INFSCI 2480
Text Processing

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Goal

- Produce a set of indexing terms
  - make the best use of resources
  - accurately match user query terms

Text Processing

- Lexical Analysis
- Extract terms
- Removing stop words
- Stemming
- Term selection

Lexical Analysis

- Control information
  - Html tags : <.*>
- Numbers and digits
  - “The first class was held in the Cathedral of Learning in 1931”
  - {1931} => keep or remove ?
- Hyphens
  - Keep or remove? When to keep? When to remove?
  - index as phrase?
- Punctuations
  - “B.C.”,”B.S.”
  - URLs
- Case-sensitive V.S case-insensitive
  - “YMCA” =? “ymca”

Lexical Analysis

- Converting byte stream to tokens
  - “The first class was held in the Cathedral of Learning in 1931.”
  - {The, first, class, was, held, in, the, Cathedral, of, Learning, in, 1931, .}

Extract Terms

- PHP
  http://php.net/manual/en/book.tokenizer.php
- JAVA
  http://download.oracle.com/javase/1.4.2/docs/api/java/util/StringTokenizer.html
- Python
  http://docs.python.org/library/tokenize.html
- Automatic services
  - http://www.opencalais.com/
  - http://www.lemurproject.org/lemur/indexing.php

Removing stop words

- Stop words :
  - 20-500 English words (*an, and, by, for, of, the, ...)*
  - Subject-dependent stop lists
- Pros
  - Improving storage efficiency
  - Improving search performance
  - ….
- Cons
  - “to be or not to be”
  - AT&T
  - “ C” => programming index

CACM text collection:

a, about, above, accordingly, across, after, afterwards, again, against, all, almost, alone, along, already, also, although, always, am, among, amongst, an, and, another, any, anybody, anyhow, anyone, anything, anywhere, apart, are, around, as, aside, at, away, awfully, b, be, became, because, become, becomes, becoming, been, before, beforehand, behind, being, below, beside, besides, best, better, between, beyond, both, brief, but, by, c, can, cannot, cant, certain, co, consequently, could, d, did, do, does,

…..

x, y, yet, you, your, yours, yourself, yourselves, z, zero, /*, manual, unix, programmer's, file, files, used, name, specified, value, given, return, use, following, current, using, normally, returns, returned, causes, described, contains, example, possible, useful, available, associated, would, cause, provides, taken, unless, sent, followed, indicates, currently, necessary, specify, contain, indicate, appear, different, indicated, containing, gives, placed, uses, appropriate, automatically, ignored, changes, way, usually, allows, corresponding, specifying.

- http://www.ranks.nl/resources/stopwords.html
- http://www.textfixer.com/resources/common-english-words.txt

Removing stop words

- Table lookup
  - Make a table with stop words
  - Match each token against the table
  - Hashes
- Build into the lexical analyzer (embedded in the tokenizor)

Stemming

- Reduce variant word forms to a single form
  - retrieve, retrieving, retrieval, retrieved, ⇨ retriev
- Stemming approaches:
  - Table lookup – use a dictionary
  - Successor variety – fancy suffix removal
  - Affix removal - Strips prefixes of suffixes (-s, -ed, -ly, -ness)

Stemming Algorithms

- Lovins (1968)
- **Porter (1980)**
- Paice/Husk (1990)
- **Krovetz (1993)**

http://www.comp.lancs.ac.uk/computing/research/stemming/Links/algorithms.htm

Term Selection

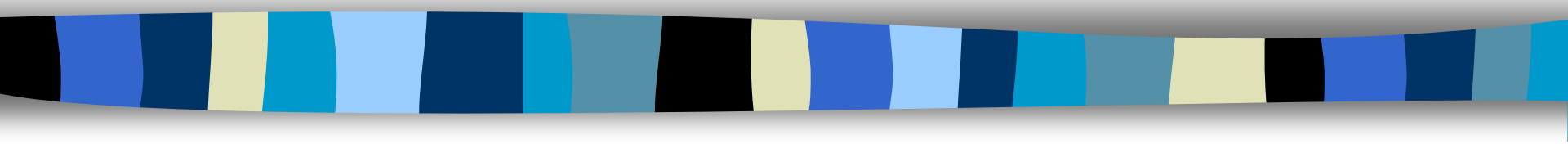
- Single word (uni-gram)
- Word pairs (bi-grams, n-grams)
- Noun phrases
  - Natural Language Processing(NLP)
  - Identify nouns along with adjectives and adverbs in the same phrase
  - “Adaptive Web” and “Interactive system design”
- Name entities
  - *“Jim bought 300 shares of Acme Corp. in 2006.”*

    <ENAMEX TYPE="PERSON">*Jim****</ENAMEX>*** *bought* ***<NUMEX TYPE="QUANTITY">****300****</NUMEX>*** *shares of* ***<ENAMEX TYPE="ORGANIZATION">****Acme Corp.****</ENAMEX>*** *in* ***<TIMEX TYPE="DATE">****2006****</TIMEX>****.*

