An Approach for Identifying and Analysing Reference Features and Spatial Relations Used in Mountain Emergency Call

M. Bunel $^a$, C. Duchêne $^a$, A.-M. Olteanu-Raimond $^a$, M. Villanova-Olivier $^b$, G. Bonhoure $^a$, T. Jouan $^a$

$a$. Univ. Paris-Est, LASTIG, MEIG, IGN, ENSG

$b$. Univ. Grenoble Alpes, CNRS, Grenoble INP, LIG

July 18, 2019
Introduction

• ANR Choucas: *Heterogeneous data integration and spatial reasoning to locate lost people in a mountain context*

• Objectives
  • Construction and enrichment of geographic data
  • Development of geovisualisation interface
  • Development of reasoning models
Objectives

• Construction of methodology to collect spatial relations and reference features from emergency calls
• Analyse the calls transcriptions
• Visualise the emergency calls
Objectives

- Construction of methodology to collect *spatial relations* and *reference features* from emergency calls
- Analyse the calls transcriptions
- Visualise the emergency calls

How to formalise the extraction of spatial descriptions from an emergency call?
Objectives

- Construction of methodology to collect *spatial relations* and *reference features* from emergency calls
- Analyse the calls transcriptions
- Visualise the emergency calls

What are the most used spatial relations and reference features?
Objectives

- Construction of methodology to collect *spatial relations* and *reference features* from emergency calls
- Analyse the calls transcriptions
- Visualise the emergency calls

How to represent the set of spatial descriptions extracted from an emergency call?
Research issues

- Language approximations and imprecisions
- Description mistakes
- Variability of vocabulary
- More than one description for the same situation
Research issues

- Language approximations and imprecisions
- Description mistakes
- Variability of vocabulary
- More than one description for the same situation

Taking into account the natural language imprecision, and the caller approximation e.g. “I’m near” vs “I’m at 50 meters”
Research issues

- Language approximations and imprecisions
- Description mistakes
- Variability of vocabulary
- More than one description for the same situation

Confusion between two reference features or in the name of a reference feature
Research issues

- Language approximations and imprecisions
- Description mistakes
- Variability of vocabulary
- More than one description for the same situation

Polysemous words, near-synonyms e.g. “below” and “under”, different acceptances for a same world e.g. “on”
Research issues

- Language approximations and imprecisions
- Description mistakes
- Variability of vocabulary
- More than one description for the same situation
Emergency calls

- The caller (victim or witness) contacts the rescuers by phone
- The caller gives elements on his situation
- He describe her position

For this research work:

- Call records are used
- No natural language processing
1. Building a call transcription template
2. Emergency calls transcription analysis
3. Sketch maps of emergency calls
Template objectives

« We are below the plateau and above the Oursière chalet and Ourisère waterfall »

- Calls segmentation
- Identify reference features and spatial relations
Template objectives

« We are below the plateau and above the Oursière chalet and Ourisère waterfall »

- Calls segmentation
- Identify reference features and spatial relations

1. We are below the plateau
2. We are above the Oursière chalet
3. We are above Ourisère waterfall
Template objectives

« We are below the plateau and above the Oursière chalet and Ourisère waterfall »

- Calls segmentation
- Identify reference features and spatial relations

1. (We, below, the Plateau)
2. (We, above, the Oursière Chalet)
3. (We, above, Oursière waterfall)
Template objectives

« We are below the plateau and above the Oursière chalet and Ourisère waterfall »

- Calls segmentation
- Identify reference features and spatial relations

1. (We, below, the Plateau)
2. (We, above, the Oursière Chalet)
3. (We, above, Oursière waterfall)

This is the first step to extract the semantic of descriptions and, by extention, to interpret the spatial descriptions made in natural language
<table>
<thead>
<tr>
<th>ext. id</th>
<th>exp. id</th>
<th>extract</th>
<th>timestamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>« We started from the Plateau of Pra mountain hut »</td>
<td>00:02:10</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>« We are below the Plateau and above the Oursière Chalet and Ourisère waterfall »</td>
<td>00:20:20</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>« We are below the Plateau and above the Oursière Chalet and Ourisère waterfall »</td>
<td>00:20:20</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>« We are below the Plateau and above the Oursière Chalet and Ourisère waterfall »</td>
<td>00:20:20</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>« We are on the Oursière waterfall trak »</td>
<td>00:30:08</td>
</tr>
<tr>
<td>Verb</td>
<td>Verb modifier</td>
<td>Spatial relation</td>
<td>Spatial relation modifier</td>
</tr>
<tr>
<td>----------</td>
<td>---------------</td>
<td>------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>start</td>
<td></td>
<td>from</td>
<td></td>
</tr>
<tr>
<td>be</td>
<td></td>
<td>below</td>
<td></td>
</tr>
<tr>
<td>be</td>
<td></td>
<td>above</td>
<td></td>
</tr>
<tr>
<td>have</td>
<td></td>
<td>above</td>
<td></td>
</tr>
<tr>
<td>be</td>
<td></td>
<td>on</td>
<td></td>
</tr>
</tbody>
</table>

Template extract 2, expression interpretation
45 emergency calls:

- Transcribed by authors and rescuers
- Partially verified
- 374 spatial descriptions identified
Emergency calls analysis: Semantic classification

Spatial relations
- Static
- Dynamic

Borillo (1998) classification

Spatial relation classification
- Projective or directional
- Topological
- Qualitative distance
- Quantitative distance
- Visibility

Clementini (2013) classification

Splitted distance Concept

Added visibility Concept
Occurences of spatial relations for our corpus
Emergency calls analysis: A quantitative analysis

Occurences of references features for our corpus
Utility of a synthetic visualisation

"We started from the plateau of Pra mountain hut. We are below the plateau and above the Oursière chalet and Ourisère waterfall. We are on the Oursière waterfall track. We are in a forest at an altitude of 1500 meters"

- Difficulty for understanding the situation
- Reference feature $\neq$ subject position
- How to represent the spatial descriptions?
Utility of a synthetic visualisation

"We started from the plateau of Pra mountain hut. We are below the plateau and above the Oursière chalet and Ourisère waterfall. We are on the Oursière waterfall track. We are in a forest at an altitude of 1500 meters"

- Difficulty for understanding the situation
- Reference feature ≠ subject position
- How to represent the spatial descriptions?
Designing the sketch maps

Sketch map example

Sketch map legend

- Reference features represented by nodes or surfaces
- Spatial relations represented by named edges or topologic relations
Evaluation process

Sketch maps evaluation process

Testers:

1. Student
2. Teacher
3. Choucas researcher

Number

Type

Sketch Map versions

1st test session

2nd test session

3rd test session

1st test type

2nd test type

Future versions
Discussion and conclusion

Conclusion:
• Construction of a template
• Analysis of 45 calls
• Proposition of sketch map

Issues:
• Heterogeneity of transcriptions
• Template complexity
• Multiplicity of interpretations

Future works:
• Definition of a spatial relation ontology based on call transcriptions
• New analysis based on ontology concepts
• Build a geometry for each spatial description
Thanks for your attention
• Clementini, E. (2013): Directional relations and frames of reference, GeoInformatica, 17(2)