Automatic Analysis of Critical Incident Reports: Requirements and Use Cases

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Critical incident
Agenda

- Incident reporting
- Material: Incident reports
- Corpus analysis
- Results
  - Linguistic and semantic characteristics
  - Use cases
- Conclusions
Critical incident reporting system (CIRS)

**Basic idea:**
Employees report errors or critical incidents

**Improvements**

- **Latent Errors**
  - (Management decisions, Processes etc.)
- **Preconditions of errors**
  - Contributing factors
- **Active incident**
- **Protection barriers**
Reporting form

Context
Event
Result
Reasons

http://circmedical.de/
Objective

- Incident reports bear relevant knowledge
- How to learn from it? How to analyse the textual information?
  - Identifying use cases for natural language processing
  - Study linguistic and semantic characteristics of these reports in comparison to clinical documents
Material and methods

Material
- 581 randomly selected reports from Inselspital Bern
- 100 randomly selected reports from cirsmedical.de

Methods
- Manual data assessment with guiding questions (linguistic, semantic)
- Linguistic analysis with openNLP (parts of speech)
- Interview with quality manager and physician
Part of speeches

- Nouns: 43%
- Adjectives: 28%
- Verbs: 15%
- Adverbs: 10%
- Others: 4%

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## Linguistic characteristics

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence structure</td>
<td>Sentences or incomplete phrases / keywords</td>
</tr>
<tr>
<td>Word usage</td>
<td><em>Personal pronouns (process descriptions), verbs, product names (drugs), names of technical devices, software, specific locations (Aufwachraum, OP), adjectives for characterizing the situation</em></td>
</tr>
<tr>
<td></td>
<td>Compound words, number expressions</td>
</tr>
<tr>
<td>Spelling</td>
<td>Misspellings; abbreviations, acronyms</td>
</tr>
<tr>
<td>Language</td>
<td>Host language and medical terms,</td>
</tr>
</tbody>
</table>
Semantic characteristics

- Rarely: diagnoses
- Clinical interventions
  - (e.g. Intubationsnarkose (intubation anesthesia), nachbeatmet (ventilated), Ambulanz-OP (ambulant surgery))
- Pharmaceutical agents
  - Heparin
- Involved persons
  - Doctor, MPA, nurse
- Technical or non-technical material including software systems
- Facts versus experiences
## Semantic characteristics: Event categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical events or events related to equipment</td>
<td>Oxygenator is burning</td>
</tr>
<tr>
<td>Administrative events</td>
<td>mistaken identity, ambiguous abbreviation as diagnosis, language barrier, mixing of laboratory probes</td>
</tr>
<tr>
<td>Hygiene-related events</td>
<td>Report on a case of Methicillin-resistant Staphylococcus aureus (MRSA) / hospital infection</td>
</tr>
<tr>
<td>Workflow-related events</td>
<td>application of wrong drug or dosis, allergy information was not transmitted to all involved persons</td>
</tr>
<tr>
<td>Events related to transport and positioning of patient</td>
<td>Patient is falling from operating table</td>
</tr>
</tbody>
</table>
Scenario: Search and retrieval of critical incident reports

- Standard search interface, semantics
- Faceted search

Event category
- Hygiene event (1)
- Technical event (1)
- Administrative event (9)
- Workflow event

Event location

Scenario: Incident analytics

- Cause – effect relations
  - What led to an incident?
  - What helped in preventing serious problems?

- Latent Errors
  - (Management decisions, Processes etc.)
- Preconditions of errors
  - Contributing factors
- Active incident
- Protection barriers
Conclusions

- Support in retrieval and analysis is desired
- Linguistic and semantics differ from clinical documents
- Need for methods for
  - identifying persons and locations,
  - separating factual from experiential or hypothetical information,
  - categorizing incident reports semantically and of events according to severity,
  - detecting events and their relations,
  - analysing time and number expressions.
Herzlichen Dank für Ihre Aufmerksamkeit

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