NLP and Perl

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Outline

Introduction

Why Perl and NLP?

`Lingua::EN::*`

- Parsing English
- Categorization and Extraction
- Link parsing

Conclusions

References

- Simon Cozens, "Advanced Perl Programming", 2^{nd} Edition (Chapter 5 - Natural Language Tools)
- Dan Brian, "Parsing Natural Language with Lingua::LinkParser", The Perl Journal, Issue 19, Fall 2000 (volume 5, number 3) `http://www.foo.be/docs/tpj/`
- `http://www.link.cs.cmu.edu/link/index.html`
- `http://search.cpan.org/`

Caveat

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- . . . but I use to ~~have fun~~. . . ehm. . . work with Perl!

Natural Language Processing

- NLP...
  - ...is intended to replay to questions on human written documents like the followings:
    - what does it mean?
    - what other documents is it like?
    - ...
  - ...uses AI techniques

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  - ...is often described as a text processing language
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    - natural language features (e.g postfix-if)

```
print $x if($x > 42);
```

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- A lot of modules around
  - CPAN (Comprehensive Perl Archive Network)
    - on line since October 26 1995 (10 years!)
    - 3061 MB
    - 283 mirrors
    - 5126 authors
    - 10066 modules

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- `Text::NLP` (version 0.1)
- `NLP::ExtractFeatures` (not in CPAN)

Lingua::EN::*

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- NLP modules
  - Lingua::EN::Sentence
  - Lingua::EN::StopWords
  - Lingua::Stem::En
  - Lingua::EN::Tagger
  - Lingua::EN::Summarize
  - Lingua::EN::NamedEntitiy
  - ...

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  - customizable module (via `add_acronyms` method)

Splitting Up Sentences (example)

```
use Lingua::EN::Sentence qw(get_sentences add_acronyms);

my $text<<EOF;
This punctuation-based assumption is generally good enought,
but screws massily on sentences containing abbreviations
followed by capital letters, e.g., This one. Shlomo Yona's
Lingua::EN::Sentence does a considerably better job:
EOF

my $sentences = get_sentences($text);

foreach my $sentence (@$sentences){
  printf "#",$sentence,"\n\n";
}
```

Splitting Up Sentences (example output)

```
[nids@vultus NLP]% split_ex.pl
#This punctuation-based assumption is generally good enought,
but screws massily on sentences containing abbreviations
followed by capital letters, e.g., This one.

#Shlomo Yona's Lingua::EN::Sentence does a considerably
better job:

[nids@vultus NLP]%
```

Stemming and Stopwording

- `Lingua::Stem::En`
  - Stemming consist in reduction of words to simpler form
    - useful in building histograms
    - "volcano erupting", "volcanoes erupted" $\Rightarrow$ "volcano erupt"
    - implementation of the Porter Stemming Algorithm (Porter, M.F., "An Algorithm For Suffix Stripping", Program 14 (3), July 1980, pp. 130-137)
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- **Plucene**, a Perl-based, and highly customizable search engine toolkit, based on the Lucene API, uses uses `Lingua::Stem::EN`

Stemming and Stopwording (example 1/2)

```
use Lingua::EN::StopWords qw(%StopWords);
use Lingua::Stem::En;
use Lingua::EN::Splitter qw(words);
use List::Util qw(sum);

print compare("The AD 79 volcanic eruption of Mount Vesuvius",
              "The volcano, Mount Vesuvius, erupted in 79AD");

print "\n";
```

Stemming and Stopwording (example 2/2)

```
sub sentence2hash{
  my $words = words(lc(shift));
  my $stemmed = Lingua::Stem::En::stem({
     -words => [grep { !$StopWords{$_} } @$words]
  });
  return { map { $_ => 1 } grep $_, @$stemmed };
}

sub compare{
  my ($h1, $h2) = map { sentence2hash($_) } @_;
  my %composite = %$h1;
  $composite{$_}++ for keys %$h2;
  return 100*(sum(values %composite)/keys %composite)/2;
}
```

Stemming and Stopwording (example output)

```
[nids@vultus NLP]% compare_ex.pl
79
[nids@vultus NLP]%
```

Only 23 lines of code (considering empty lines)

Bayesian Analysis

- `Algorithm::NaiveBayes`
  - "Naive Bayes" machine learning algorithm
  - if compared to other algorithms (kNN, SVM, Decision Trees)
    - pretty fast
    - reasonably competitive in quality

