Introduction to SRILM Toolkit

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Available Web Resources

- SRILM: "http://www.speech.sri.com/projects/srilm/"
  - A toolkit for building and applying various statistical language models (LMs)
  - Current version: 1.4.5(stable) 1.4.6(beta)
  - Can be executed in Linux environment

- Cygwin: "http://www.cygwin.com/"
  - Cygwin is a Linux-like environment for Windows
  - Current version: 1.5.18-1

Steps for Installing Cygwin

1. Download the cygwin installation file "**setup.exe"** from the website
2. Run setup.exe
3. Choose "Install from Internet" (or others)
4. With a default setting, it will be installed in "**c:\cygwin**"
5. "Local Package Directory" means the temporary directory for packages
6. Choose a downloadable (mirror) website

Steps for Installing Cygwin (cont.)

7. Note that:

   If you want to compile original source code

   Change Category “View” to Full

   Check if the packages **“binutils”, “gawk”, “gcc”, “gzip”, “make”, “tcltk”, “tcsh”** are selected

   If not, use the default setting

8. After installation, run cygwin

   It will generate “**.bash_profile**”, “**.bashrc**”, “**.inputrc**” in “**c:\cygwin\home\yourname**”

Steps for Installing SRILM Toolkit

Now we then install "**SRILM**" into the "**Cygwin**" environment

1. Copy "**srilm.tgz**" to "**c:\cygwin\srilm**"
   - Create the "**srilm**" directory if it doesn't exist
   - Or, merely copy "**srilm.zip**" to c:\cygwin

2. Extract "**srilm.tgz**" (src files) or "**srilm.zip**" (executable files)

```
commands in cygwin:
$ cd /
$ mkdir srilm      //create the "srilm" directory
$cd srilm
$ tar zxvf srilm.tgz   //extract srilm.tgz
```

Steps for Installing SRILM Toolkit (cont.)

3. Edit “c:\cygwin\home\yourname\.bashrc”
   - Add the following several lines into this file

```
export SRILM=/srilm
export MACHINE_TYPE=cygwin
export PATH=$PATH:$pwd:$SRILM/bin/cygwin
export MANPATH=$MANPATH:$SRILM/man
```

4. Restart “Cygwin”
   - We can start to use the SRILM if the precompiled files (e.g., those extracted from “**srilm.zip**”) are installed/copied into the desired directory
   - Or, we have to compile the associated source code files (e.g., those extracted from “**srilm.tgz**”) manually (See **Steps “5”**)

Steps for Installing SRILM Toolkit (cont.)

5. Compile the SRILM source code files
   - Run cygwin
   - Modify “/srilm/Makefile”
     - Add a line: “**SRILM = /srilm”** into this file
   - Switch current directory to “**/srilm**”
   - Execute the following commands

```
$ make World
$ make all
$ make cleanest
```

   - Check “INSTALL” or “srilm/doc/README.windows” for more detailed information

Environmental Setups

- Change cygwin's maximum memory

  "regtool -i set /HKLM/Software/Cygnus\ Solutions/Cygwin/heap_chunk_in_mb 2048"

  – Referred to: "http://cygwin.com/cygwin-ug-net/setup-maxmem.html"

- Use Chinese Input In Cygwin
  – Manually edit the "**.bashrc**" and "**.inputrc**" files

.inputrc

```
set meta-flag on
set convert-meta off
set output-meta on
set input-meta on
```

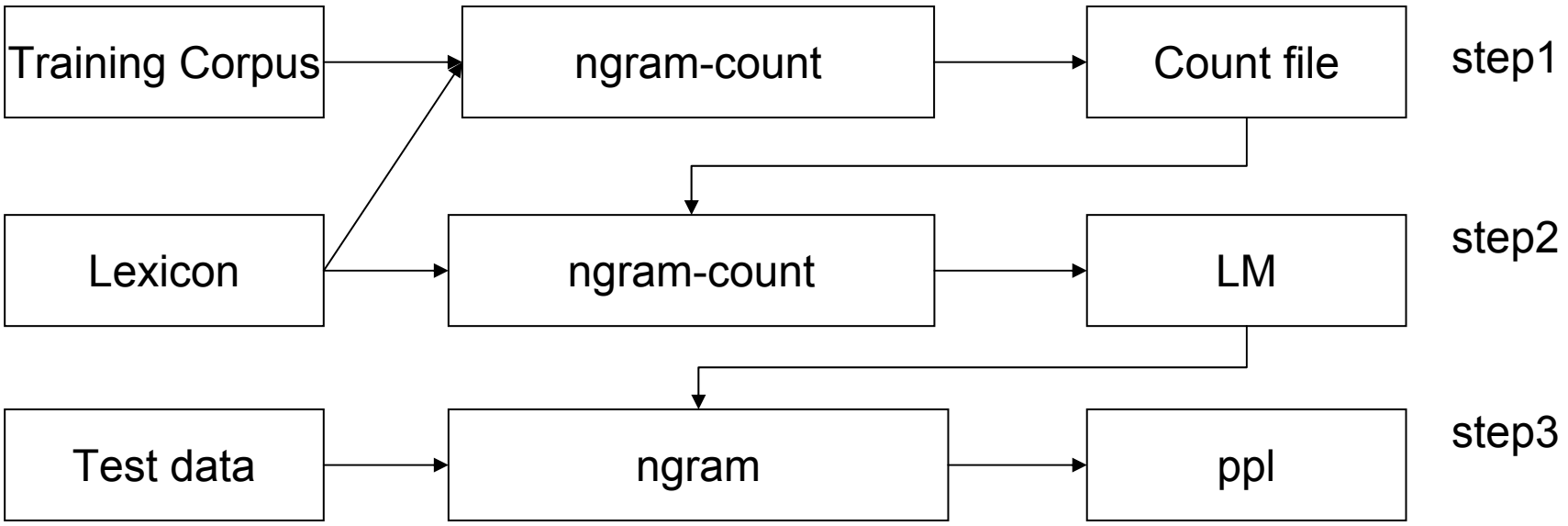
.bashrc

```
export LESSCHARSET=latin1
alias ls="ls --show-control-chars"
```

