Paraphrasing
4
Microblog Normalization

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Instituto Superior Técnico
INESC-ID L2F
In a nutshell...
In a nutshell...

Automatically create a Normalization corpora

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Automatically create a Normalization corpora

Build a Paraphrase model for Normalization

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In a nutshell...

Normalization Model

Leavin canada
goin bac to cali
In a nutshell...

Leavin canada
goin bac to cali

Normalization Model

Leaving Canada, going back to California
msg 4 Warren G his cday is today 1 yr older.
msg 4 Warren G his cday is today 1 yr older.
Why Normalize?

*msg 4* Warren G his *cday* is today 1 *yr* older.

Bing Translator

味精 4 沃伦 G 他 cday 今天是较旧的 1 年。
Why Normalize?

msg 4 Warren G his cday is today 1 yr older.

Bing Translator

味精 4 沃伦 G 他 cday 今天是较旧的 1 年。

monosodium glutamate 4 warren G he cday today is older 1 year.
Related Work: Lexical Normalization

- $\text{msg} \rightarrow \text{message}$
- $4 \rightarrow \text{for}$
- $\text{yr} \rightarrow \text{year}$
Related Work: Lexical Normalization

- Yang and Eisenstein, 2013; Hassan and Menezes, 2013; Liu et al., 2012; Han et al., 2013; Han et al., 2012; Han and Baldwin, 2011; Gouws et al., 2011; Beaufort et al., 2010; Liu et al., 2010; Contractor et al, 2010; Kaufmann, 2010; Cook and Stevenson, 2009; Kobusset al., 2008; Choudhury et al., 2007; Aw et al., 2006... and many many many more
Lexical Normalization

- Finding lexical normalizations
- Is lexical normalization enough???
Is lexical normalization enough???

msg 4 Warren G his cday is today 1 yr older.

Bing Translator

味精 4 沃伦 G 他 cday 今天是较旧的 1 年。
Is lexical normalization enough???

- Lexical normalization

message for Warren G his birthday is today 1 year older.
Is lexical normalization enough???

- Lexical normalization

message for Warren G his birthday is today 1 year older.

His birthday today is 1 year older Warren G message.

Bing Translator

他的生日今天是大 1 岁的沃伦 G 消息。
How to make it better???

message for Warren G his birthday is today 1 year older.
A message for Warren G, his birthday is today, he is 1 year older.

A message to/from Warren G, because his birthday is today, he is one year older.

- Punctuation
- Pro-drop
- Missing articles
Previous work

- Beam Search Decoder combining different models (Wang and Ng, 2013)

<table>
<thead>
<tr>
<th>Model</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pronunciation</td>
<td>2day → today</td>
</tr>
<tr>
<td>Missing word “Be”</td>
<td>I late → I am late</td>
</tr>
<tr>
<td>Retokenization</td>
<td>u.where → u . where</td>
</tr>
<tr>
<td>Apostrophe</td>
<td>im → I’m</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>lol → laughing out loud</td>
</tr>
<tr>
<td>Time</td>
<td>1130am → 11:30 am</td>
</tr>
</tbody>
</table>
Previous work

- Other possible models/features:

<table>
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<tr>
<td>Swapping letters</td>
<td>conscience → conscience</td>
</tr>
<tr>
<td>Letter Repetition</td>
<td>goooooood → good</td>
</tr>
<tr>
<td>Context</td>
<td>rly → really</td>
</tr>
<tr>
<td>Visual</td>
<td>g00d → good</td>
</tr>
<tr>
<td>Measure Units</td>
<td>100k → 100000</td>
</tr>
</tbody>
</table>
Problem
Problem

- I am too lazy
Problem

- I am too lazy
  - Need to look at the data and look for stuff to normalize
Problem

- I am too lazy
  - Need to look at the data and look for stuff to normalize
  - Implement models/features to address each case
Problem

- I am too lazy
  - Need to look at the data and look for stuff to normalize
  - Implement models/features to address each case
  - Repeat again for every new language to normalize
Problem

- I am too lazy
  - Need to look at the data and look for stuff to normalize
  - Implement models/features to address each case
  - Repeat again for every new language to normalize

- How to build a good normalizer without working that hard???
Dream

“I have a dream.”