Bayesian Analysis (example 1/3)

```
use XML::RSS;
use Lingua::EN::StopWords qw(%StopWords);
use Lingua::EN::Splitter qw(words);
use Algorithm::NaiveBayes;

my $nb = new NaiveBayes->new();
for my $category (qw(interesting boring)){
  my $rss = new XML::RSS;
  $rss->parsefile($category.".rdf");
  for $i (@{$rss->{'items'}}){
  $nb->add_instance(
     attribute => invert_item($i),
     label     => $category);
  }
}
$nb->train;
```

Bayesian Analysis (example 2/3)

```
sub invert_string{
  my ($string, $weight, $hash) = @_;
  for my $i (grep {!$StopWords{$_}} @{words(lc($string))}){
     $hash->{$i} += $weight
  }
}

sub invert_item{
  my $item = shift;
  my %hash;
  invert_string($item->{title}, 2, \%hash);
  invert_string($item->{description}, 1, \%hash);
  return \%hash;
}
```

Bayesian Analysis (example 3/3)

```
my $target = new XML::RSS;
$target->parsefile("incoming.rdf");
for my $item (@{$target->{items}}){
  print "$item->{'title'}: ";

  my $predict = $nb->predict(attribute => invert_item($item));
  print int($predict->{interesting}*100)."% interesting\n";
}
```

Bayesian Analysis (example output)

```
[nids@vultus NLP]% bayesian_ex.pl
Elektro, the oldest U.S. Robot: 12% interesting
Open-Source technique for GM Crops: 99% interesting
...
```

Only 38 lines of code (considering empty lines)

Link parsing

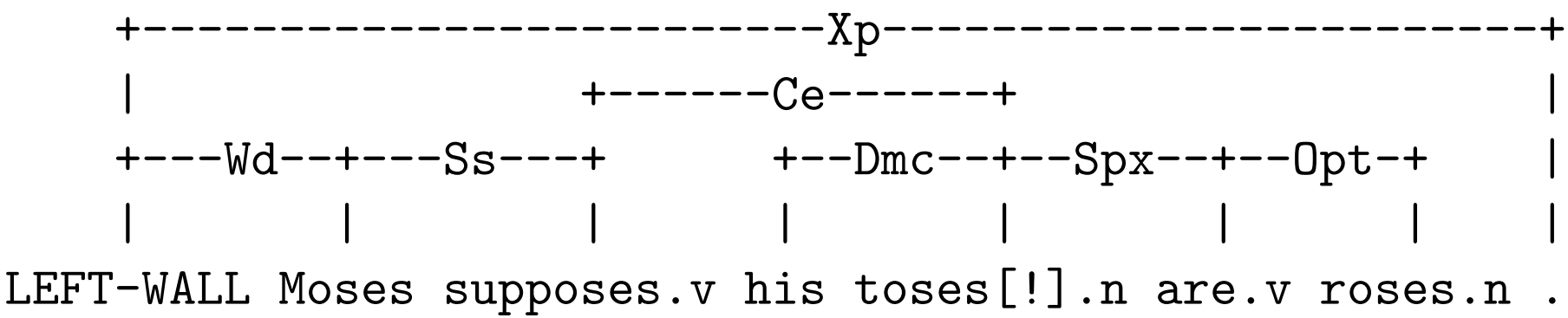
- `Lingua::LinkParser`
  - implements the Link Grammar Parser by Sleator, Temperley and Lafferty at CMU.
  - given a sentence, the module assigns to it a syntactic structure, which consists of set of labeled links connecting pairs of words
  - it can be used/tested on-line (via cgi): `http://www.link.cs.cmu.edu/link/submit-sentence-4.html`
  - starting from version 4.0 supports morpho-guessing (marked with the `[!]` symbol)

Link parsing (example)

```
use Lingua::LinkParser;

my $parser = new Lingua::LinkParser;
my $text   = "Moses supposes his toses are roses.";

my $sentence = $parser->create_sentence($text);
my $linkage  = $sentence->linkage(1);

print $parser->get_diagram($linkage);
```

Caveat: this code on my machine produces a segmentation fault error. But my machine is a mess :)

Link parsing (example output)



Conclusions

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- A lot of tools
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  - . . . if something is missing you can program it by yourself

Call for contribution

- Module `Lingua::IT::*` is quite small
  - `Lingua::IT::Conjugate`
  - `Lingua::IT::Hyphenate`
  - `Lingua::IT::Numbers`
- Also other Italian Language modules are few
  - `Lingua::Stem::It`
  - `Lingua::StopWords::IT`

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- If you work in NLP research you can contribute...

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