

stage1: 下载数据集, 路径为/home/zx1116/kaldi-trunk/egs/librispeech/s5/data

```
root@ubuntu:/home/zx1116/kaldi-trunk/egs/librispeech/s5# ./run.sh
local/download_and_untar.sh: data part dev-clean was already successfully extracted, nothing to do.
local/download_and_untar.sh: data part test-clean was already successfully extracted, nothing to do.
local/download_and_untar.sh: data part dev-other was already successfully extracted, nothing to do.
local/download_and_untar.sh: data part test-other was already successfully extracted, nothing to do.
local/download_and_untar.sh: data part train-clean-100 was already successfully extracted, nothing to do.
Downloading file '3-gram.arpa.gz' into 'data/local/lm'...
'3-gram.arpa.gz' already exists and appears to be complete
Downloading file '3-gram.pruned.1e-7.arpa.gz' into 'data/local/lm'...
'3-gram.pruned.1e-7.arpa.gz' already exists and appears to be complete
Downloading file '3-gram.pruned.3e-7.arpa.gz' into 'data/local/lm'...
'3-gram.pruned.3e-7.arpa.gz' already exists and appears to be complete
Downloading file '4-gram.arpa.gz' into 'data/local/lm'...
'4-gram.arpa.gz' already exists and appears to be complete
Downloading file 'g2p-model-5' into 'data/local/lm'...
'g2p-model-5' already exists and appears to be complete
Downloading file 'librispeech-lm-corpus.tgz' into 'data/local/lm'...
'librispeech-lm-corpus.tgz' already exists and appears to be complete
Downloading file 'librispeech-vocab.txt' into 'data/local/lm'...
'librispeech-vocab.txt' already exists and appears to be complete
Downloading file 'librispeech-lexicon.txt' into 'data/local/lm'...
'librispeech-lexicon.txt' already exists and appears to be complete
```

stage2: 准备声学模型相关文件, 将原始数据集转换为kaldi文件夹(生成表单, 数据检查等), 路径为/home/zx1116/kaldi-trunk/egs/librispeech/s5/data/LibriSpeech/part

```
root@ubuntu:/home/zx1116/kaldi-trunk/egs/librispeech/s5# ./run.sh
utils/validate_data_dir.sh: Successfully validated data-directory data/dev_clean
local/data_prep.sh: successfully prepared data in data/dev_clean
utils/validate_data_dir.sh: Successfully validated data-directory data/test_clean
local/data_prep.sh: successfully prepared data in data/test_clean
utils/validate_data_dir.sh: Successfully validated data-directory data/dev_other
local/data_prep.sh: successfully prepared data in data/dev_other
utils/validate_data_dir.sh: Successfully validated data-directory data/test_other
local/data_prep.sh: successfully prepared data in data/test_other
utils/validate_data_dir.sh: Successfully validated data-directory data/train_clean_100
local/data_prep.sh: successfully prepared data in data/train_clean_100
```

