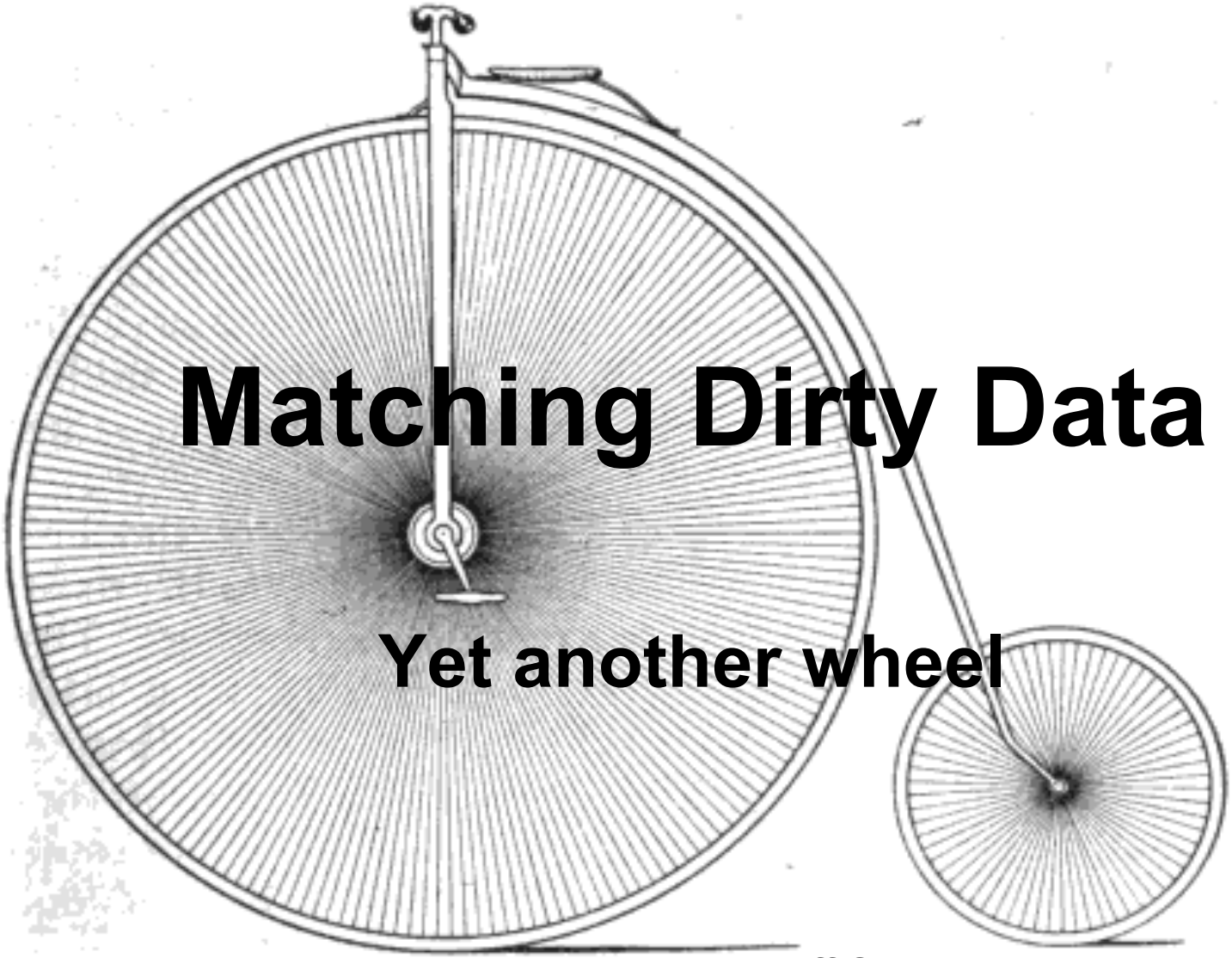


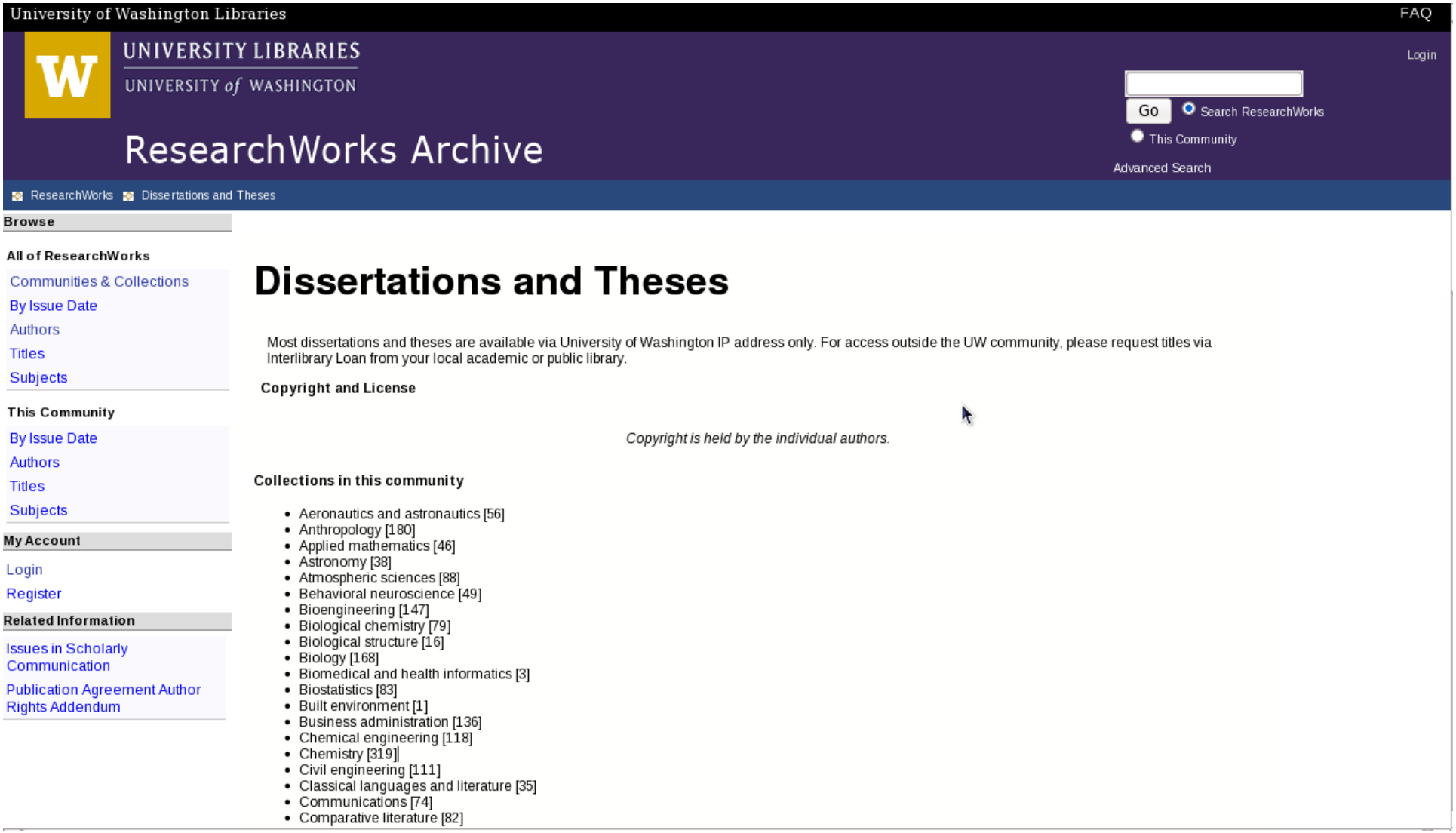
Matching Dirty Data

Yet another wheel

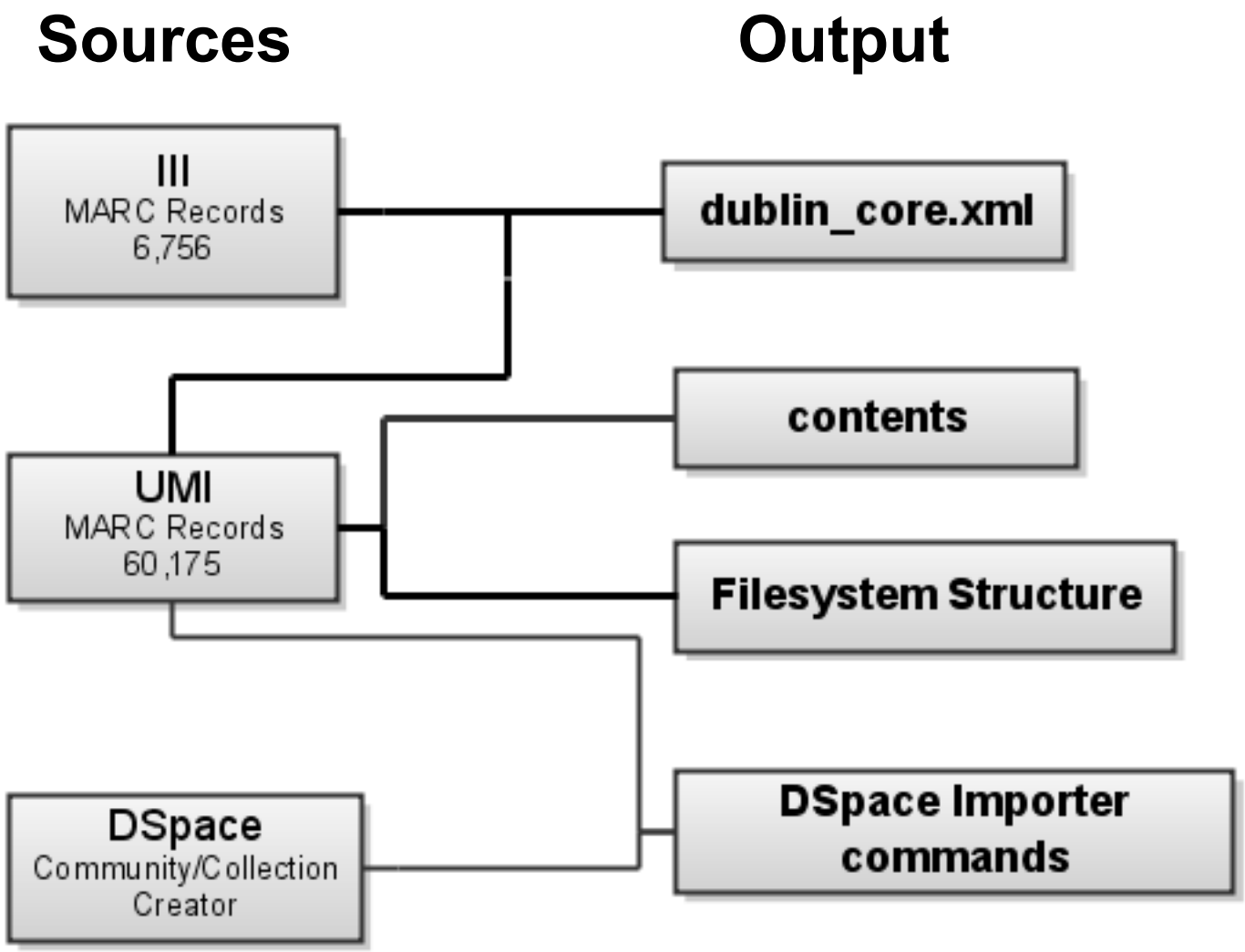
Jeff Sherwood, Programmer.
Anjanette Young, Systems Librarian.
University of Washington, Libraries.

DSpace Repository

Goal Ingest Metadata and PDF's for ETD's received from UMI into a DSpace repository.



Electronic Theses & Dissertations



MARC Fields

UMI Records

=001 (Filename)
=520 (Abstract)

III Records

=001 (OCLC number)
=100 (Author)
=245 (Title)
=260 (Date published)
=502 (type and date)
=695 (Department)
=941 (Local identifier)

dublin_core.xml

```
<dublin_core>
   <dcvalue element="identifier" qualifier="other">
      iii[941]</dcvalue>
   <dcvalue element="title" qualifier="none">
      iii[245][a][b]</dcvalue>
   <dcvalue element="contributor" qualifier="author">
      iii[100][a][b][c]</dcvalue>
   <dcvalue element="description" qualifier="abstract">
      umi[520][a]</dcvalue>
   <dcvalue element="subject" qualifier="other">
      iii[655][a][x]</dcvalue>
</dublin_core>
```