Martin Luther King
Dream

- Obtain **data** with tweets paired with normalizations

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Dream

- Obtain **data** with of tweets paired with normalizations
- Build a **model** that learns to normalize based on these examples

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But how can we get the data?

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But how can we get the data?

- Annotate (Wang and Ng, 2013)
  - Not scalable

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But how can we get the data?

- Annotate (Wang and Ng, 2013)
  - Not scalable
- Extract Paraphrases in Twitter (Xu et al, 2013)
  - No distinction between original tweet and normalization
  - Works in practice by using a formal language model

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Do people normalize text online?
Do people normalize text online?

- Claim: Yes, but they do it in another language.
Translationese

- Standardization during translations (Laviosa, 1998; Volansky et al., 2013)
- No equivalent idiosyncrasies

msg 4  Warren G his cday is today 1 yr older. happy cday may god bless u and the... - 发信息给  Warren G，今天是他的生日，又 老了一岁了。生日快乐，愿上帝保佑 你和 ...
msg 4 Warren G his cday is today 1 yr older. happy cday may god bless u and the...
msg 4 Warren G his cday is today 1 yr older. happy cday may god bless u and the...

Bing Translator

味精 4 沃伦 G 他 cday 今天是较旧的 1 年。快乐 cday 5 月上帝保佑你和...

发信息给 Warren G, 今天是他的生日, 又老了一岁了。生日快乐,愿上帝保佑你和...
msg 4 Warren G his cday is today 1 yr older. happy cday may god bless u and the...
msg 4 Warren G his cday is today 1 yr older. happy cday may god bless u and the...

Send a message to Warren g, today is his birthday, old and a one year old. Happy birthday and may God bless you and ...
Send a message to Warren G, today is his birthday, old and a one year old. Happy birthday and may God bless you and ...
Send a message to Warren G,
today is his birthday,
old and a one year old.
Happy birthday and may God bless you and ...
Translationese

abbreviation, punctuation, completion

**msg 4 Warren G**
Send a **message** to Warren g,

**his cday is today**
today is his birthday,

**1 yr older.**
old and a one year old.

**happy cday may god bless u and the...**
Happy birthday and may God bless you and ...
Translationese

msg 4 Warren G → Send a message to Warren g,

his cday is today → today is his birthday,

1 yr older. → old and a one year old.

happy cday may god bless u and the... → Happy birthday and may God bless you and ...
msg 4 Warren G
Send a message to Warren g,

his cday is today
today is his birthday,

1 yr older.
old and a one year old.

happy cday may god bless u and the...
Happy birthday and may God bless you and ...
Send a message to Warren g,

Today is his birthday,

Old and a one year old.

Happy birthday and may God bless you and...
Where do these come from?
Where do these come from?

- Microblogs as Parallel Corpora (Ling et al, 2013)

【2013.9.7】It was an important result for #Portugal in a very special date for me. I would like to dedicate this victory to my father that has left us 8 years ago. 这是一场重要的胜利，在今天这个对我来说很特别的日子。我要把这场胜利献给我的父亲，他八年前离开了我们。

msg 4 Warren G his cday is today 1 yr older. happy cday may god bless u and the... - 发信息给 Warren G，今天是他的生日，又老了一岁了。生日快乐，愿上帝保佑你和...
Building a Normalizer
## Building a Normalizer

- Get parallel corpora

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<th>Other Language</th>
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<tr>
<td>To DanielVeuleman yea iknw imma work on that</td>
<td>对DanielVeuleman说, 是的我知道, 我正在向那方面努力</td>
</tr>
<tr>
<td>Warren G his cday is today 1 yr older.</td>
<td>发信息给Warren G, 今天是他的生日, 又老了一岁了。</td>
</tr>
<tr>
<td>Where the hell have you been all these years?</td>
<td>这些年你TMD到哪去了</td>
</tr>
<tr>
<td>onni this gift only 4 u</td>
<td>أوني هذه الهدية فقط لك</td>
</tr>
<tr>
<td>Next Monday I am gonna see a movie in German language at the cinema.</td>
<td>В понедельник я буду смотреть фильм на немецком в кинотеатре.</td>
</tr>
<tr>
<td>oppa!! I love u (≧∀≦*́)</td>
<td>사랑해요(´・ω・`)</td>
</tr>
<tr>
<td>huv a gd time</td>
<td>素敵♥貴重な時間やね</td>
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Building a Normalizer

