Language Understanding Systems

Language Modeling with OpenGRM Tools

Evgeny A. Stepanov

SISL, DISI, UniTN & VUI, Inc.
evgeny.stepanov@unitn.it

Outline

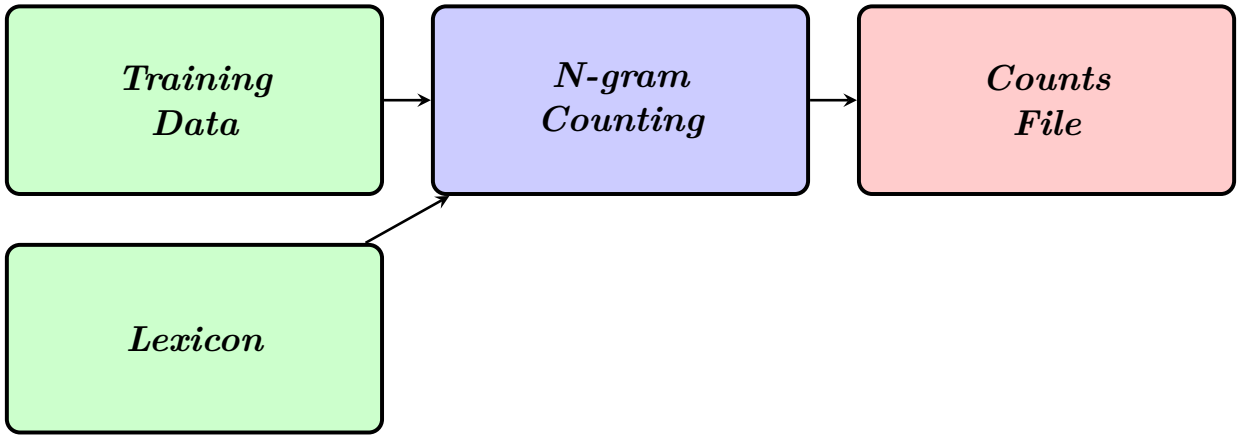
Section 1

Language Models

LM Functionality

