नेपाली
मौलिक स्पीच कर्पस

NEPALI
RAW SPEECH CORPUS

Nepali Raw Speech Corpus

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Annotated, quality language data (both-text & speech) and tools in Indian Languages to Individuals, Institutions and Industry for Research & Development - Created in-house, through outsourcing and acquisition.

Linguistic Data Consortium for Indian Languages,
Central Institute of Indian Language,
Mysore, India-570006

Nepali Raw Speech Corpus
This Documentation is a part of LDC-IL Nepali Raw Speech Corpus.

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1.1 INTRODUCTION

Lack of basic linguistic resources have been the first and foremost bottleneck in development of language technology for Indian languages. When text data itself has been available for most of the Indian languages, one could not even think of the speech data. India is one of the foremost multilingual country where multilingualism is ingrained and most people speak more than one language with more than 75 languages having more than one million speakers (as per 2011 Census of India data). As per a study[1] of KPMG and Google released in 2017, the internet user base grew at a compound annual growth rate (CAGR) of 41% between 2011 and 2016 to reach 234 million users at the end of 2016 and this trend is likely continue. It is also estimated that internet users in Indian language will account for nearly 75% of India's internet user base by 2021.

Despite this, the availability of technology in Indian languages have been on close to null. This is mainly due to the reason that the technology developing agencies find it either too difficult to come up with the language support on various applications for Indian languages or it is economically not a viable solution. However, recent analyses from various quarters have shown that the latter is not correct and the major issue is availability of the linguistic resources based on which language technology and language support for various types of applications proves to be a bottleneck for the developing community, be it industry or otherwise.

Considering this as an issue, the Government of India has taken several initiatives to provide the basic ingredients which may prove as a catalyst for the development of language technology in Indian languages. As part of the this initiative, a scheme named Linguistic Data Consortium for Indian Languages (LDC-IL) was established by the Ministry of Human Resource and Development at Central Institute of Indian Languages, Mysore.

The goal of LDC-IL was to develop linguistic resources for all Indian languages with the initial focus more on the scheduled languages of India. These linguistic resources may be as deemed fit by the language technology developing community.

Based upon the recommendations of the Project Advisory Committee which includes ex-officio members from MeitY, IITs Ministry of HRD, Director and other academicians from reputed Institutes/Universities working in this area as well as major and minor industrial entities working in this area, the LDC-IL decided to embark upon developing the text and speech corpus for the scheduled languages of India.

There have been several types of datasets prepared under LDC-IL. This document serves as a generic documentation for the raw speech corpus of the LDC-IL being released for several languages.

[1] https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/04/Indian-languages-Defining-Indias-Internet.pdf

1.2 LDC-IL SPEECH CORPUS

LDC-IL speech corpus is collected after careful deliberations on what type of speech corpus is required for various types of speech based linguistic analysis that may suit multifarious needs of the research and development community.

After several meetings with the experts from around India and abroad, it was decided that LDC-IL should focus on not just developing a speech corpus for a particular need, rather to get the data that would be useful for various tasks such as ASR, STT, linguistic analysis, speech therapy and so on.

Keeping this in mind, various types of content were created a priori before the speech recordings took place. The content of these datasets have been prepared in consultation with the experts from the language as well as linguists giving inputs to ensure that no specific sound patterns are missed out.

For example, it has been ensured that the speech datasets contain all the phones and allophones of the language and ample examples are available in the language to prove their phonemic status in the language. To ensure that the corpus is good for an ASR, the continuous speech is recorded in natural environment.

2 CONTENT TYPE DESCRIPTIONS

Each content type has a number of files with each file containing standard content. A sub-set of these files in each of the content types selected randomly constitute subsets that are given to a speaker for reading out in natural flow. A few full sets (namely W3B, W4, and W5) are also read in full by certain selected speakers in each age group.

There are three age group ranges selected for LDC-IL datasets. These are '16 to 20 years', '21 to 50 years' and 'above 50 years'. Attempt has been made to collect equal number of male and female data from each of the age groups.

