A, An, and The
Automatically Identifying and Correcting the Most Common Errors in English Article Usage

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Overview of Presentation
- Background
  - The problem with articles (Ø, a/an, the)
  - Research on article errors
  - Research on article error analysis systems
- Research Questions
  - What article errors do learners typically make?
  - How can a system be trained to automatically identify and correct article errors?
- Results
  - Common article errors in university student writing
  - A Fast and Accurate Error Correction System (AntCorrector)
- Conclusion / Future Work

Background (1)
The problem with articles (Ø, a/an, the)
- English articles are notoriously difficult for non-native speakers of English
  - Master (1987; 1995); Celce-Murcia & Larsen-Freeman (1999); Cheng & Warren (1999); Wong & Celce-Murcia (2003); Han et al., (2006)
  - 27% of all errors in the JLE corpus involve articles
- Gamon et al. (2009)
  - 12% of all errors in the ICLE and CLEC corpora involve articles

Background (1)
The problem with articles (Ø, a/an, the)
- A brief review of article complexities
  - Strength of countability
    - Strong: "I want to read book."
    - Medium: I want to eat cake.
    - Weak/None: I want to get knowledge.
  - Adjectives
    - Good: "He has a good knowledge of English."
    - Better: She has the better knowledge of English.
    - Best: She has the best knowledge of English.

Background (1)
The problem with articles (Ø, a/an, the)
- A brief review of article complexities
  - Units of measure
    - The temperature is 60 degrees.
    - He has a temperature.
    - The time is 3 o’clock.
    - I don’t have the time.
  - Proper Nouns
    - Have you seen Tokyo Tower?
    - Have you seen the Statue of Liberty, in Odaiba, Tokyo?

"As any teacher of English as a Second Language can attest, one of the most complex problems faced by a non-native speaker is when to use a (or an), the, or 0 (zero or no) article..."
(Na Rae Han et al, 2006: 115)
Background (2)
Research on article errors

- Identification of Error Types
  - Books
  - Research papers

- Research on Teaching about Article Errors
  - Books
    - Any ESL/EFL textbook
  - Research papers

Consciousness raising and indirect feedback can be effective in teaching about article errors.

Research Question 1:
What article errors do learners typically make?

- Literature Findings
  - Omission errors account for 70.37% of all non-speech related article errors in the NICT JLE Corpus (Gamon et al., 2009).
  - Omission errors account for 58% of all article errors in student TOEFL essays (Han et al., 2006: 125).

<table>
<thead>
<tr>
<th>Error Type</th>
<th>Chinese</th>
<th>Japanese</th>
<th>Russian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omission</td>
<td>0.723</td>
<td>0.723</td>
<td>0.742</td>
</tr>
<tr>
<td>Agreement</td>
<td>0.277</td>
<td>0.277</td>
<td>0.258</td>
</tr>
<tr>
<td>Agreement</td>
<td>0.180</td>
<td>0.180</td>
<td>0.207</td>
</tr>
<tr>
<td>Agreement</td>
<td>0.415</td>
<td>0.415</td>
<td>0.415</td>
</tr>
<tr>
<td>Agreement</td>
<td>0.110</td>
<td>0.110</td>
<td>0.110</td>
</tr>
<tr>
<td>Agreement</td>
<td>0.189</td>
<td>0.189</td>
<td>0.189</td>
</tr>
<tr>
<td>Total</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Very few error analysis systems have become mainstream (except Microsoft Word Grammar checker, ETS Criterion, JIEM CASEC/G/GTS/WT).

Research Question 1:
What article errors do learners typically make?

- Subjects:
  - Location: Faculty of Sci. and Eng., Waseda University
  - Number: 26 students
  - Age: 2nd year undergraduate (CBD Course)
  - Level: TOEIC (Min. 555 pts. Max. 840 pts., Ave. 661 pts.)
  - Corpus
    - Genre: 4 homework essays collected over 6 weeks in 2010

Research Question 2:
What article errors do learners typically make?

- One of the most common mistakes that non-native speakers make with articles is using a or an with plural or uncountable nouns.
  - http://www.rpi.edu/dept/llc/writecenter/web/esl.html

- This lesson avoids directly dealing with the related (and relevant) questions of:
  - zero article
  - countable and uncountable nouns, singular and plural uses
  - Some of these remaining 'rules' are relatively simple...
  - (Farrow, N. K., 2008)
Research Question 1: What article errors do learners typically make?

Results 1

Distribution of Article Errors

- Distribution
- 56% (111/199)
- 17% (34/199)
- 10% (20/199)
- 7% (14/199)
- 7% (13/199)
- 6% (12/199)
- 5% (10/199)
- 4% (8/199)
- 3% (6/199)
- 2% (4/199)
- 1% (3/199)

Results 2

Distribution of Article Errors

- omission errors 10% (20/199)
- deletion errors 31% (61/199)
- change errors 59% (118/199)

Results 3

Correction Type | Frequency | Percentage |
--- | --- | --- |
add "the" | 111 | 56% |
add "a" | 34 | 17% |
delete "the" | 14 | 7% |
change "a" to "the" | 13 | 7% |
add "an" | 14 | 7% |
delete "a" | 6 | 3% |
change "the" to "a" | 9 | 5% |
change "an" to "a" | 6 | 3% |

Total | 199 | 100% |

Experimental Design

- Approach: A rule-based system (a set of "IF-THEN" statements)
- Examples:
  - IF singular noun appears THEN scan back to find the appearance of an article.
  - IF no article appears THEN add "the"
  - IF "a" is followed by "most" THEN change "a" to "the"
- Rationale:
  - Can be created/understood/interpreted by humans
  - Can be modified (improved) easily
  - Can be tailored to the quirks of a particular domain (learner writing)
  - Can work at small (classroom) scale levels