stage3: 准备语言模型相关文件, 包括发音字典, 路径为/home/zx1116/kaldi-trunk/egs/librispeech/s5/data/local/dict\_nosp, 根据发音字典生成语言文件夹lang, 路径为/home/zx1116/kaldi-trunk/egs/librispeech/s5/data/lang\_nosp, 根据语言文件夹生成测试文件, 路径为/home/zx1116/kaldi-trunk/egs/librispeech/s5/data/local/lm

```

--> text contains only allowed whitespaces
--> 41 entry/entries in data/lang_nosp_test_tgmed/phones/sets.txt
--> data/lang_nosp_test_tgmed/phones/sets.int corresponds to data/lang_nosp_test_tgmed/phones/sets.txt
--> data/lang_nosp_test_tgmed/phones/sets.{txt, int} are OK

Checking data/lang_nosp_test_tgmed/phones/extra_questions.{txt, int} ...
--> text seems to be UTF-8 or ASCII, checking whitespaces
--> text contains only allowed whitespaces
--> 14 entry/entries in data/lang_nosp_test_tgmed/phones/extra_questions.txt
--> data/lang_nosp_test_tgmed/phones/extra_questions.int corresponds to data/lang_nosp_test_tgmed/phones/extra_questions.txt
--> data/lang_nosp_test_tgmed/phones/extra_questions.{txt, int} are OK

Checking data/lang_nosp_test_tgmed/phones/word_boundary.{txt, int} ...
--> text seems to be UTF-8 or ASCII, checking whitespaces
--> text contains only allowed whitespaces
--> 346 entry/entries in data/lang_nosp_test_tgmed/phones/word_boundary.txt
--> data/lang_nosp_test_tgmed/phones/word_boundary.int corresponds to data/lang_nosp_test_tgmed/phones/word_boundary.txt
--> data/lang_nosp_test_tgmed/phones/word_boundary.{txt, int} are OK

Checking optional_silence.txt ...
--> reading data/lang_nosp_test_tgmed/phones/optional_silence.txt
--> data/lang_nosp_test_tgmed/phones/optional_silence.txt is OK

Checking disambiguation symbols: #0 and #1
--> data/lang_nosp_test_tgmed/phones/disambig.txt has "#0" and "#1"
--> data/lang_nosp_test_tgmed/phones/disambig.txt is OK

Checking topo ...

Checking word_boundary.txt: silence.txt, nonsilence.txt, disambig.txt ...
--> data/lang_nosp_test_tgmed/phones/word_boundary.txt doesn't include disambiguation symbols
--> data/lang_nosp_test_tgmed/phones/word_boundary.txt is the union of nonsilence.txt and silence.txt
--> data/lang_nosp_test_tgmed/phones/word_boundary.txt is OK

Checking word-level disambiguation symbols...
--> data/lang_nosp_test_tgmed/phones/wdisambig.txt exists (newer prepare_lang.sh)
Checking word_boundary.int and disambig.int
--> generating a 67 word/subword sequence
--> resulting phone sequence from L.fst corresponds to the word sequence
--> L.fst is OK
--> generating a 14 word/subword sequence
--> resulting phone sequence from L_disambig.fst corresponds to the word sequence
--> L_disambig.fst is OK

Checking data/lang_nosp_test_tgmed/oov.{txt, int} ...
--> text seems to be UTF-8 or ASCII, checking whitespaces
--> text contains only allowed whitespaces
--> 1 entry/entries in data/lang_nosp_test_tgmed/oov.txt
--> data/lang_nosp_test_tgmed/oov.int corresponds to data/lang_nosp_test_tgmed/oov.txt
--> data/lang_nosp_test_tgmed/oov.{txt, int} are OK

--> data/lang_nosp_test_tgmed/L.fst is olabel sorted
--> data/lang_nosp_test_tgmed/L_disambig.fst is olabel sorted
--> data/lang_nosp_test_tgmed/G.fst is ilabel sorted
--> data/lang_nosp_test_tgmed/G.fst has 597083 states
--> utils/lang/check_g_properties.pl successfully validated data/lang_nosp_test_tgmed/G.fst
--> utils/lang/check_g_properties.pl succeeded.
--> SUCCESS [validating lang directory data/lang_nosp_test_tgmed]
Succeeded in formatting data.

```

stage4:

stage5: /mfcc/storage/中创建分散存储

```

root@ubuntu:/home/zx1116/kaldi-trunk/egs/librispeech/s5# ./run.sh
utils/create_split_dir.pl: link mfcc/storage/1 already exists, not overwriting.
utils/create_split_dir.pl: link mfcc/storage/2 already exists, not overwriting.
utils/create_split_dir.pl: link mfcc/storage/3 already exists, not overwriting.
utils/create_split_dir.pl: link mfcc/storage/4 already exists, not overwriting.