The list of the datasets and their notation is given in the table below:

SL	Notation	Conent Type
01.	T1	Contemporary Text (News)
02.	T2	Creative Text
03.	S	Sentence
04.	D	Date
05.	W1	Command and Control Words
06.	W2	Place Name
07.	W2	Person Name
08.	W3A	Most Frequent Word-Part
09.	W3B	Most Frequent Word-FullSet
10.	W4	Phonetically Balanced-Fullset
11.	W5	Form and Function Word-Fullset

Table 1: LDC-IL Speech Data Content Types

Detailed descriptions of each of the content types are given in the following sub-sections.

2.1 T1: CONTEMPORARY TEXT

The Contemporary Text (news) data is given the notation of T1. News items have been selected from the LDC-IL news corpora. The text is contemporary in nature as the news items such have been picked over a period from 2005 to 2012, either from news websites or from the print editions newspapers of the respective language.

The domain information is present in the news items as well as the news items deal various topics such as political news, editorials, sports news and so on. Given that the news items have been collected from local news reported for each language, the style may be considered as colloquial or belonging to the news reporting style.

Each LDC-IL dataset 'Contemporary Text 'contains minimum of 500 words per speaker, which is rarely repeated. Since it is the continuous text, it constitutes the largest part of the speech corpora, in terms of data size and time duration.

2.2 T2: CREATIVE TEXT

'Creative Text –T2' is extracted mainly from literary sources. It is used to capture literary terms. Creative Texts are stories or essays collected from books. The text may be any standard text which is descriptive in nature. It exhibits the language style of a particular period from which the text is taken.

Creative texts were prepared in two types. In the first 6 or 8 essays or short stories were prepared. One of these selected randomly from the set, is assigned to one speaker for reading out. The same story may be read by multiple speakers.

In the other approach a distinct text is given to each individual

The creative text section of the LDC-IL Speech dataset comprises of mostly six essays or short stories. One of these essay or short story, selected randomly from the set of the six stories, is assigned to one speaker for reading out. The same story may be read out by multiple speakers.

2.3 D: DATE

Languages tend to speak out the date in a specific and many a times in a particular manner which may not always conform to the grammatical structure of the language. To capture it, LDC-IL tried to document how a date is spoken in each of the languages.

The normal way is put a question before the informant the answer of which must be in a date format. Normally the following six questions were placed before the informant and the informants would answer minimum one of the questions.

1. What is tomorrow's date?
2. When is Gandhi Jayanthi observed?
3. What is the date today?
4. When do we celebrate our Independence Day?
5. What is your date of birth?
6. On which date you go to market?

2.4 S: SENTENCES

To ensure that all the types of syntactic structures are covered in the speech data, a set of sentences have been constructed with the help of language experts and linguists for each of the languages. It is ensured that all possible sentence structures are covered including all types of tenses, aspects, moods, compound and complex sentences and so on.

These sentences are isolated sentences and not part of a continuous speech. While care has been taken to extract sentences from the text corpus of the corresponding language, sometimes sentences have also been modified to ensure that the specific valid sentence structure of the language is present.

Very long sentences are avoided while selecting or constructing the sentences, so that the informant can read the sentences easily. The words used in these sentences are common words which are found in day-to-day life. Each sentence in the list contains minimum four words. The sentences are not too long so that each sentence does not span for more than a line in the prompting sheet. Care is taken to avoid abusive or taboo words.

Each speaker is given 25 sentences out of this sentence list for reading out.

2.5 W1: COMMAND AND CONTROL WORDS

Spoken language usually contains a lot of sentences that are commands or use a lot of control words. This happens mostly in the conversational speech. Even though the LDC-IL speech corpus at present does not contain the conversation speech, an attempt has been made by including common command and control sentences/phrases carefully crafted with the help of respective language experts and linguists.

These include imperative sentences, optative sentences as well as other controlling phrases which may come as a reply to an interrogative sentence. Each of the languages has a set of command and control sentences created before the speech data is recorded. Each speaker is given a list of 30 command and control sentences randomly selected from the set. Each of these phrases/sentences is repeated three times by each speaker while recording.

