Lexico-syntactic Text Simplification and Compression with Typed Dependencies

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Outline

- Describe two systems
  1. Text simplification for lexical and syntactic simplification
  2. Sentence compression system
- Evaluation
  - Quality of simplified and compressed output
  - Novel study on examining impact of text simplification and compression on Reading Comprehension
Sentence Simplification and Compression
- An Example -
(outputs from our system)
The original police inquiry, which led to Mulcaire being jailed in 2007, also discovered evidence that he has successfully intercepted voicemail messages belonging to Rebekah Brooks, who was editor of the Sun when Mulcaire was working exclusively for its Sunday stablemate.
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Lexical Simplification

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Sentence Compression

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Text Simplification System for Syntactic and Lexical Simplification
Our Text Simplification System

Syntactic Simplification

- handcrafted rules
  - apposition
  - conjunction
  - cleft constructions
  - passive voice
  - standardise quotations
  - relative clauses
  - subordination
  - verbose styles

Siddharthan, 2010

Lexical Simplification

SEW aligned corpus (Coster and Kauchak, 2011)

- English Wikipedia
- Simple English Wikipedia

Synchronous Dependency Grammars based Rules Harvesting System

Wordnet

Siddharthan and Angrosh, 2014
Angrosh and Siddharthan, 2014
Chapman should receive psychiatric treatment.

Chapman should get psychiatric treatment.

Diagram:  
```
(1) Chapman  (2) should  (3) receive  (4) psychiatric  (5) treatment
    nsubj     aux      dobj               amod
    Chapman    should    treatment
               psychiatric
```
Chapman should receive psychiatric treatment.

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Rule to change receive to get – Wikipedia Context

| DELETE   | dobj(X0[receive], X1[treatment]) |
| INSERT   | dobj(X2[get], X1) |
Chapman should receive psychiatric treatment.

Chapman should get psychiatric treatment.

Rule to change receive to get – Wordnet context

DELETE :  `dobj(X0[receive], X1[care, attention, aid, tending, treatment, intervention, therapy, electrotherapy, medication, administration, electroshock, ECT, management, direction, ...])`

INSERT :  `dobj(X2[get], X1)`. 
Text Simplification System – Features

- handle complex lexico-syntactic simplification
- use handwritten rules for most common syntactic cases (Siddharthan 2010)
- use automatically harvested rules for lexicalised paraphrase (Siddharthan & Angrosh, 2014)
- generalise lexical content in automatically harvested rules – to make them generalise better (Angrosh & Siddharthan, 2014)
Sentence Compression System
Our Sentence Compression System

- Designed
  - to look at text as a whole
  - to satisfy global constraints such as:
    - lexical density
    - ratio of hard words
    - text length

- We call it
  - Reluctant Trimmer – based on reluctant paraphrasing (Dras, 1999) – ‘make as little change as possible to the text’
Reluctant Trimmer - Architecture

**Generation**
- Text Input
- Select each sentence
- Collection of sets of compressed sentences
- Generate dependency parse
- A* search to generate compression candidates

**Selection**
- Integer Linear Programming
- One sentence per set
- Compressed Text
Step 1

Step 2

Step 3

Step 1 - Dependency structure for “2009 detention of American hikers by Iran”
Reluctant Trimmer – Graphical View

Step 1

Step 2

Step 2 – Trimming Dependency Tree

Step 3

Sentences Generated:
C1: detention
C2: detention of hikers
C3: detention of hikers by Iran
Reluctant Trimmer – Graphical View

Step 1

Step 2

Step 3 – Decoding with ILP
Evaluation 1

- Quality -

Fluency, Simplicity & Meaning Preservation
Quality – Evaluated Systems

OUR SYSTEMS

- Text Simplification (TS)
- Reluctant Trimmer (RT)
- Hybrid (HYB) TS + RT

Applies RT to the output of TS
Quality – Evaluated Systems

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COMPARED WITH

- Quasi Synchronous Grammar (QTSG)

  - Quasi Synchronous Tree Substitution Grammar (QTSG) (Woodsend and Lapata, 2012)
  - Derive rules from the same Wikipedia dataset
  - QTSG has the same scope as ours – syntactic and lexical simplification & compression
Quality – Evaluated Systems

**OUR SYSTEMS**

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- English Wikipedia
- Simple English Wikipedia
Quality – Dataset & Methodology

- **Dataset**
  - Evaluation set of 50 sentences from Wikipedia (Zhu et al., 2010)

- **Method**
  - 40 participants in Amazon Mechanical Turk
  - Participants were asked to rate fluency, simplicity and meaning preservation
Quality – Comparison with QTSG