```

stage6: 生成mfcc特征, 此处我没gpu环境, 所以改了cmd, 用run.pl

```

root@ubuntu:/home/zx1116/kaldi-trunk/egs/librispeech/s5# ./run.sh
steps/make_mfcc.sh --cmd run.pl --nj 40 data/dev_clean exp/make_mfcc/dev_clean mfcc
steps/make_mfcc.sh: moving data/dev_clean/feats.scp to data/dev_clean/.backup
utils/validate_data_dir.sh: Successfully validated data-directory data/dev_clean
steps/make_mfcc.sh: [info]: no segments file exists: assuming wav.scp indexed by utterance.
steps/make_mfcc.sh: Succeeded creating MFCC features for dev_clean
steps/compute_cmvn_stats.sh data/dev_clean exp/make_mfcc/dev_clean mfcc
Succeeded creating CMVN stats for dev_clean
steps/make_mfcc.sh --cmd run.pl --nj 40 data/test_clean exp/make_mfcc/test_clean mfcc
steps/make_mfcc.sh: moving data/test_clean/feats.scp to data/test_clean/.backup
utils/validate_data_dir.sh: Successfully validated data-directory data/test_clean
steps/make_mfcc.sh: [info]: no segments file exists: assuming wav.scp indexed by utterance.
steps/make_mfcc.sh: Succeeded creating MFCC features for test_clean
steps/compute_cmvn_stats.sh data/test_clean exp/make_mfcc/test_clean mfcc
Succeeded creating CMVN stats for test_clean
steps/make_mfcc.sh --cmd run.pl --nj 40 data/dev_other exp/make_mfcc/dev_other mfcc
utils/validate_data_dir.sh: Successfully validated data-directory data/dev_other
steps/make_mfcc.sh: [info]: no segments file exists: assuming wav.scp indexed by utterance.
steps/make_mfcc.sh: Succeeded creating MFCC features for dev_other
steps/compute_cmvn_stats.sh data/dev_other exp/make_mfcc/dev_other mfcc
Succeeded creating CMVN stats for dev_other
steps/make_mfcc.sh --cmd run.pl --nj 40 data/train_clean_100 exp/make_mfcc/train_clean_100 mfcc
utils/validate_data_dir.sh: Successfully validated data-directory data/train_clean_100
steps/make_mfcc.sh: [info]: no segments file exists: assuming wav.scp indexed by utterance.
steps/make_mfcc.sh: Succeeded creating MFCC features for train_clean_100
steps/compute_cmvn_stats.sh data/train_clean_100 exp/make_mfcc/train_clean_100 mfcc
Succeeded creating CMVN stats for train_clean_100

```

stage7: 提取子集

```

root@ubuntu:/home/zx1116/kaldi-trunk/egs/librispeech/s5# ./run.sh
feat-to-len scp:data/train_clean_100/feats.scp ark,t:data/train_2kshort/tmp.len
utils/subset_data_dir.sh: reducing #utt from 28539 to 2000
utils/subset_data_dir.sh: reducing #utt from 28539 to 5000
utils/subset_data_dir.sh: reducing #utt from 28539 to 10000

```

## stage8: 训练声学模型

```

steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 17
steps/train_mono.sh: Pass 18
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 19
steps/train_mono.sh: Pass 20
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 21
steps/train_mono.sh: Pass 22
steps/train_mono.sh: Pass 23
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 24
steps/train_mono.sh: Pass 25
steps/train_mono.sh: Pass 26
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 27
steps/train_mono.sh: Pass 28
steps/train_mono.sh: Pass 29
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 30
steps/train_mono.sh: Pass 31
steps/train_mono.sh: Pass 32
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 33
steps/train_mono.sh: Pass 34
steps/train_mono.sh: Pass 35
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 36
steps/train_mono.sh: Pass 37
steps/train_mono.sh: Pass 38
steps/train_mono.sh: Aligning data
steps/train_mono.sh: Pass 39
steps/diagnostic/analyze_alignments.sh --cmd run.pl data/lang_nosp exp/mono
steps/diagnostic/analyze_alignments.sh: see stats in exp/mono/log/analyze_alignments.log
653 warnings in exp/mono/log/align.*.log
exp/mono: nj=20 align prob=-99.99 over 1.99h [retry=0.0%, fail=0.0%] states=127 gauss=1001
steps/train_mono.sh: Done training monophone system in exp/mono

```

## stage9: 三音子模型训练

### 参数对比:

```

zx1116@ubuntu:~/kaldi-trunk/src/gmmbin$ ./gmm-info /home/zx1116/kaldi-trunk/egs/librispeech/s5/exp/mono/0.mdl
./gmm-info /home/zx1116/kaldi-trunk/egs/librispeech/s5/exp/mono/0.mdl
number of phones 346
number of pdfs 127
number of transition-ids 2196
number of transition-states 1058
feature dimension 39
number of gaussians 127
zx1116@ubuntu:~/kaldi-trunk/src/gmmbin$ ./gmm-info /home/zx1116/kaldi-trunk/egs/librispeech/s5/exp/mono/final.mdl
./gmm-info /home/zx1116/kaldi-trunk/egs/librispeech/s5/exp/mono/final.mdl
number of phones 346
number of pdfs 127
number of transition-ids 2196
number of transition-states 1058
feature dimension 39
number of gaussians 1001
zx1116@ubuntu:~/kaldi-trunk/src/gmmbin$ ./gmm-info /home/zx1116/kaldi-trunk/egs/librispeech/s5/exp/tri1/final.mdl
./gmm-info /home/zx1116/kaldi-trunk/egs/librispeech/s5/exp/tri1/final.mdl
number of phones 346
number of pdfs 1576
number of transition-ids 25006
number of transition-states 12463
feature dimension 39
number of gaussians 10027

```