2.6 W2: PROPER NOUN (PERSON NAMES AND PLACE NAMES)

Recognizing proper nouns by using an ASR system is a complex task. For example, voice recognition application in mobile phone may have a few hundreds of names to distinguish when placing a call through voice command. Native speakers use different pronunciations depending on their language of origin and familiarity with the language. The speakers use different pronunciation for native and foreign names ranging from a nativised pronunciation to a totally foreignised pronunciation. All this adds to the complexity of an ASR system in recognizing proper nouns. To address this issue LDC-IL speech data has been collected to include person names and place names.

2.6.1 Person Names

Person names are included to capture the native pronunciations. The names are taken from people from different walks of life like Politicians, Film Actors and Directors, Writers, Kings and Queens, Astrologers, Historical Personalities, Scientists, Sports persons etc.

2.6.2 Place Names

Place names are included to capture the native pronunciations. This data set contains Indian place names. These include main cities, district names and popular tourist destinations from all over India. Some local place names are also included like names of villages, taluk headquarters, district names, local forest reserves, local tourist and pilgrimage destinations etc.

Each speaker typically pronounce 20 person names and 10 place names, out of the total Proper Noun wordlist of the particular language. Each word is uttered three times

2.7 W3: MOST FREQUENT WORDS

Most frequent word list is the regularly and repeatedly used list of words. Since these words are used most frequently in a language, it is imperative to have these words in our dataset.

The most frequent words dataset is derived from LDC-IL Corpus. However, it may be noted that when the most frequent word list was extracted, the text corpus was rather small. So, the frequency list might change if it is compared to the current LDC-IL text corpus.

2.7.1 W3A: Most Frequent Words-Part

The most frequent words of a language are randomly picked from a list of around 1000 most frequent wordlist of a language. Each speaker records randomly selected 30 words from this list. Each word is uttered thrice.

2.7.2 W3B: Most Frequent Words-Full

Two speakers, one male and one female, pronounces the full set of 1000 most frequent words. This is done for each dialect of the language, if available.

2.8 W4: PHONETICALLY BALANCED VOCABULARY

To cover all possible phonemic occurrences of a language, the "phonetically balanced Vocabulary" is prepared. It is a list of words in which the occurrence of a phoneme in initial medial and final positions of that language can be represented.

The pronunciation of the phoneme is varied according to the position of the phoneme in a word and the influence of the following and proceeding phoneme. The pronunciation of initial position is different from middle and final positions. For example the phoneme 'pa' is used in different forms while pronouncing words like

- '**pa**llaʊi'- 'pa' inherent vowel at initial position (CV initial)
- '**pra**kaɻa' - 'p' as pure consonant in conjunction with 'ra' in initial position, (CCV Initial)
- '**spa**ndana',- 'pa' with inherent vowel preceded by a consonant at medial position(CCV Initial)
- '**pa**rika**lpa**ne'- 'pa' inherent vowel at initial position (CV initial) and 'pa' with inherent vowel preceded by a consonant in the medial position (CCV Medial)
- 'a:**pta**' - 'p' with followed by a consonant in the final position (CCV medial)

Using the articulation score as the measure, phonetically balanced lists have been used to test differences among transmission systems and to test the effects of noise. The phonetically balanced words used in word recognition testing contain speech sounds that occur in the same frequency as those of conversational speech.

2.9 W5: FORM AND FUNCTION WORDS

Form and function words dataset is a closed class list of words. They are quite limited in a language. These constitute mostly the indeclinable words of a language. Form words are static, bearing some content with them. They are meaningful and are actually the building blocks of a language.

The Form and Function dataset includes Grammatical function words, numerals, kinship terms, measurement terms, list of colours, days, months, seasons, directions, zodiac sings, body parts, planets etc. These words are included to the native words which may not be frequent in the overall corpus, but needs representation.