Experimental Procedure

- Pre-processing:
  - Tag corpus data with article errors (199 errors) in Microsoft Word
  - Save as (Unicode UTF-8) plain text (no data cleaning necessary)
  - Split sentences with multiple errors into single sentences containing only one "marked" error (to simplify measuring the system performance)
  - Part-Of-Speech (POS) tag all sentences (with CLAWS)
- Step 1: Divide the corpus data in training and testing sets
  - Training Data: 149 randomly selected sentence errors
  - Testing Data: 50 randomly selected sentence errors
- Step 2: Build the rule-based system based on the training data
- Step 3: Measure the system performance on the testing data
  - Performance Measures: Accuracy, Precision, Recall
  - Comparison Measure: Microsoft Word Grammar Checker

Research Question 2: Can a system be created to identify and correct article errors?
Research Question 2:
Can a system be created to identify and correct article errors?

Performance Measures

<table>
<thead>
<tr>
<th>System Result</th>
<th>omission</th>
<th>deletion</th>
<th>change</th>
<th>Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Result</td>
<td>true</td>
<td>false</td>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>true</td>
<td>false</td>
<td>false</td>
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</tr>
<tr>
<td>false</td>
<td>true</td>
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<td>false</td>
<td>true</td>
</tr>
<tr>
<td>false</td>
<td>false</td>
<td>false</td>
<td>false</td>
<td>true</td>
</tr>
</tbody>
</table>

- Accuracy = \( \frac{true + true + true + true}{true + false + false + true} = 1 \)
- Precision omission = \( \frac{true}{true + true + false + false} = 1 \)
- Recall omission = \( \frac{true + false}{true + false + false + false} = 1 \)

Results (149 training samples) with AntChecker

<table>
<thead>
<tr>
<th>System Result</th>
<th>omission</th>
<th>deletion</th>
<th>change</th>
<th>Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Result</td>
<td>112</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<tr>
<td>0</td>
<td>1</td>
<td>10</td>
<td>5</td>
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</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Performance Measures

- Accuracy = 133/149 = 89%
- Precision omission = 112/112 = 100%
- Recall omission = 112/120 = 93%
- Precision deletion = 11/12 = 92%
- Recall deletion = 11/13 = 85%
- Precision change = 10/10 = 100%
- Recall change = 10/16 = 62%

Comments

- Analyzing the training data revealed (possible) human-level mistakes.
- Examples:
  - Adding "the" NASA should learn a lot from this disaster and must never cause disasters like this.
  - We highly think a pilot of an airplane is a male.
  - Therefore, some students was not permitted to enter "a" to "the" country.

Results (50 testing samples) with AntChecker

<table>
<thead>
<tr>
<th>System Result</th>
<th>omission</th>
<th>deletion</th>
<th>change</th>
<th>Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct (Desired) Result</td>
<td>27</td>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
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<tr>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Performance Measures

- Accuracy = 33/50 = 64%
- Precision omission = 27/27 = 100%
- Recall omission = 27/38 = 71%
- Precision deletion = 5/5 = 100%
- Recall deletion = 5/8 = 62%
- Precision change = 0/0 = -
- Recall change = 0/4 = 0%

Results (50 testing samples) with Microsoft Grammar Checker

<table>
<thead>
<tr>
<th>System Result</th>
<th>omission</th>
<th>deletion</th>
<th>change</th>
<th>Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct (Desired) Result</td>
<td>0</td>
<td>0</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>0</td>
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<td>0</td>
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</tr>
</tbody>
</table>

Performance Measures

- Accuracy = 0/50 = 0%
- Precision omission = 0/0 = -
- Recall omission = 0/38 = 0%
- Precision deletion = 0/0 = -
- Recall deletion = 0/8 = 0%
- Precision change = 0/0 = -
- Recall change = 0/4 = 0%
Research Question 2:
Can a system be created to identify and correct article errors?

- Results (149 training samples) with Microsoft Grammar Checker

<table>
<thead>
<tr>
<th>System Result</th>
<th>omission</th>
<th>deletion</th>
<th>change</th>
<th>Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct (Desired) Result</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>deletion</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>change</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Ø</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Performance Measures

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>2/149 = 1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>0/0</td>
</tr>
<tr>
<td>Recall</td>
<td>0/120</td>
</tr>
<tr>
<td>F-score</td>
<td>1/13</td>
</tr>
</tbody>
</table>

Comments

- Many article ‘errors’ not corrected by the AntCorrector system still lead to grammatical English

- Examples:
  - Next, the Nobel Committee sends invitations to the members of the scientific or engineering community in September.
  - Therefore he was driving a car in the wrong lane.
  - It is said that there are four major cause of the disaster and death of crews.

Conclusion and Future Work

- Conclusion
  - Omission errors are the most common article errors.
  - Many elaborate error analysis systems have been proposed.
  - But... poor performing tools are still the predominantly used by learners in the classroom
    - ubiquitous, intuitive, easy to use, built into popular word processors
  - More work is required to bring NLP systems to the real-world
    - AntCorrector demonstrates that a simply approach can be effective in restricted domains (e.g., the university writing class)

- Future Work
  - Improve the performance of AntCorrector
  - Embed the system in a web-based correction tool
  - Trial the software with a large user groups:
    - Initial trial: 10,000 students; Later trials: 50,000 students

References