- Translate into English (Google, Bing, Youdao)

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Building a Normalizer

- Filter bad examples (Phrasal Alignment)

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<td>oppa!! I love u (*\geq \forall \leq*)</td>
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## Building a Normalizer

- Train a Phrase-based SMT model

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Normalization Model (Phrase)

- Phrase-based SMT model (Koehn, 2003)
Normalization Model (Phrase)

- Phrase-based SMT model (Koehn, 2003)

```
We r 2 young to talk about 4ever
```

```
We 're too young , can not talk about forever
```
Normalization Model (Phrase)

- What we can achieve with this model
Normalization Model (Phrase)

- What we can achieve with this model
  - Abbreviations

I wanna go 4 Pizza 2day

Normalization Model

I want to go for Pizza today
Normalization Model (Phrase)

- What we can achieve with this model
  - Abbreviations
  - Punctuation

I’ll cook it brotha!

Normalization Model

I will cook it, brother!
Normalization Model (Phrase)

- What we can achieve with this model
  - Abbreviations
  - Punctuation
  - Apostrophe

*hes* not very well → He is not very well
Normalization Model (Phrase)

- What we can achieve with this model
  - Abbreviations
  - Punctuation
  - Apostrophe
  - Context-based

Adam n me n
Vegas

Normalization Model

Adam and
me in vegas
Normalization Model (Phrase)

- What we can achieve with this model
  - Abbreviations
  - Punctuation
  - Apostrophe
  - Context-based
  - Orthographic errors
  - ……

Adidas **goin** hard this year!!!

Adidas **going** hard this year!!!
Limitation of this Model
Limitation of this Model

- Can only normalize seen words
  - Even though we know that:

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<td>forever</td>
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<td>4get</td>
<td>forget</td>
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  - Even though we know that:

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<td>forget</td>
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- We cannot infer that:

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<tr>
<td>4got</td>
<td>????????</td>
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Normalization Model (Character)

- A character-based normalization model:
  - Use phrase pairs as parallel segments

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<tr>
<td>4get</td>
<td>forget</td>
</tr>
<tr>
<td>goingfor</td>
<td>going for</td>
</tr>
<tr>
<td>goooood</td>
<td>good</td>
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Normalization Model (Character)

- A character-based normalization model:
  - Use phrase pairs as parallel segments
  - Build a phrase-based SMT model on **characters**
Normalization Model (Character)

- A character-based normalization model:
  - Use phrase pairs as parallel segments
  - Build a phrase-based SMT model on *characters*
  - Lattice generation

I wanna to meeееeeet DanielVeuleman
Normalization Model (Character)

- A character-based normalization model:
  - Use phrase pairs as parallel segments
  - Build a phrase-based SMT model on characters
  - Lattice generation
  - Phrase-based Normalization

I want to meet Daniel Veuleman

I am a lattice!
Normalization Model (Character)

- What we can learn from this model now?
Normalization Model (Character)

- What we can learn from this model now?
  - Phonetically Similar Substitutions

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<tr>
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<tbody>
<tr>
<td>s</td>
<td>s</td>
<td>0.87</td>
</tr>
<tr>
<td>s</td>
<td>c</td>
<td>0.04</td>
</tr>
<tr>
<td>s</td>
<td>z</td>
<td>0.02</td>
</tr>
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Normalization Model (Character)

● What we can learn from this model now?
  ○ Phonetically Similar Substitutions
  ○ Logographic Substitutions