3 PLANNING FOR FIELDWORK

3.1 DATASET PREPARATION AND DISTRIBUTION

To ensure representativeness of the speech corpora, a conscious effort has been made to balance the speech data by taking varieties of styles into consideration. The first and foremost among at LDC-IL has been to take an expert view on the varieties of languages. For example, for Kannada it is ensured that speech varieties from different regions such as Hyderabad Karnataka, Bombay Karnataka, Coastal Karnataka and Old Mysore get proportionate weightage.

LDC-IL collected the data using two approaches, with two different kind of Dataset Models They are as follows

- Dataset Model 1 (T1, T2, W1, W2, W3, W4, W5, S, D)
- Dataset Model 2 (Distinct Texts of T1 and T2)

Some Languages followed Model-1 only, and some Languages followed both Model-1 and Model-2 After the regions are identified, speech samples are collected as per the criteria shown in the tables below:

Standard Speech Dataset Distribution for Each LDC-IL Fieldwork Dataset Model 1							
Content type	**Content size#**	**Content to be read by one speaker**	**Total No. of speakers**	**Age group wise no. of speaker; Female & Male equally distributed#**			**Content selection type**
				16-20	20-50	50+	
Contemporary Text	150 Texts	1 Text	150	18	90	42	Distinct Text
Creative Text	6 Texts	1 text	150	18	90	42	Random set*
Sentences	142 Sentences	25 Sentences	150	18	90	42	Random set*
Command and Control Words	82 Words	30 Words	150	18	90	42	Random set*
Person Names	489Words	20 Words	150	18	90	42	Random set*
Place Names	511 Words	10 Words	150	18	90	42	Random set*
Most Frequent Words	1144Words	30 Words	150	18	90	42	Random set*
Phonetically Balanced Vocabulary	390 words	Full set	6	2	2	2	Full set to be read by the speaker
Form and Function Words	432 words	Full set	6	2	2	2	Full set to be read by the speaker
1000 Most Frequent Words	1000 Words	Full set	2	0	2	0	Full set to be read by the speaker
*picked randomly by machine #The figures shown are for illustration purpose only. The numbers may differ for each language. Please refer specific Language documentation for actual figures.							

Table 2: Standard Speech Dataset Distribution for Each LDC-IL Fieldwork with Modle-1 Dataset

Speech dataset distribution for fieldwork Dataset Model 2						
Content type	**Content size**	**Content to be read by one speaker**	**Total No. of speakers**	**Age group wise no. of speaker; Female & Male equally distributed**		**Content selection type**
				16-20	21-50	
Contemporary Text (News)	150 Texts	1 Text	150	75	75	Distinct Text
Creative Text	150 Texts	1 text	150	75	75	Distinct Text

Table 3: Standard Speech Dataset Distribution for Each LDC-IL Fieldwork with Modle-2 Dataset

As the data is collected from different cities across India (as per the demand of the language), its imperative that proper preparation is made before proceeding towards the field such that day-to-day necessities of field are met with. Investigators had to make that s/he had sufficient charged batteries as well as alkaline batteries if so required, empty SD cards, laptops in proper condition, sufficient number of random and full datasets (prompt sheets) and so on. These formed as the daily routine for the linguists while in the field.

4 FIELD WORK

Some common guidelines and instructions were provided to the field workers before proceeding to the field. A brief of it is noted below.

4.1 POSSIBLE PLACES FOR COLLECTING DATA

Once the dataset is prepared and taken to the field, the next step is to determine places where there is an availability of speakers who can read fluently. The best possible places are schools, colleges, universities, govt. offices etc.

The Head of these organizations have to be briefed and asked permission for recording data from students, faculties etc. Certain infrastructural requirements like space, if possible power source for charging batteries etc. has to be requested from the institutions. The speakers from whom we collect data are referred as informants.

4.2 FIELD WORK ETHICS

The informants are briefed about the procedures, nature and purpose of speech data collection. Informants are informed about the funding agency behind the data collection. In case of LDC-IL, the data collection is funded by Govt. of India. Informant are made aware of who exactly is carrying out the data collection process and what will be done with the data collected before they give their consent.