MARC Loader . . . No.

```
|||0|0| | |0|n|G|0|@ov_action="o"
|||0|0| | |0|n|G|0
|@ov_protect="b=V0123456789d(690,695:d)
                                hn(590:d)y(099,249,852,856:d)y(910,925,
                                980,981)F26"
035|001  |+|0|0|b|o|0|y|N|0|%001(start="1-9",char="!-~")
245||+|0|0|b|t|0|y|N|0|%bracket="h"
500-599||+|0|0|b|n|0|y|N|0|
600-651||-w|0|0|b|d|0|y|N|0|
653-657||+|0|0|b|d|0|y|N|0|
690-699||-w|0|0|b|d|0|y|N|0|
700-715||-w|0|0|b|b|0|y|N|0|
730-740||-w|0|0|b|f|0|y|N|0|
```

Matching overview

Ham-fisted Method

1. Exact Title + Exact Author
2. Exact Title + Shortened Author

Cool Math Method

Calculate Similarity of Title
Calculate Similarity of Author

1. Exact Title + Fuzzy Author
2. Fuzzy Title + Fuzzy Author
3. Fuzzy Title or Fuzzy Author

Pymarc - the MARC Hammer

```
umi_dict = {
  Alaskan Bootlegger: {author: Leon Kania, umi_count = 1},
  title2_value: {author: author2_value, umi_count = index2},
  . . .
   }

iii_dict = {
  Alaskan Bootlegger: {author: Leon W. Kania, iii_count = 9},
  title2_value: {author: author2_value, iii_count = index2},
  . . .
   }
```

Exact title + exact author

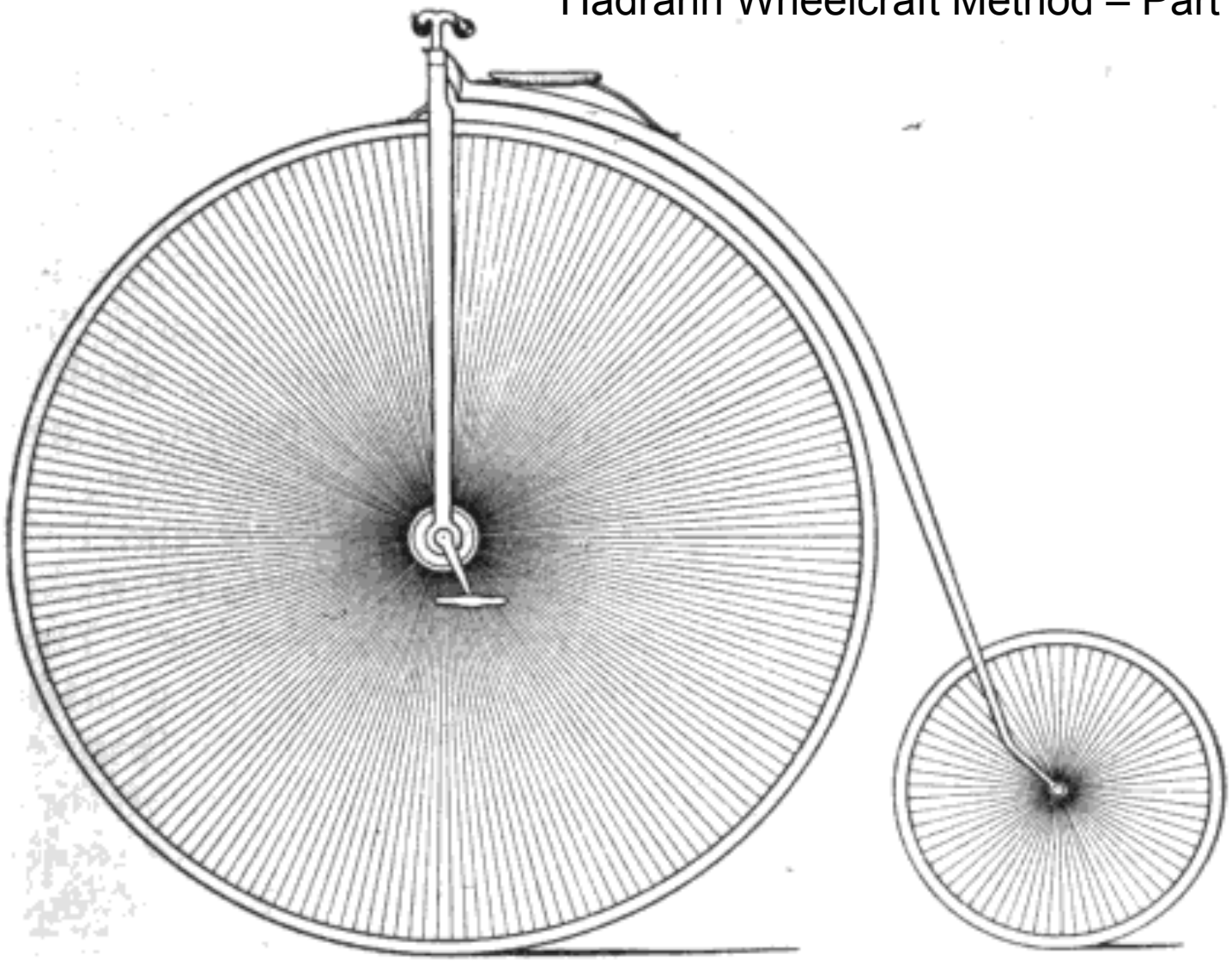
```
# Exact Title
# Create sets out of the dictionary keys
umi_set = set(umi_dict.iterkeys())
iii_set = set(iii_dict.iterkeys())

# Find the Intersection of sets.
title_match = umi_set & iii_set

# Verify Intersection with Exact Author
for x in title_match:
    if umi_dict[x][author] == iii_dict[x][author]:
        . . . do stuff.
```

