Intelligent Writing Assistance
... and beyond

Christian Stab
Overview

- Intelligent Writing Assistance
- Classifying Edit Categories in Wikipedia Revisions
- Argumentative Writing Support
- Multiple Document Summarization
Intelligent Writing Assistance

Overview

Interdisciplinary Research Field

- Psychology, Philosophy, Linguistics, Computer Science

Goals of Intelligent Writing Assistance

- Feedback about written text
- Improvement of writing skills and text quality
- Identification of flaws in written text
- Support different writing tasks

Existing approaches

- Spell-Checking, Grammar checking, ...

Future Writing Assistance might incorporate:

- Feedback about readability, Discourse Analysis, Feedback about content, ...
Intelligent Writing Assistance

✗ IWA aims NOT to:
- automatically grade texts
- replace teachers
- automatically correct text

✔ IWA covers:
- Improvement of the writing process
- Assistance during writing
- Improvement of learning curve
- Providing individual guidance of learners
Intelligent Writing Assistance

Challenges

**Analysis of the writing process**
- What are common patterns/styles of writing?
- In which way do authors revise text?

**Support different writing tasks**
- Handling of multiple documents (summarization)
- Argumentative writing

**Assessment of text quality on different levels**
- Which criteria are appropriate for assessing text quality?
- How to assess the content of texts?
- How to automatically judge the credibility or readability?

**Provide Feedback**
- When to provide feedback?
- Which levels are appropriate?
Classifying Edit Categories in Wikipedia Revisions

Johannes Daxenberger and Iryna Gurevych
(daxenberger@ukp.informatik.tu-darmstadt.de)
Analysis of the collaborative writing process

Analyzing user collaboration
- Identify types of changes
- Analysis of collaborative writing patterns

Article Revision History
- Changes of articles from different authors
- Tracking of individual edits

Goal: Automatic classification of edits
- Predict types of edits
- Are there correlations between revision acts and text quality?
User Collaboration in Wikipedia

Production

Web User

Collaboration

Reception

Wikipedia Edit Category Taxonomy

Edit Category

SURFACE
- Markup
  - Insert
  - Delete
  - Modify
- Paraphrase
- Grammar Spelling
- Relocation

POLICY
- Revert
- Vandalism

TEXT-BASE
- Information
  - Insert
  - Delete
  - Modify
- Reference
  - Insert
  - Delete
  - Modify
- File
  - Insert
  - Delete
  - Modify
- Template
  - Insert
  - Delete
  - Modify

Other

13.11.2013 | Computer Science Department | UKP Lab - Prof. Dr. Iryna Gurevych | Christian Stab | 9
### Edit Categories: Examples

#### INFORMATION-INSERT, MARKUP-INSERT

<table>
<thead>
<tr>
<th>Einstein's key insight was</th>
<th>Einstein's cheese master insight was</th>
</tr>
</thead>
</table>

#### VANDALIZE

| in the Ireland | in Ireland |
Annotation Study

- Expert Annotators
- Multi-labeling: each edit is labeled with a set of categories \( Y \subset L \), where \( L \) is the set of all edit categories, \( |L|=21 \), \( 1 \leq |Y| \leq 21 \)
- Data reliability (inter-annotator agreement):
  - Krippendorf’s \( \alpha = 0.67 \) [English] – 0.75 [German]

Corpus available for download

English
- 1,995 Edits
- 891 Revisions
- 3 Annotators

German
- 1,326 Edits
- 813 Revisions
- 2 Annotators
Edit Category Distribution

Number of Edits/Revisions which have been labeled with a certain category

- Abs. number of Edits
- Abs. number of Revisions
Automatic Classification of Edit Categories: Features

**Meta data Features**
Author group, Comment length, Comment n-grams, Is Revert…

**Textual Features**
Character n-grams, Cosine similarity, Difference in the number of capital letters/digits/tokens, …

**Markup Features**
Difference in the number & type of templates/links/images, …

**Language Features**
Difference in the number of spelling errors, semantic similarity, difference in number & type of POS tags
Automatic Classification of Edit Categories: English Data Set

<table>
<thead>
<tr>
<th></th>
<th>Baseline (Random)</th>
<th>Best Classifier</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td>0.08</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Exact Match</strong></td>
<td>0.05</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Micro-F1</strong></td>
<td>0.11</td>
<td>0.66</td>
</tr>
<tr>
<td><strong>Macro-F1</strong></td>
<td>0.08</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>One Error</strong></td>
<td>0.89</td>
<td>0.31</td>
</tr>
</tbody>
</table>

![Graph showing F1 scores for different edit categories]
Automatic Classification of Edit Categories: Which Features are Important?
Conclusion & next steps

**Corpus containing annotated revisions**
- Including annotation guideline

**DKPro-TC (Text Classification Framework)**
- Is available for free at [https://code.google.com/p/dkpro-tc/](https://code.google.com/p/dkpro-tc/)
- Is applicable for several text classification
- Contains numerous features extractors

**Future Work**
- Recent findings indicate a correlation between article development and quality
- Can revisions be used to support authors regarding text quality?