There have been situations where the informant would find it distressing that the data given by them will be segmented and further processed. In such cases, their opinions have to be respected and the investigators have to refrain from taking their data. The informants are made aware of the degree of confidentiality and anonymity that will be maintained after collecting the data. The informants are also made aware of the potential benefits of the data to the wider community. Once the informant is aware of all these information and is ready to give the data, consent is acquired in written along with certain personal details such as their educational qualification, mother tongue, place of elementary education etc.

Informants are allowed to read the dataset earlier before recording so that they can get familiar with the content of the text. It is ensured that the informants do not have any objection to the content they are about to read. For example, the informant may have objection regarding the political, social views expressed in the content. In such cases, a different dataset is offered to the informant. There are certain texts in the data set, which may pose difficulty for a certain informant to read. For Example, some informants may have difficulty in reading contents which involve dialogues between people. Such contents may differ in dialects spoken by the informant which may pose a difficult situation for them while reading. In such cases, a different dataset is offered to the informant. Complex datasets are given only to the informants who are capable of reading them and state likewise.

An attempt is made to reduce the extra noise as much as possible before recording. If necessary, test recordings are conducted before the actual recording on certain portions of the text.

Brief introduction about the informant and investigator along with details like place, time, region etc. are collected at the beginning of each recording. The conversation between investigator and informant is done in their native language so that the informant is comfortable and the natural flow of language is established.

Care is taken while recording the words, so that there is a pause between two words or between utterances of the same word. All the words of the content type W1to W5 (i.e. 'Command and Control words', 'Proper Nouns', 'Most Frequent Words', 'Phonetically Balanced Vocabulary' and 'Form and Function words') are repeated three times in a sequence. A pause is maintained between two sentences as well while recording.

While recording the News Item and Creative Text, the informants are briefed to read the text given, as naturally as possible. It should be as natural as reading a book or newspaper. Informants answer to a particular question themselves regarding date format. This is done to capture how people usually pronounce the date. The investigator does not prompt any particular format

4.3 DATA COLLECTION

The LDC-IL data is recorded using Roland EDIROL Recorder. It is a 24-bit Linear PCM (R-09) Recorder.

4.3.1 Technical Specifications for collecting data

Recording Setup:	Sample Rate : 48.0 KH
Recording Mode:	wav -16bit
Date Setup:	Current date and time.
Storage:	SD Card
Power:	•Always use rechargeable batteries (Ni-MH) for recording. Otherwise line hum will come. Never use Ni-CD battery type as it is potential for 'memory effect'. • Rechargeable batteries need to be thoroughly recharged before recording (minimum 16 hrs continuous charging).
Peak	While recording please be aware that it should not reach the peak i.e. PEAK (in the recorder) should not glow.
Recording Distance	•Keep minimum 5 cm to 25 cm distance between the microphone and the speaker and if possible use microphone holder. • The recorder should not be placed orthogonally but it should be placed diagonally. • Do not move the recorder during recording • Fix the recorder upon a table/ fixed plane if possible. • Try to have fixed the distance between the recorder and speaker • The recorder should not be placed orthogonally but it should be placed diagonally

Table 4: Technical Specifications for collecting data

After each recording, it is recommended to verify the recorded data, whether it is recorded in the right way. If the informant also wishes to hear the data, the investigator may oblige.

4.3.2 Metadata

The value of speech data can be determined according to the quality of metadata obtained. It is imperative to maintain metadata of the entire data collection for linguistic analysis.

After the recording is taken from the informant, personal details are collected. Care should be taken so that the signature and other formalities are completed as required.

The metadata of the speech corpus is made through the personal details taken from the informants. A typical copy of metadata sheet contains information as noted below:

Informant Data:

Name:
Dataset ID:
Address:
Gender:
Age Group: (with three options of 16 to 20, 21 to 50, and 50+)
Educational Qualification: (with three options of School/Bachelors/Masters)
Place of Elementary Education:
Mother Tongue:
Dialect (if any):

Investigator Data:

Name:
Date:
Place:
Region:
Environment:

It is to note that the name and the address of the informants are discarded while archiving metadata to keep the confidentiality and anonymity.

