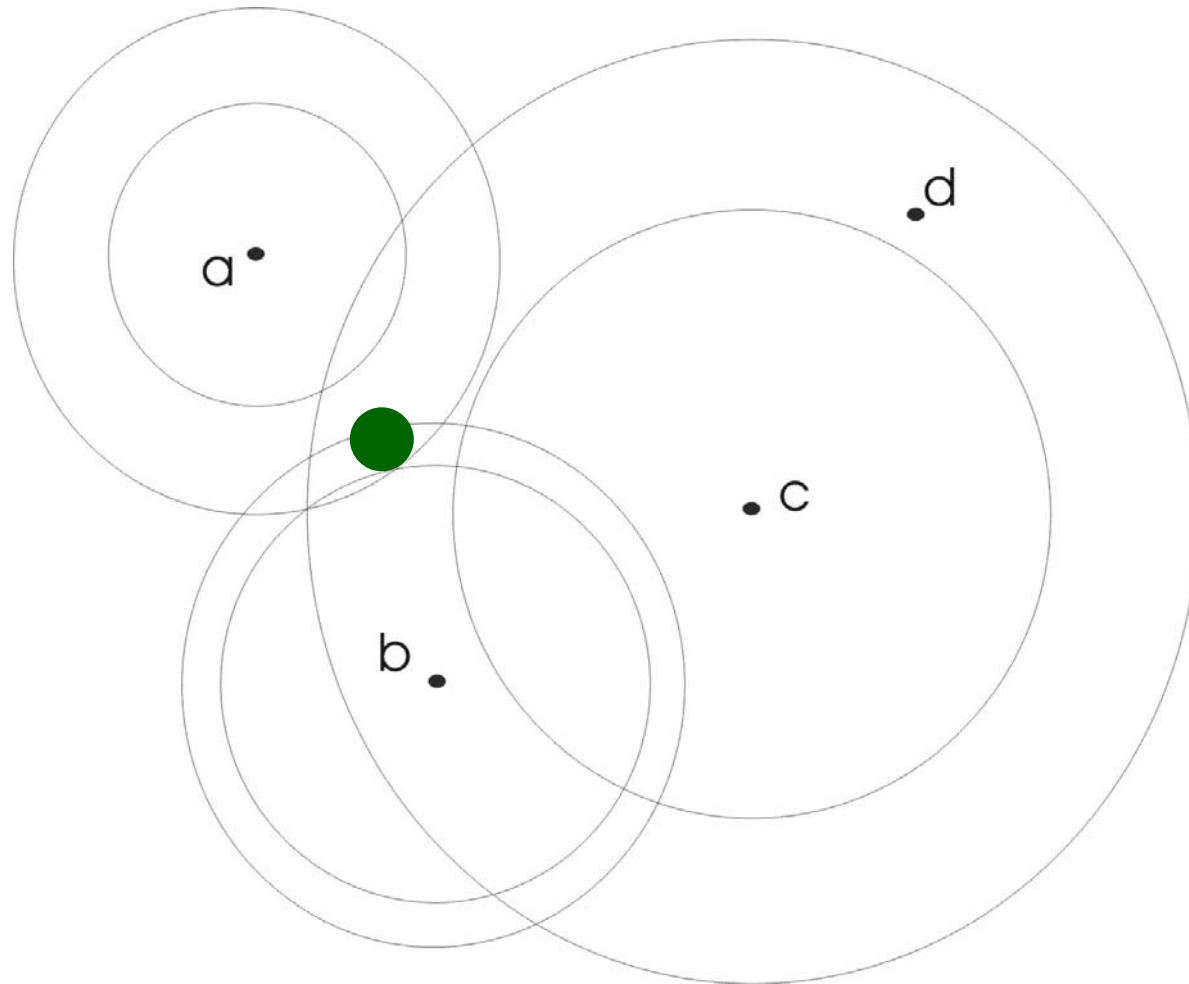


Location approximation

x is located near c



Location approximation



Neighborhoods

- What are the boundaries for neighborhoods such as
 - European Quarter
 - City Center
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- Boundaries are often vague
 - Gazetteers contain no information on the boundaries
 - Sometimes a centroid is provided
- Boundaries could be useful
 - To support queries like
“Restaurants in the European quarter”
 - To interpret natural language statements such as
“The hotel is located in the European quarter”