Term processing in Python

- http://pypi.python.org/pypi/topia.termextract/#downloads

Lemur (a toolkit in IR)



http://sourceforge.net/apps/trac/lemur/wiki/Quick%20Start

Download and compile

- [http://sourceforge.net/projects/lemur/files/lemur/indri-5.0/indri-5.0.tar.gz/download].
  - Run the commands:

    tar -zxf indri-5.0.tar.gz

    cd indri-5.0

    ./configure

    make

Input Content

- <DOC>
  <DOCNO> document_number
  </DOCNO>
  <TEXT>
  Index this document text.
  </TEXT>
  </DOC>

Create parameter_file

```
<parameters>
    <memory>200m</memory>
    <index>/path/to/outputIndex</index>
    <stemmer> <name>krovetz</name> </stemmer> <corpus>
        <path>/path/to/collection1/</path>
        <class>trectext</class>
    </corpus>
    <corpus>
        <path>/path/to/collection2/</path>
        <class>trecweb</class>
    </corpus>
    <field><name>title</name></field>
    <field><name>date</name><numeric>true</numeric><parserN
    ame>DateFieldAnnotator</parserName></field>
</parameters>
```

Indexing

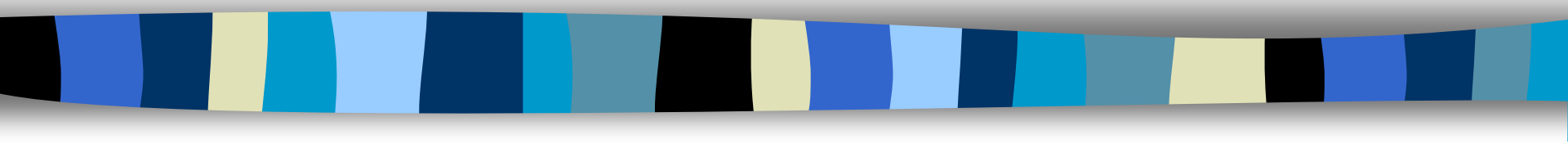
- Run the commands:

  indri-5.0/buildindex/**IndriBuildIndex parameter_file**

- In Python, you can extract indexed info from indri

  f = os.popen(**'dumpindex** /home/yiling/hci/indri/index dv %d' %docid)

OpenCalais



Implementation steps

- Register http://www.opencalais.com/user
- Request API Key
- Preparing input content
  - TEXT
  - HTML,
  - XML
- Start implementing your scripts
  - http://www.opencalais.com/documentation/calais-web-service-api/forming-api-calls/input-parameters

Example in Python

license = “the requested key from OpenCalais“

params =

"""

<c:params xmlns:c="http://s.opencalais.com/1/pred/" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">

<c:processingDirectives c:contentType="text/txt" c:enableMetadataType="GenericRelations“
c:outputFormat="text/simple">

</c:processingDirectives>

<c:userDirectives c:allowDistribution="true" c:allowSearch="true" c:externalID="17cabs901" c:submitter="yiling">

</c:userDirectives>

<c:externalMetadata>

</c:externalMetadata>

</c:params>

“””

content = "NEW YORK (CNNMoney.com) -- The U.S. Postal Service may be forced to eliminate”

```
def get_oc_result(license, content, param):
    url = "http://api.opencalais.com/enlighten/rest/"
    headers = {"Content-type": "application/x-www-form-urlencoded"}
    conn = httplib.HTTPConnection('api.opencalais.com')
    conn.request("POST", "/enlighten/rest/", urlencode({'content':content, 'licenseID':license,
    'paramsXML':params}), headers)
    r1 = conn.getresponse()
    data = r1.read()
    return data

oc_out = get_oc_result(license, content, params)
print oc_out
```

Sample of OpenCalais Output

<CalaisSimpleOutputFormat>
<Person count="2" relevance="0.121">Kenneth E. Kendall</Person>
<Position count="2" relevance="0.338">designer</Position>
<Position count="2" relevance="0.368">airport Ramp Planner</Position>
<Company count="1" relevance="0.082" normalized="PRENTICE HALL">Prentice-Hall</Company>
<IndustryTerm count="1" relevance="0.215">averbal protocol</IndustryTerm>
<IndustryTerm count="1" relevance="0.133">computer applications</IndustryTerm>
<IndustryTerm count="1" relevance="0.326">verbal protocol</IndustryTerm>
<IndustryTerm count="1" relevance="0.353">userInteractive systems</IndustryTerm>
<IndustryTerm count="1" relevance="0.171">software vendors</IndustryTerm>
<Position count="1" relevance="0.326">control-room Ramp Planner</Position>
<Position count="1" relevance="0.326">text editor</Position>
<Technology count="1" relevance="0.326">verbal protocol</Technology>
<Topics>
<Topic Taxonomy="Calais" Score="0.926">Technology_Internet</Topic>
</Topics>
</CalaisSimpleOutputFormat>

Questions, Comments or Discussions

ONLINE TEXT PROCESSING SOURCE

HTTP://GNOSIS.CX/TPIP/

HTTP://PROQUEST.SAFARIBOOKSONLINE.COM/BOOK/SOFTWARE-ENGINEERING-AND-DEVELOPMENT/PATTERNS/9781933988665