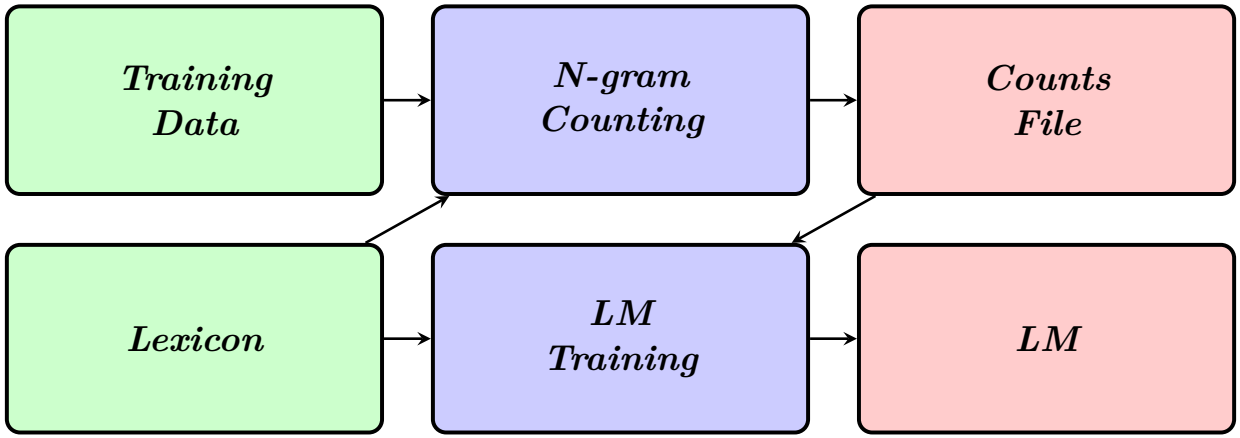
LM Functionality

- Compute n-gram counts from the corpus



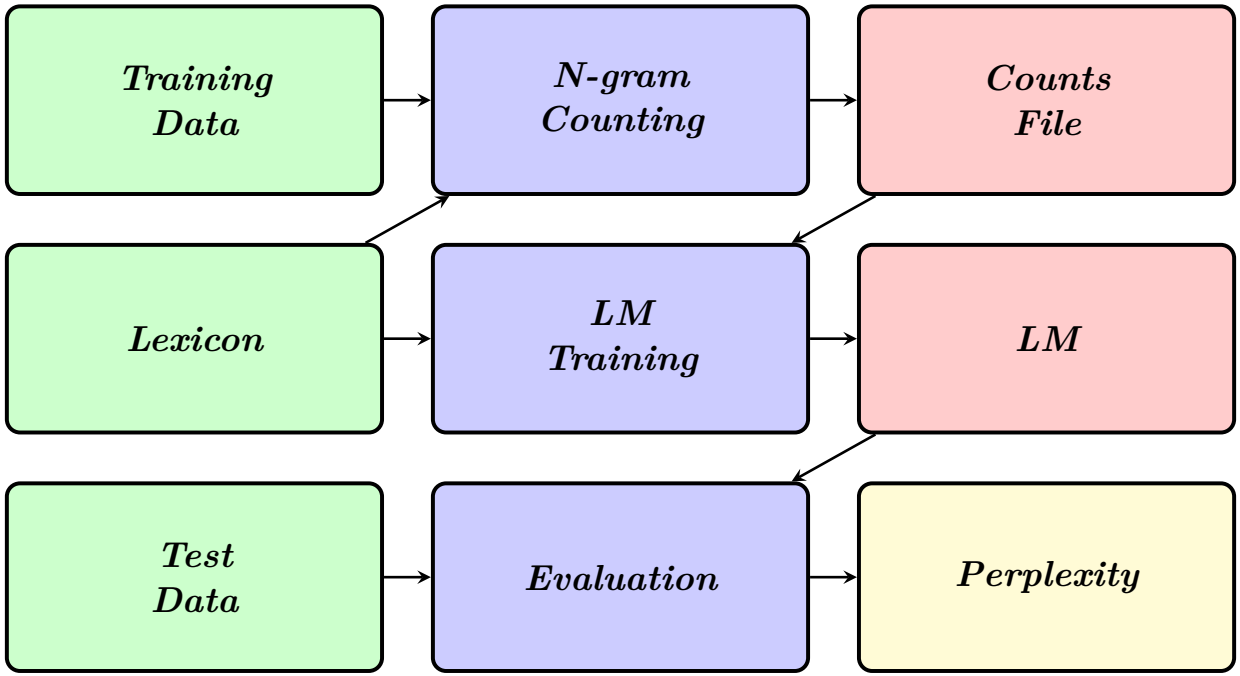
LM Functionality

- Compute n-gram counts from the corpus
- Train LM from the n-gram counts file