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Argumentative Writing Support

Christian Stab

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Argumentative Writing Support

Motivation

- Writing well-structured arguments is a complex task
  - Argument structure has to be easily comprehensible
  - Components of an argument should be traceable
  - Arguments should be well connected with the context and the “message” of the text
  - …

- “Students are usually underprepared in writing well-structured arguments”\(^1\)
  - NAEP persuasive writing assessment (2007)

- Argumentative Writing Support (AWS) is a particular type of IWA
  - provides feedback about written argumentation
  - aims at improving argumentation skills of authors/writers
  - improves argument comprehension (for the reader) and argumentation structures in written text

Argumentative Writing Support

Motivation

Recent findings in psychology emphasize the need of AWS

- Argumentation tutorials significantly improve the argumentation style\(^1\)
  - Authors are more precise in presenting the claim after receiving argument tutorials
  - Performance in providing support (for arguments) is increased

- Global text revisions as a strategy for improving argumentation style\(^2\)
  - Expert writers make more global revisions resulting in well-structured argumentation schemes
  - Revision and argumentation tutorials lead to more global revisions and better argumentation style

- Order of argumentation components influences reading and recall performance\(^3\)
  - Arguments can be read faster when the claim precedes the reason
  - Claims where recalled better than reasons
  - Claim-first arguments where recalled more accurately than reason-first arguments
  - Readers identify claims by the presence of markers (cue phrases, e.g. qualifiers or modals)
  - Marked arguments are read faster and recalled more accurately in claim-first arguments

Argumentative Writing Support

Vision

Argumentative Writing Support
Feedback about argumentation

Argumentative Support Systems
- Support users create, and manipulate arguments
- Manual argument diagramming
- Support for argument improvement e.g. by recommending missing structures

Argument Extraction / Mining
- Identifying argumentative components in written text by means of NLP
- Automatic Identification
- Deriving the structure between argument components
Argumentative Writing Support

Argument Structures

- Arguments includes one **claim** that is at least supported by one **premise**

  ![Diagram](image)

- But the structures are usually more complex:

  ![Complex Diagram](image)

Create an annotated corpus based on essays

- Annotation guidelines & schemes

Investigate NLP-Methods for identifying components and structures

- How to identify argumentative segments in text?
- What about discourse analysis or RST?
- Which feature sets are appropriate for different argumentative aspects?

Find out which feedback type is appropriate

- Identify types of feedback by means of the findings from psychology.
- Is structural feedback enough?
Multi Document Summarization

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Multiple Document Summarization
Overview

- **Deutscher Bildungsserver** ([http://www.bildungsserver.de/](http://www.bildungsserver.de/))
  - Collection dossier- and theme pages, containing short descriptions

![Diagram of Dossier page](image)

- Dossier page
- Short description
- Links to source documents
Multiple Document Summarization
Overview

For about 5000 pages the description is missing

Short description

Links to source documents
Multiple Document Summarization
Creation of corpora

A: Read hardcopy of documents.

B: Create a 100-word softcopy abstract for each document using the document author’s perspective.

C: Create a 200-word softcopy multi-document abstract of all 10 documents together written as a report for a contemporary adult newspaper reader.

D, E, F: Cut, paste, and reformulate to reduce the size of the abstract by half.
Multiple Document Summarization
Intelligent Writing Assistance

Adaptive Summarization Support

Interacts/revises

feedback

creates

Summarization System

Summarization

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How to learn from user interactions in summarization tasks?
- Which information can be used to improve summarization methods?
- How to integrate them in a summarization system

Which information should be provided to the user?
- Summarization of single documents and leave the integration to the user?
- or complete summarization for revision?
Summary

Overview of UKP’s current research in the area of IWA

Analysis of the writing process

Argumentative Writing Support

Support for Multiple Document Summarization

Challenges in Intelligent Writing Assistance
  - Quality assessment of text during the writing process
  - User feedback
  - Tailored methods with respect to the user
Questions…

Thanks for your attention!

Questions?