  – Referred to: "http://cygwin.com/faq/faq_3.html#SEC48"

Functionalities of SRILM

- Three Main Functionalities
  - Generate the n-gram count file from the corpus
  - Train the language model from the n-gram count file
  - Calculate the test data perplexity using the trained language model



Format of the Training Corpus

- Corpus: e.g., “CNA0001-2M.Train” (56.7MB)
  - Newswire Texts with Tokenized Chinese Words

中華民國 八 十九 年 一月 一 日
萬
黃 兆 平
面對 這個 歷史性 的 時刻
由 中國 電視公司
昨晚 在 中 正紀念堂 吸引 了 超過 十 萬 人潮
共同 迎接 千禧 年
勤奮 努力
欣欣向榮 外
……

Format of the Lexicon

- Lexicon: “Lexicon2003-72k.txt”

巴
八
扒
叭

墨竹
默祝
末梢
沒收
墨守
陌生
……

- Vocabulary size: 71695
- Maximum character-length of a word: 10

Generating the N-gram Count File

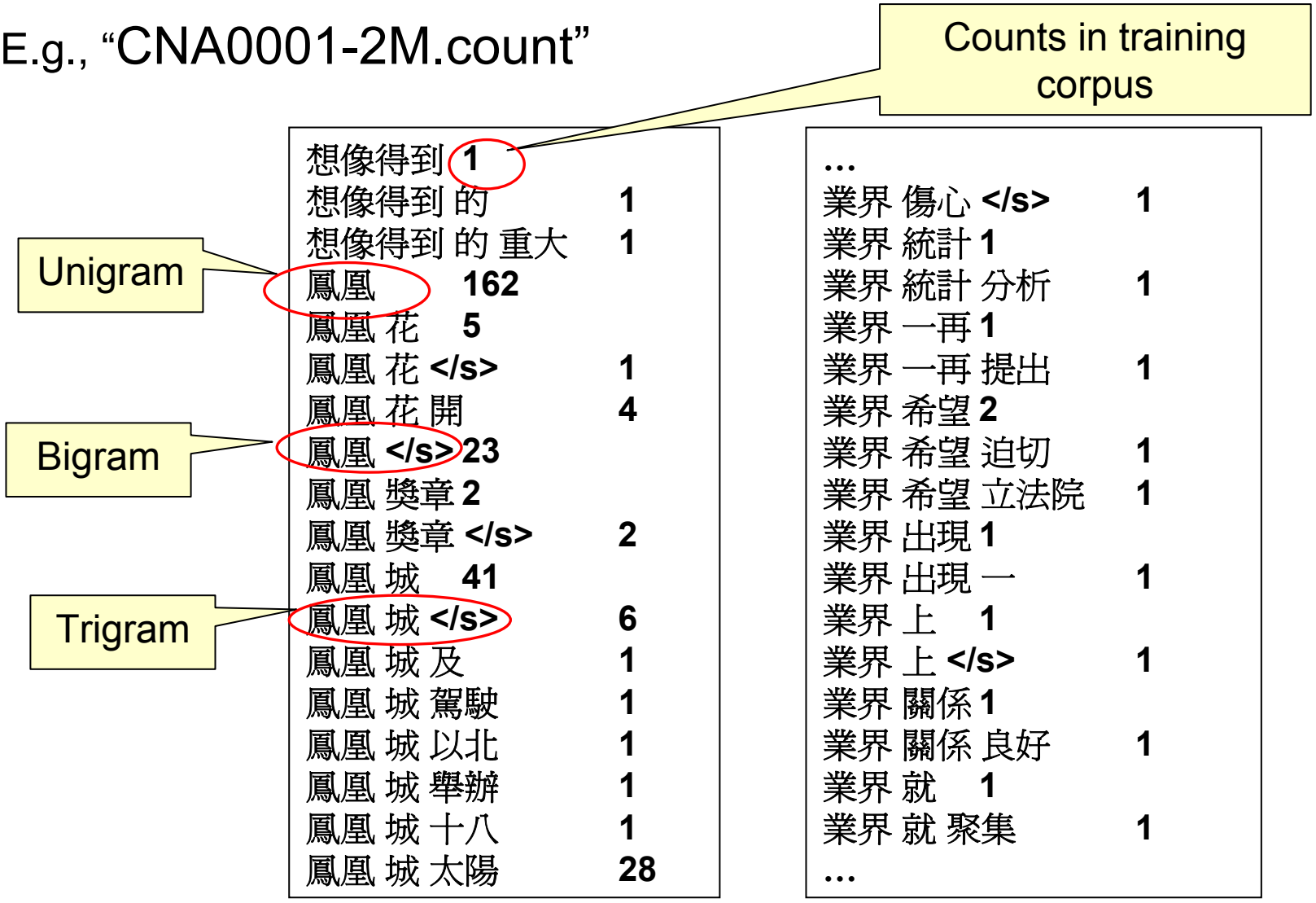
- Command

```
ngram-count -vocab Lexicon2003-72k.txt
            -text CNA0001-2M.Train
            -order 3
            -write CNA0001-2M.count
            -unk
```