Mean Scores - Our systems outperform QTSG

<table>
<thead>
<tr>
<th>Compared Systems</th>
<th>Our Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Wikipedia</td>
<td></td>
</tr>
<tr>
<td>Simple English Wikipedia</td>
<td></td>
</tr>
<tr>
<td>Quasi Synchronous Grammar</td>
<td></td>
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<tr>
<td>Text Simplification</td>
<td></td>
</tr>
<tr>
<td>Reluctant Trimmer</td>
<td></td>
</tr>
<tr>
<td>HYBRID</td>
<td></td>
</tr>
</tbody>
</table>
Quality – Comparison with SEW

Text Simplification performs better than SEW

- **English Wikipedia**
- **Simple English Wikipedia**
- **Quasi Synchronous Grammar**
- **Text Simplification**
- **Reluctant Trimmer**
- **Hybrid**

**Comparison Systems**

<table>
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<th>OUR SYSTEMS</th>
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**Dimensions:**

- Fluency
- Simplicity
- Meaning
Evaluation 2

Reading Comprehension
Reading Comprehension – Objective

Goal

- To evaluate Text Simplification (TS) systems as a function of reading comprehension skills (Siddharthan & Katsos, 2012)
Reading Comprehension – Objective

Goal

- To evaluate Text Simplification (TS) systems as a function of reading comprehension skills

Motivation

- Current TS evaluation studies focus at sentence level and not at textual level.
- Difficulties in designing tests, recruiting participants, costs etc.
- This is a pilot study on crowd sourcing platform to evaluate TS at textual level
Reading Comprehension – News Summaries

- Breaking News English (BNE) Website
  - provides high quality news summaries at various levels of simplification
  - recently nominated by the British Council for the 2014 ELTons award for Innovation in Learner Resources.
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We used from BNE:
  • five news stories, each with two versions:
    (a) Hard (b) Easy (both manual summaries)
  • multiple choice questions
Reading Comprehension – Method

- Amazon Mechanical Turk
- 50 Participants
- each participant sees each of 5 news stories in exactly one of the 5 versions in a Latin square design
- five versions:
  1. (a) Hard (manual)
  2. (b) Easy (manual)
  3. (c) Text Simplification
  4. (d) Reluctant Trimmer
  5. (e) Hybrid (RT + TS)
- summaries and questions were shown alternatively
Reading Comprehension – Results

- Categorised participants into four groups based on average accuracy over MCQ over all the texts:

<table>
<thead>
<tr>
<th>Overall Accuracy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCELLENT</td>
<td>acc ≥ 0.9</td>
</tr>
<tr>
<td>GOOD</td>
<td>0.8 &gt; acc ≥ 0.9</td>
</tr>
<tr>
<td>MODERATE</td>
<td>0.8&gt; acc ≥ 0.5</td>
</tr>
<tr>
<td>POOR</td>
<td>acc ≤ 0.5</td>
</tr>
</tbody>
</table>

- Fitted GLMM with:
  - correct answer as dependent variable
  - version and reader ability as fixed effects
  - Participant and question as random effects
Two Categories of Systems

- do not lose information – Hard, TS
- lose information – Easy, RT, HYB
Reading Comprehension – Results

Systems that do not lose information:

- Excellent readers are close to 100% accuracy for original text
- No scope for improvement for them
Reading Comprehension – Results

- Significant Improvement from Text Simplification for moderate readers (p = 0.075)
- GLMM analysis: marginal interaction between comprehension and version (reader ability=moderate : version=TS, z = 1.78, p = 0.075)
Reading Comprehension – Results

- Poor readers perform badly with automated systems
Reading Comprehension – Results

- Systems that lose information – RT & HYB comparable to Easy

Average words per text in Breaking News English set

<table>
<thead>
<tr>
<th></th>
<th>Easy</th>
<th>Hard</th>
<th>Text Simplification</th>
<th>Reluctant Trimmer</th>
<th>Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>152.8</td>
<td>172.6</td>
<td>184.4</td>
<td>149.2</td>
<td>151.4</td>
</tr>
</tbody>
</table>

EXCELLENT | GOOD | MODERATE | POOR
Conclusion

- Described two systems
  1. Lexico-syntactic text simplification (TS) system
  2. Sentence compression system

- Evaluation
  1. Quality
     • showed that our systems perform better
  2. Reading Comprehension (RC)
     • presented a novel study on evaluating TS using RC
     • showed that it is viable to evaluate TS systems through online comprehension tests
     • these are initial results – need further studies with difficult questions to evaluate better
Future Work

- We only investigate sentence-level text simplification
- Discourse level effects that also need to be considered when simplifying larger texts, including:
  - sentence ordering (Barzilay et al., 2002; Siddharthan, 2003a; Barzilay and Lapata, 2008),
  - discourse connectives (Siddharthan and Katsos, 2010) and anaphora choice (Nenkova et al., 2005; Siddharthan et al., 2011).
References