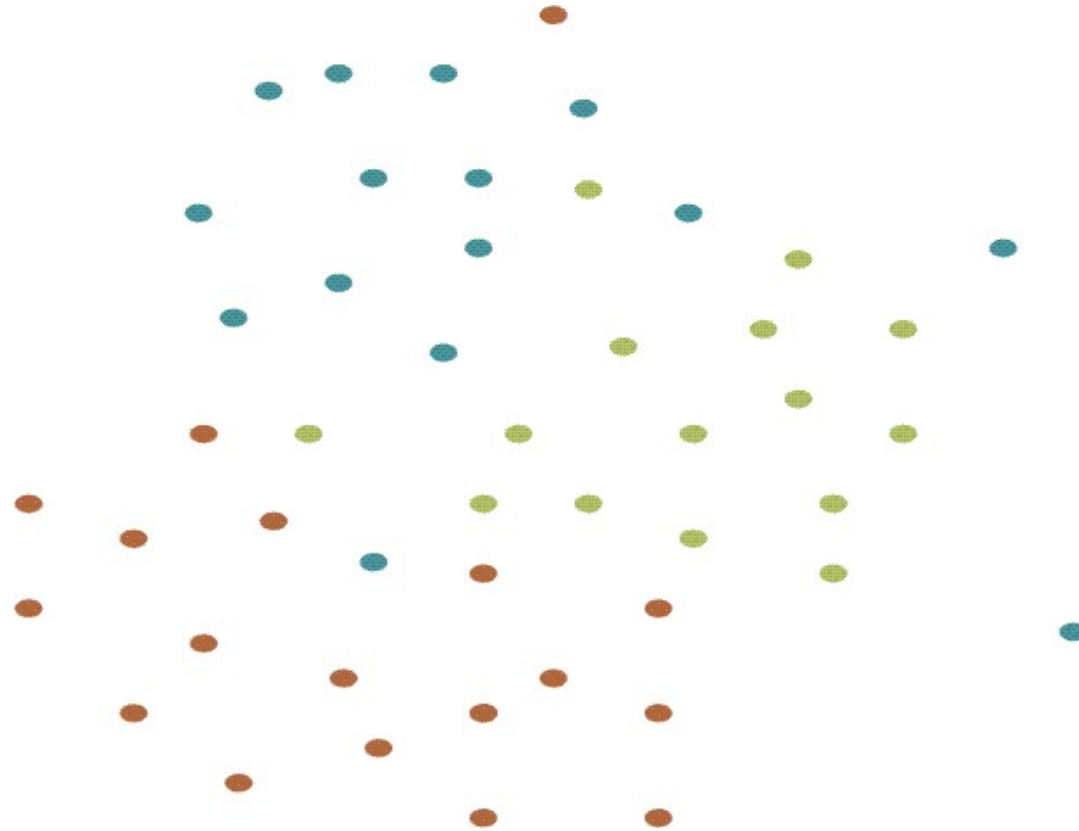
Obtaining footprints

- The footprint of a region R is represented as a fuzzy set
 - Mapping m from locations to $[0,1]$
 - $m(x) = 1$ iff x belongs to R
 - $m(x) = 0$ iff x does not belong to R
 - $m(x) \in]0,1[$ iff x more or less belongs to R

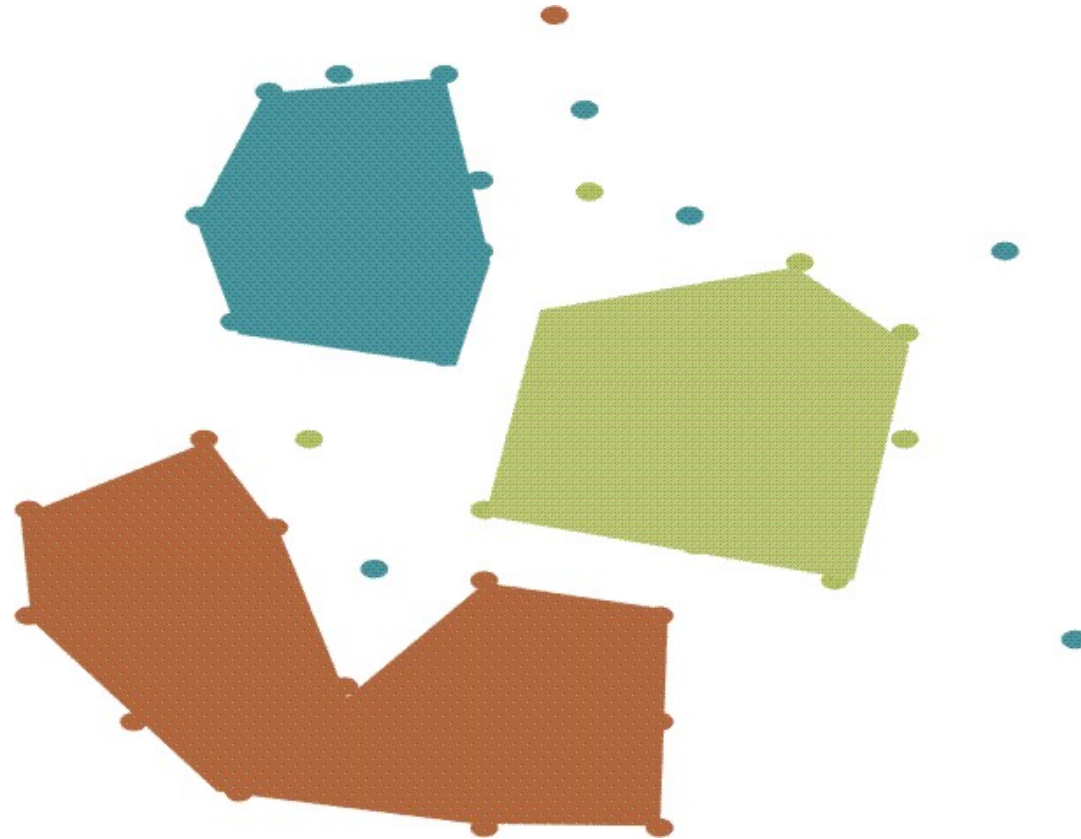
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- Extraction based on set of locations that are known to lie in the neighborhood
 - “Hotel X is located in Brussel’s EU neighborhood”
 - Additional heuristics

