# Language Understanding Systems

*Language Modeling with OpenGRM Tools*

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# Outline

1. Language Models

2. OpenGRM for Language Modeling

3. Exercises

# Section 1

## Language Models

# LM Functionality

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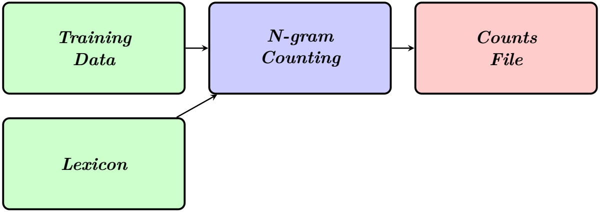
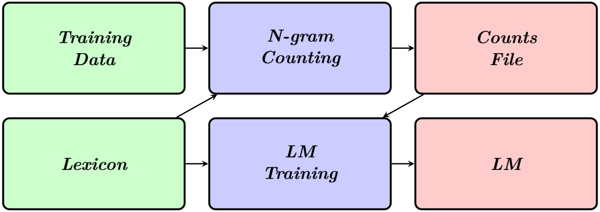
- Compute n-gram counts from the corpus



# LM Functionality

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



*Training Data*

*N-gram Counting*

*Counts File*

*Lexicon*

*LM Training*

*LM*

# LM Functionality

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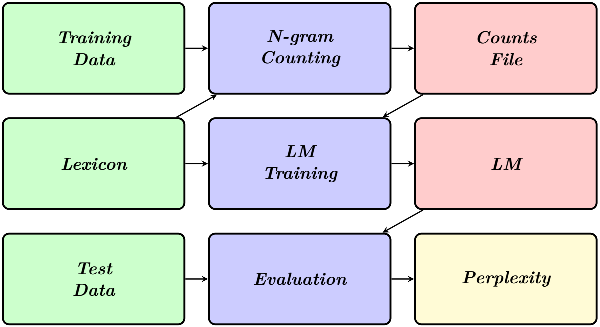
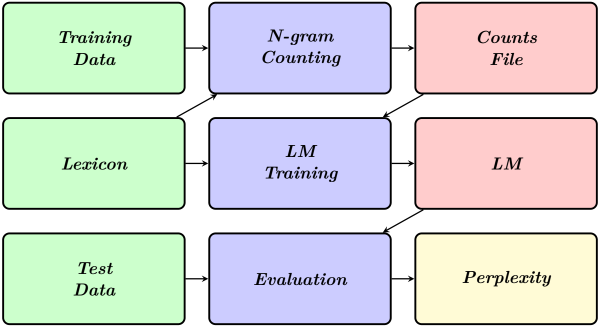
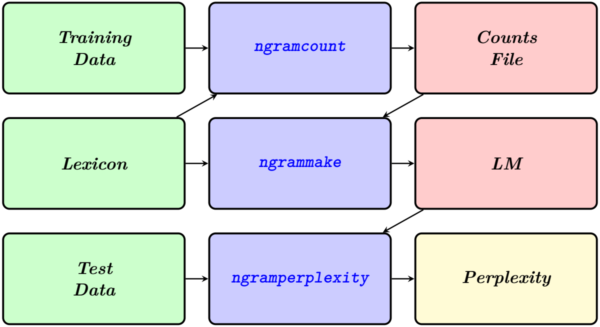
- Train LM from the n-gram counts file
- Calculate the test data *perplexity* using LM



# Language Modeling



# LM Tools: OpenGRM



# OpenGRM: Discounting

*OpenGRM*

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

Section 2

# OpenGRM for Language Modeling

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Signals & Interactive Systems

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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...

# 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`

# 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