Dataset ID: It is a unique ID given to each speaker.

The following fields are considered for the distinctiveness of each data item recorded. Each field contributes certain features which pave way for diverse research.

Gender: The Speech data is taken from both male and female to capture the difference in intensity and pitch. The difference in vocal folds size between men and women makes them different in their pitched voices. Male voice usually has low pitch whereas a female voice is of high pitch. Pitch and intensity are proportional to each other.

Age Group: Different age groups exhibit difference in pitch and loudness. As the human body ages, it undergoes changes such as lessening strength, slower movements, degeneration of body tissues etc. these factors impact the voice as well. As people age their speech slows down, syllables and words are elongated, sentences are punctuated with more pauses for air. Scientific studies also show that as male and female age, the changing larynxes changes pitch and intensity. Age also affect the hearing process, which may make a person speak louder.

Educational Qualification: This determines the fluency and speed of reading speech data.

Place of Elementary Education: This parameter determines the effects of environment and dialect of a particular place of childhood which impacts the articulation of the speech.

Mother Tongue: Mother Tongue is one of the influential factors of a native speaker, for example In Karnataka, mainly in Canara region; it can be observed that the mother tongue of native Kannada speakers may be Tulu, Konkani, Chitpavani etc. This influences the articulation of Kannada speech in these areas.

Place: Place gives better information about the speech data collected. For example, Kannada spoken in Kundapura has its own distinct variety even when it belongs to Canara region.

Date: Date describes the timeline of data collected. It becomes useful information for historic research and language evolution in time line. It also dates the technology being used in that age.

Region: Region is an influencing factor of the language. Hence keeping the information about it with the data is always useful.

Environment: The recording environment information’s like Indoor, Outdoor, School, Office, etc is useful, and its marking could be helpful in determining the noise level and the kind of noise that can be expected with the data.

Each of the datasets released contain a metadata sheet which has information about each of the audio files. A total of 25 fields are there in the metadata sheet.

A brief of each of these 25 fields/legends is given in the table below:

SL	Legend	Description
1	Language	Name of the Language
2	SpeakerID	Each speaker has a unique identity language. However, this is within the language. If one is working on speech corpus from more than one language, the IDs may get repeated.
3	ContentType	This corresponds to the notation of the content types noted above.
4	ContentID	This corresponds to the ID of the text being read out.
5	Gender	Notes gender, whether it is male, female or other.
6	AgeGroup	Three age groups of 16 to 20, 21 to 50, and50+
7	Dialect	Notes the dialect of the language. An attempt has been made to cover all the dialects of the language as agreed upon in the academia of the language experts and linguists.
8	ReadInScript	The script in which the content has been provided to read in.
9	RecordingEnvironment	A brief info on the environment in which the recording has been done.
10	PowerSource	The source of the power using which the recording was done. It may be Li-ion, NiCd or Alkaline batteries.
11	RecorderManufacturer	Manufacturer of the recorder.
12	RecorderType	Type of the recorder. It is mostly 24-bit Linear PCM (R-09).
13	SamplingFrequency	Sampling frequency. It's mostly 48.
14	BitPerSample	Bit per sample. It is mostly 16-bit.
15	Channel	How many channels. All of LDC-IL data is stereo. Only data set is mono which is segregated and constitutes a separate dataset of its own.
16	State	Name of the Indian state/province to which the speaker belongs to.
17	District	Name of the Indian district to which the speaker belongs to.
18	Place	Name of the place to which the speaker belongs to.
19	MotherTongue	Mother tongue of the speaker. It is note that data has been taken from people who professo to speak the language. However, it may be that the speaker uses the target language as a second or third language. However, as long as the speaker confidently says (and it is also verified by other speakers of the community), some samples have been taken from these types of users as well. This adds to the variety of the speech data collected.
20	EducationalQualification	Highest educational qualification of the speaker.
21	PlaceOfElementaryEducation	Place of the elementary education. This usually corresponds to the early childhood experiences which happens to more than often affect the way a language spoken.
22	RecordingDate	Date when the recording took place.
23	Investigator	Name of the Investigator.
24	RecordedText	Text of the recorded speech (in the script of the language).
25	TextInRoman	Text of the recorded speech (in the Roman transliteration as per the LDC-IL transliteration scheme. If the text is long (as is the case with T1 and T2 content types), a reference of the corresponding file is given.)