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<td>4</td>
<td>4</td>
<td>0.71</td>
</tr>
<tr>
<td>4</td>
<td>for</td>
<td>0.06</td>
</tr>
<tr>
<td>4 e</td>
<td>fore</td>
<td>0.89</td>
</tr>
</tbody>
</table>
Normalization Model (Character)

- What we can learn from this model now?
  - Phonetically Similar Substitutions
  - Logographic Substitutions
  - Visual Substitutions

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<tr>
<td>o</td>
<td>o</td>
<td>0.86</td>
</tr>
<tr>
<td>o</td>
<td>θ</td>
<td>0.01</td>
</tr>
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Normalization Model (Character)

- What we can learn from this model now?
  - Phonetically Similar Substitutions
  - Logographic Substitutions
  - Visual Substitutions
  - Segmentation
  - ...

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<tr>
<td>ingfor</td>
<td>ing for</td>
<td>0.45</td>
</tr>
<tr>
<td>gf</td>
<td>gf</td>
<td>0.01</td>
</tr>
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Results (Normalization)

- Normalization Dataset
  - Training set: 1.3M normalization pairs
  - Test set: 1290 normalization pairs/translation pairs
    - annotation from previous work + normalization
Results (Normalization)

- Evaluation with BLEU

Orig: I wanna meeeeeeet DanielVeuleman

Norm: I want to met Daniel Veuleman

Ref: I want to meet Daniel Veuleman

Score: X.XX
Results (Normalization)

- Setups
  - Phrase-based Model (P)

- I wanna meeet Daniel Veuleman
- I want to met Daniel Veuleman
Results (Normalization)

- **Setups**
  - Phrase-based Model (P)
  - Phrase-based Model + Character-based Model (PC)

```
I wanna meeemeet Daniel Veuleman
```

```
Character-based Model
```

```
I wanna meet Daniel Veuleman
```

```
Phrase-based Model
```

```
I want to meet Daniel Veuleman
```
## Results (Normalization)

- **Normalization Results**

<table>
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<tr>
<th>Setup</th>
<th>BLEU</th>
</tr>
</thead>
<tbody>
<tr>
<td>No normalization</td>
<td>19.90</td>
</tr>
<tr>
<td>Normalization(P)</td>
<td>21.96</td>
</tr>
<tr>
<td>Normalization(PC)</td>
<td>22.39</td>
</tr>
</tbody>
</table>
Results (Translation)

- Translation Systems
  - Moses (NIST)
  - Moses (NIST+Weibo)
  - Online Systems (Google, Bing, Youdao)
    - Online A, Online B and Online C
Results (Translation)

- Translation Results

<table>
<thead>
<tr>
<th>Setup</th>
<th>Ours (NIST)</th>
<th>Ours (NIST+Weibo)</th>
<th>Online A</th>
<th>Online B</th>
<th>Online C</th>
</tr>
</thead>
<tbody>
<tr>
<td>No normalization</td>
<td>15.1</td>
<td>24.4</td>
<td>20.1</td>
<td>17.9</td>
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# Results (Translation)

- Translation Results

<table>
<thead>
<tr>
<th>Setup</th>
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<th>Ours (NIST+Weibo)</th>
<th>Online A</th>
<th>Online B</th>
<th>Online C</th>
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<td>Normalization (P)</td>
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<td>24.3</td>
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<td>18.1</td>
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- wanna = want to
- gotta = going to
- u = you
- 4 = for
## Results (Translation)

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<tr>
<td>Normalization (PC)</td>
<td><strong>15.9</strong></td>
<td><strong>24.4</strong></td>
<td><strong>20.6</strong></td>
<td><strong>18.2</strong></td>
<td><strong>19.1</strong></td>
</tr>
</tbody>
</table>

- representin=representing
- peaceof=peace of
Conclusion

● Presented a method to build a normalization system using translation
  ○ Corpora built using translation
  ○ Model built using Machine Translation on the phrase level and character level
Conclusion

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  - Model built using Machine Translation on the phrase level and character level
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- More Data = better
  - … and we are crawling everyday
Future Work

- Some problems in the model
  - No null translations (missing words or punctuation)
Thank you very much for your attention :)