Exact title + Truncated author

```
def shortenAuthorName(name):
    #Leon W. Kania        ->       [Leon, W., Kania]
    namelist = str(name).split()
    if len(namelist) > 2:
        shortname = "%s %s" % (namelist[0], namelist[-1])
    else:
        shortname = name
    return shortname
```

"If you break three spokes, it is time for a rebuild"

Charles Hadrann,
"Hadrann Wheelcraft Method – Part 1 Lacing"



Rogues Gallery

USE OF CROWN LENGTH TO DEFINE STEM FORM: SEGMENTED TAPER EQUATION (DOUGLAS FIR)

Use of crown length to define stem form :: segmented taper equation

Towards an understanding of seismic performance of three-dimensional structures: Stability and reliability

Towards an understanding of seismic performance of 3D structures :: stability & reliability

Hoekstra, Hopi Danielle Elisabeth

Hoekstra, Danielle E

Arnason, Halldor

Halldór Árnason

Levenshtein Edit Distance

Edit distance is the number of operations required to transform one string of characters into the another.

How many steps to turn

kitten

into **sitting**?

3

kitten → sitten (k changes to s)

sitten → sittin (e changes to i)

sittin → sitting (insert g)

LD is Always...

≥ difference in string lengths
≤ length of the longer string
= 0 if the strings are identical