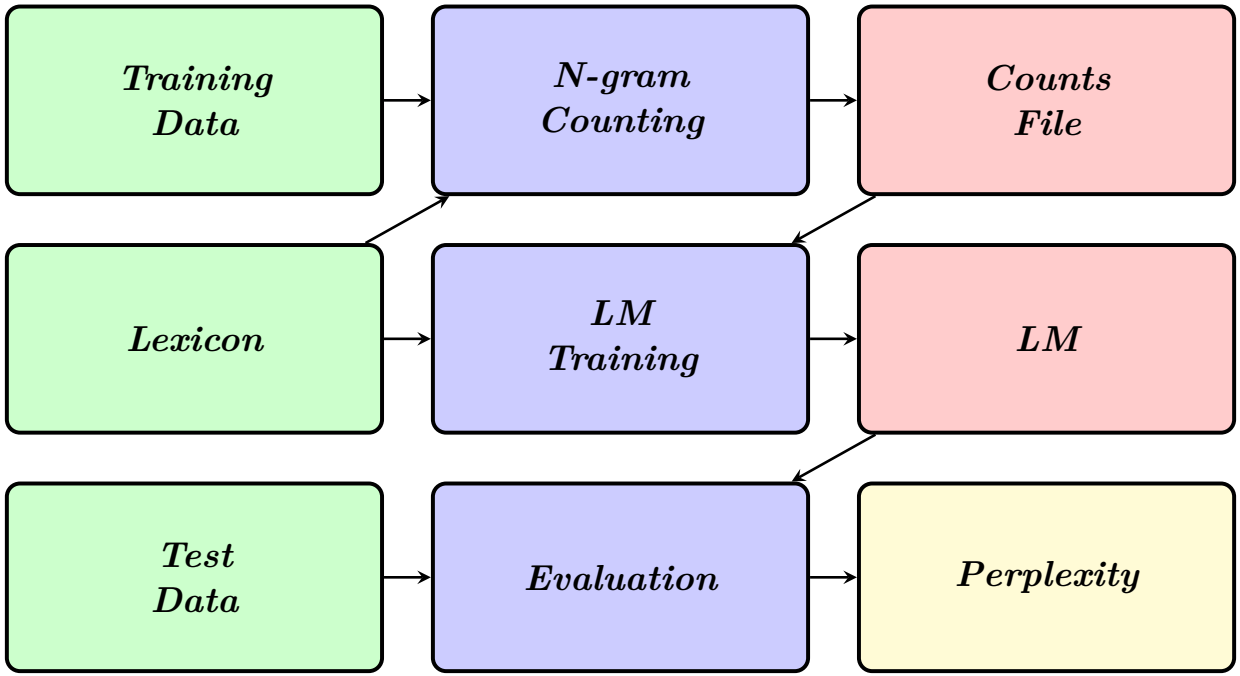


LM Functionality

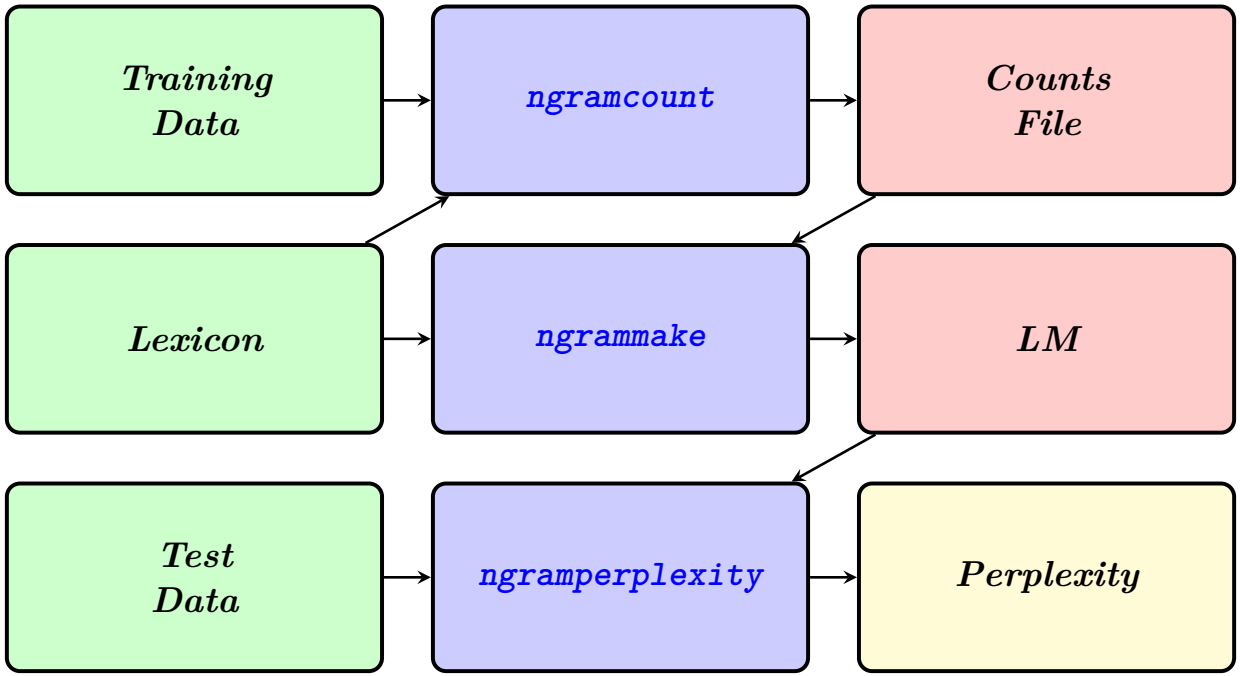
- Compute n-gram counts from the corpus
- Train LM from the n-gram counts file
- Calculate the test data *perplexity* using LM