  – Parameter Settings
    -vocab: lexicon file name
    -text: training corpus name
    -order: n-gram count
    -write: output countfile name
    -unk: mark OOV as <unk>

Format of the N-gram Count File

•E.g., "CNA0001-2M.count"



Generating the N-gram Language model

- Command

```
ngram-count  -read CNA0001-2M.count
             -order 3
             -lm CNA0001-2M_N3_GT3-7.lm
             -vocab Lexicon2003-72k.txt
             -gt1min 3 -gt1max 7
             -gt2min 3 -gt2max 7
             -gt3min 3 -gt3max 7
```

  – Parameter Settings

    -read: read count file

    -lm: output LM file name

    -gt**n**min: Good-Turing discounting for **n**-gram

Format of the N-gram Language Model File

- E.g., “CNA0001-2M_N3_GT3-7.lm”

```
\data\
ngram 1=71697
ngram 2=2933381
ngram 3=1205445

\1-grams:
-0.8424806              </s>
-99             <s>     -1.291354
-2.041174       一      -1.287858
-3.804316       一一    -0.8553778
-5.374712       一一恐怖        -1.269383
-4.772653       一一恐怖攻擊    -
0.8950238
-9.690391       一丁點
-3.51804        一九九  -2.89049
-7.180892       一了百了        -0.1229095
-6.481923       一刀兩斷        -0.6672484
-4.802495       一下    -0.4828814
```

Log of backoff weight (Base 10)

```
-1.38444    <s> 裏 表現
-1.38444    <s> 裏 面
-1.076253   <s> 裏 海
-0.624772   戈 裏 峰
-0.624772   年 裏 </s>
-1.198803   那 裏 </s>
-0.3165856          哪 裏 去
-0.7112821          家 裏 的
-1.323742   家 裏 開
-0.4998333          時間 裏 </s>
-0.3147101          眼 裏 </s>
-0.323742   過程 裏 </s>
-0.721682   <s> 恒 生
-0.323742   億 恒 科技
-0.1760913          化 粧 品

\end\
```

Log probability (Base 10)

Calculating the Test Data Perplexity

- Command:

```
ngram -ppl 506.pureText
      -order 3
      -lm CNA0001-2M_N3_GT3-7.lm
      -vocab
```

  – Parameter Settings
    -ppl: calculate perplexity for test data

```
file 506.PureText: 506 sentences, 38307 words, 0 OOVs
0 zeroprobs, logprob= -117172 ppl= 1044.42 ppl1= 1144.86
```

$$10^{-\frac{\text{logprob}}{\#\text{Sen}+\#\text{Word}}}$$

$$10^{-\frac{\text{logprob}}{\#\text{Word}}}$$

Other Discounting Techniques

- Absolute Discounting

```
ngram-count  -read CNA0001-2M.count
             -order 3
             -lm CNA0001-2M_N3_AD.lm
             -vocab Lexicon2003-72k.txt
             -cdiscount1 0.5
             -cdiscount2 0.5
             -cdiscount3 0.5
```

- Witten-Bell Discounting

```
ngram-count -read CNA0001-2M.count
            -order 3
            -lm CNA0001-2M_N3_WB.lm
            -vocab Lexicon2003-72k.txt
            -wbdiscount1
            -wbdiscount2
            -wbdiscount3
```

Other Discounting Techniques (cont.)

- Modified Kneser-Ney Discounting

```
ngram-count -read CNA0001-2M.count
            -order 3
            -lm CNA0001-2M_N3_KN.lm
            -vocab Lexicon2003-72k.txt
            -kndiscount1
            -kndiscount2
            -kndiscount3
```

- Available Online Documentation:

  "http://www.speech.sri.com/projects/srilm/manpages/"