CDA-Compliant Section Annotation of German-Language Discharge Summaries: Guideline Development, Annotation Campaign, Section Classification

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Discharge Summary – Example

**PHYSICIAN HOSPITAL DISCHARGE SUMMARY**

**Provider:** Ken Cure, MD  
**Patient:** Patient H Sample  
**Provider’s Pt ID:** 6910828  
**Sex:** Female  
**Attachment Control Number:** XA728302

**HOSPITAL DISCHARGE DX**

- 174.8 Malignant neoplasm of female breast: Other specified sites of female breast
- 163.8 Other specified sites of pleura.

**HOSPITAL DISCHARGE PROCEDURES**

1. 32650 Thoracoscopy with chest tube placement and pleurodesis.

**HISTORY OF PRESENT ILLNESS**

The patient is a very pleasant, 70-year-old female with a history of breast cancer that was originally diagnosed in the early 70's. At that time she had a radical mastectomy with postoperative radiation therapy. In the mid 70's she developed a chest wall recurrence and was treated with further radiation therapy. She then went without evidence of disease for many years until the late 80's when she developed bone metastases with involvement of her sacroiliac joint, right trochanter, and left sacral area. She was started on Tamoxifen at that point in time and has done well until recently when she developed shortness of breath and was found to have a larger pleural effusion. This has been tapped on two occasions and has rapidly reaccumulated so she was admitted at this time for thoracoscopy with pleurodesis. Of note, her CA15-3 was 44 in the mid 90's and recently was found to be 600.

**HOSPITAL DISCHARGE PHYSICAL FINDINGS**

Physical examination at the time of admission revealed a thin, pleasant female in mild respiratory distress. She had
Data: 3000PA Corpus (Hahn et al., MIE 2018)

- **German Clinical Reference Text Corpus**
  - 1106 documents
  - discharge summaries
  - transfer letters
  - 1.2M tokens
  - 170K sentences

Locations:
- Aachen
- Jena
- Leipzig
**Workflow**

**extraction**

- Hospital Information System
  - Jena University Hospital
  - 1,106 doc.

**annotation**

- 8 annotators (medical students)
- tool: WAT-SL (Kiesel et al., EACL 2017)

**classification**

- training phase
- main annotation

- baseline classifier (bow)
Annotation – Iterative Training Process

- 4 iterations prior to annotation of whole text corpus

6-20 categories

Krippendorff’s alpha $\alpha = [0,1]$

- guideline definitions / adaptations
- discussion
- few documents
- data preparation
- tool configuration
- annotation work
- staff instruction
- agreement computation

30-50 documents

different segmentation units
- paragraphs
- sentences
1\textsuperscript{st} and 2\textsuperscript{nd} Iteration

- **Self-defined categories**
  1. Preamble
  2. Anamnesis
  3. Diagnostics
  4. Therapy
  5. Future
  6. Appendix
  7. Mix (only in 2nd iteration)

- **Agreement (α)**
  - 1\textsuperscript{st} iteration: .89
  - 2\textsuperscript{nd} iteration: .80

- **Different levels of segmentation granularity**
  - Paragraphs
  - *Sentences (used in all subsequent annotations)*
3\textsuperscript{rd} Iteration

- **Clinical Document Architecture (CDA)**
  - XML-based Health Level 7 (HL7) interoperability standard
  - In Germany: not fully operational, soon mandatory
  - CDA suited for clinical documentation, not for annotation

- **Agreement (\(\alpha\)):** .70
# Categories – Redefinition of CDA

<table>
<thead>
<tr>
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4th Iteration

- **Annotation instruction**
  - Redefined CDA
  - Hierarchy

- **Agreement** ($\alpha$): .75

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Final Annotation

- 1106 documents annotated

- Agreement
  - 50 documents
  - $(\alpha) = .82$

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Baseline Classifier

- **Features:** bow statistics
- Logistic regression model with a 10-fold cross-validation

- **Results**
  - Average f-score: **0.82**
  - Precision: 0.82
  - Recall: 0.84
  - Average accuracy 83.7%

- **Ganesan et al. (IEEE Big Data, 2014)**
  - 9 categories
  - Logistic regression
  - Average accuracy: 93%
  - English language

### Categories

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Acknowledgements

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