Language Modeling



LM Tools: OpenGRM



OpenGRM: Discounting

OpenGRM

- Absolute (Ney)
- Witten-Bell (default)
- Kneser-Ney
- Katz
- presmoothed
- unsmoothed

Section 2

OpenGRM for Language Modeling

OpenGRM Tools

OpenGRM Tools

- **`ngramcount`**: takes as input a *fst archive* representing a text input and outputs an *fst* representing counts of n-grams

OpenGRM Tools

- **`ngramcount`**: takes as input a *fst archive* representing a text input and outputs an *fst* representing counts of n-grams
- **`ngrammake`**: takes as input a *counts fst* (the output of `ngramcount`) and outputs an *fst* representing a n-gram back-off stochastic LM

OpenGRM Tools

- **`ngramcount`**: takes as input a *fst archive* representing a text input and outputs an *fst* representing counts of n-grams
- **`ngrammake`**: takes as input a *counts fst* (the output of `ngramcount`) and outputs an *fst* representing a n-gram back-off stochastic LM
- **`ngrammerge`**: merges two *counts fsts* (the output of `ngramcount`) or two *LMs* (the output of `ngrammake`)

OpenGRM Tools

- **`ngramcount`**: takes as input a *fst archive* representing a text input and outputs an *fst* representing counts of n-grams
- **`ngrammake`**: takes as input a *counts fst* (the output of `ngramcount`) and outputs an *fst* representing a n-gram back-off stochastic LM
- **`ngrammerge`**: merges two *counts fsts* (the output of `ngramcount`) or two *LMs* (the output of **`ngrammake`**)
- **`ngramapply`**: intersects n-gram model with *fst archive*;

OpenGRM Tools

- **`ngramcount`**: takes as input a *fst archive* representing a text input and outputs an *fst* representing counts of n-grams
- **`ngrammake`**: takes as input a *counts fst* (the output of `ngramcount`) and outputs an *fst* representing a n-gram back-off stochastic LM
- **`ngrammerge`**: merges two *counts fsts* (the output of `ngramcount`) or two *LMs* (the output of **`ngrammake`**)
- **`ngramapply`**: intersects n-gram model with *fst archive*;

Other useful tools:

- **`ngramsymbols`**: produces a lexicon from an input text corpus;
- **`ngramread/ngramprint`**: utilities to read/write n-gram models from/to text file;
- others...

Signals & Interactive Systems

FAR Tools

FARs – *weighted finite-state machines archives* – a concatentation of the file representation of one or more finite-state machines.

Commands:

- **`farcompilestrings`** – text to FAR
- **`farprintstrings`** – FAR to txt
- **`farinfo`** – information on contained FSMs
- **`farequal`** – compare two FARs for equality
- **`farcreate`** – create FAR from input FSTs
- **`farextract`** – split FAR into constituent FSTs

Refer to manual for options:

`http://www.openfst.org/twiki/bin/view/FST/FstExtensions#FstArchives`

Signals & Interactive Systems SiS LAB

Example

Input file: text.txt
Build Language Model:

```
ngramsymbols < text.txt > lex.txt
farcompilestrings --symbols=lex.txt
                  -keep_symbols=1 text.txt > text.far
ngramcount --order=3 text.far > text.cnts
ngrammake --method=witten_bell text.cnts > text.lm
```

Generate random sentence:

```
ngramrandgen text.lm | farprintstrings
```

Section 3

Exercises

Exercises

- Read Tool Manuals (for options)
- Train different language models (LM) using train.txt
  - vary order {1-3}
  - vary smoothing
  - take care of unknown words using lexicon (e.g. frequency cut-off)
  - compute LM perplexity on test.txt
  - report order & smoothing method with lowest perplexity