Obtaining footprints



Obtaining footprints



Spatial relationships

- It may be of interest to know that neighborhood A
 - is a part of neighborhood B: $PP(A,B)$
 - borders neighborhood B: $EC(A,B)$
 - overlaps with neighborhood B: $PO(A,B)$

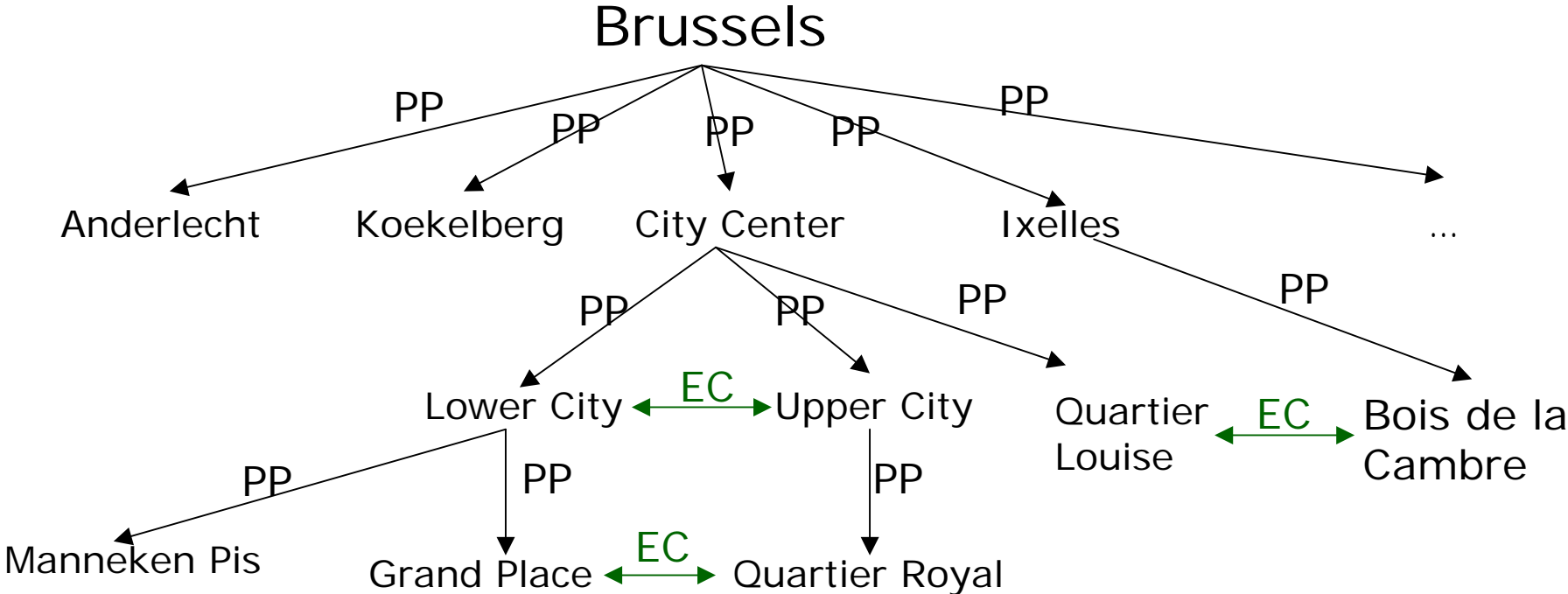
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 - for query relaxation
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- Pattern-based approach
 - the $\langle NP \rangle$ neighborhood includes $\langle NP \rangle$, $\langle NP \rangle$, and $\langle NP \rangle$
 - located on the boundary between $\langle NP \rangle$ and $\langle NP \rangle$

Spatial relationships



Inconsistencies

- Inconsistencies arise because
 - Some relationships are wrong: $PP(a,b)$ and $PP(b,a)$
 - Some relationships are vague: $PP(a,b)$ and $EC(a,b)$

Inconsistencies

- Inconsistencies arise because
 - Some relationships are wrong: $PP(a,b)$ and $PP(b,a)$
 - Some relationships are vague: $PP(a,b)$ and $EC(a,b)$
- Consistency checking & reasoning are based on a fuzzification of the RCC calculus in which
 - Regions can be vague (fuzzy footprints)
 - Spatial relations can be satisfied to some degree (i.e. spatial relations are fuzzy relations)

Conclusions

- Our goal is to improve local search services based on semi-structured and unstructured web-information
 - Support for neighborhoods
 - Better support for landmarks
 - Increased coverage
- This requires a formalism that is tolerant for imprecision
 - Fuzzy relations to represent closeness information
 - Fuzzy footprints to delineate neighborhoods
 - Fuzzy relations to represent qualitative spatial relations