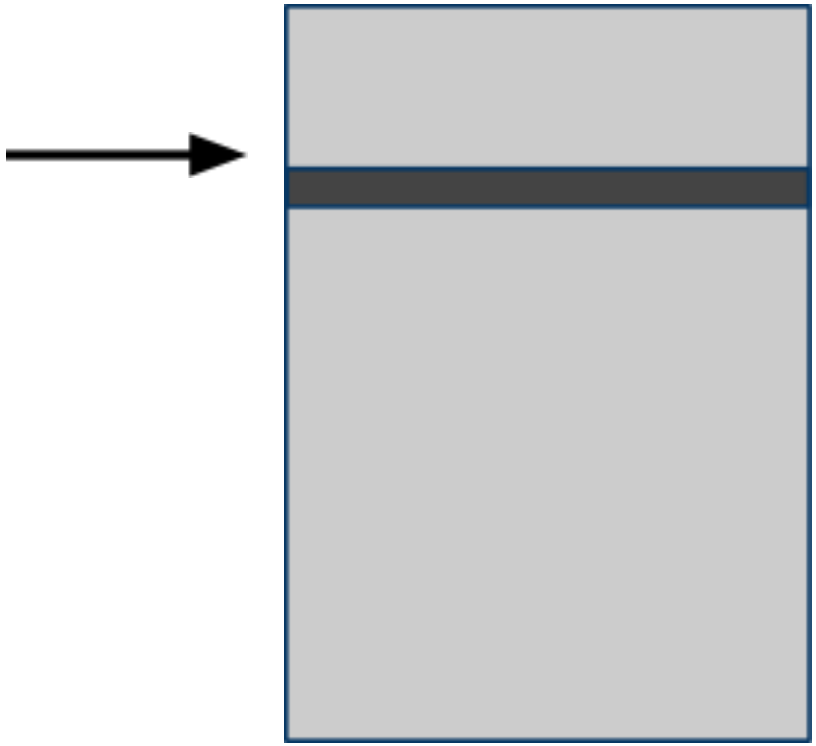
Similarity Score

$$similarity = 1 - \frac{d_L}{\max(|s_1|, |s_2|)}$$

Optimizations

Reduce the Search Space

"A stochastic model of cyclical interaction processes"



All titles

Reduce the Search Space

Identify Stopwords

the: 24587
for: 7643
with: 3323
effects: 1958
evaluation: 1073
...
hypoxic: 1
reduplication: 1
picaresque: 1
emperador 1
heteroduplex 1

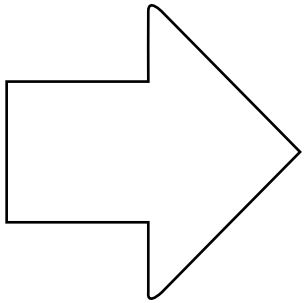
Throw out common words in titles

Keep the rarer ones

Reduce the Search Space

Extract Significant Words

"Stochastic models for DNA sequence data"



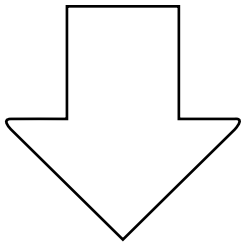
stochastic dna sequence

Reduce the Search Space

```
rec = {'title': 'Stochastic models...',}

index['stochastic'].append(rec)
index['dna'].append(rec)
index['sequence'].append(rec)
```

Reduce the Search Space

index['stochastic']



{'title': "Stochastic models for DNA sequence data", ...}
{'title': "A stochastic model of clan systems", ...}
{'title': "A stochastic model of cyclical interaction processes", ...}
{'title': "Stochastic reliability models for maintained systems", ...}
{'title': "Uniform approximation and almost periodicity of doubly stochastic operators", ...}

Normalize Names

Hoekstra, Hopi Danielle Elisabeth

Hoekstra, Danielle E

Normalize Names

Hoekstra, H

Hoekstra, D

Normalize Names

Arnason, Halldor

Halldór Árnason

Normalize Names

Arnason, H

Árnason, H

Improvements

Jaro-Winkler Algorithm

$$d_j = \frac{1}{3}\left(\frac{m}{|s_1|} + \frac{m}{|s_2|} + \frac{m-t}{m}\right)$$

What's a "match"?

Two characters match if they are a reasonable distance from one another as defined by:

$$\left\lfloor \frac{max(|s_1|, |s_2|)}{2} \right\rfloor - 1$$

Example

$$d_j = \frac{1}{3}\left(\frac{m}{|s_1|} + \frac{m}{|s_2|} + \frac{m-t}{m}\right)$$

s1 = Martha
s2 = Marhta

$$d_j = \frac{1}{3}\left(\frac{6}{6} + \frac{6}{6} + \frac{6-1}{6}\right)$$

$$\approx 0.944$$

Example

$$similarity = 1 - \frac{d_L}{\max(|s_1|, |s_2|)}$$

s1 = Martha
s2 = Marhta

$$similarity = 1 - \frac{2}{6}$$

$$\approx 0.667$$

Jaro-Winkler works
best for short strings

Resources

Levenshtein & Jaro-Winkler

Background

http://en.wikipedia.org/wiki/Levenshtein_distance
http://en.wikipedia.org/wiki/Jaro-Winkler_distance

Code

http://pypi.python.org/pypi/editdist/0.1
http://pypi.python.org/pypi/python-Levenshtein/0.10.1

Miscellaneous

String Comparison Tutorial

http://bit.ly/ZGSmF

SecondString - Java text analysis library

http://secondstring.sourceforge.net/

MarcXimiL - MARC de-duping package

http://marcximil.sourceforge.net/

http://snurl.com/uggtn