Table 5: Metadata Legends and their Description

4.3.3 Data Transferring and Storing

After the data is collected for the day or when the SD card is full, the data needs to be transferred to the PC. It is important, to take certain precautions in this process so that the data is safely transferred. The data should be copied and pasted in the PC rather than cut and pasted. After successful transfer and rechecking the copied data, the SD card can be cleared.

For easier maintenance and organization of the data in PC, folder system is recommended for saving data. Each recorded wave file has to be labelled with corresponding speaker ID.

The investigator should try to get the required number of speakers/data before completing the field work within their schedule.

4.3.4 Observations

One of the reasons for error prone reading could be the over consciousness of the informant about being voice recorded. Despite being informed, the informant may try to read the data in a dramatic way, but may eventually lead to normal reading after few sentences. Even after the informants give consent and their data, they may later change their mind or express their concern about the text they have read. Some may even request to discard their recordings. In such cases, the investigator has to reassure them about their given data. If they still want their data to be discarded, they have to be accommodated. It is preferable to provide complete information to the informants to avoid such situations. In many instances informants assume that they are giving auditions for Radio Jockey vacancies, or some reality shows. They should be briefed about the purpose of data collection beforehand to avoid such situations.

The investigator may be in not so hospitable environments depending upon the region they are visiting. Proper precaution and aid is to be acquired before visiting such places.

The investigator may have to face challenges in food and accommodation since he/she travels in unfamiliar places. It is recommended to be prepared for such situations. The investigator should be prepared for all such hardships and take proper measures to minimize them beforehand.

5 ORGANISING AND ARCHIVING THE DATA

After the field work is completed, the data has to be stored in a server as soon as possible for safe keeping. Taking a backup of the saved data is also recommended as the data collected is of vital importance.

5.1.1 Text - Speech Mapping and Naming Conventions

After the data is stored, it is segmented and mapped with its corresponding text and metadata. Each recording is named in accordance with its metadata information like language name, speaker id, content id, gender, age, content type etc.

A Typical LDC-IL naming convention for recorded data is shown bellow.

"LDC-IL_Scheduled_Kannada_Female_16To20_Contemporary Text-T1_SP-0035_T1-0035.wav"
"LDC-IL_Scheduled_Kannada_Male_21To50_Sentence-S_SP-0001_S-0004.wav"

Wave Surfer, free software, is used for segmentation of LDC-IL Speech data. It is an open source tool which can be downloaded freely from the web. While segmenting the speech data file for archiving, the introduction, content headings and any unnecessary speech are discarded. Only the dataset content is retained.

The ASR data is prepared keeping in the view, the stochastic systems such as HMMs or neural networks that do not use explicit rules for speech recognition. On the contrary, they rely on stochastic models which are trained using some statistical optimization procedure, with very large amounts of speech corpus.

5.1.2 Observations

While segmenting a single large recording containing all the content types, there may be instances where an informant has made an error and later corrected it. In such cases, it is always a good approach to segment a recording from the end of the file in reverse order so that the correct utterance can be found before incorrect utterance; hence the incorrect utterance can be discarded/ignored. One may observe the interventions of investigator or other people between reading two data items which may also need to be discarded.

6 DATA VERIFICATION AND QUALITY CONTROL

Since mapping audio recordings with its corresponding text and other metadata information is a manual task. The process is prone to human errors; the data verification process will be done

Much of the audio text mapping is automated, but in case of distinct set texts, and other metadata entry is done by human needs verification. In this,

- The Audio recording of each speaker is checked against the mapped text.
- Each distinct text audio recording will be matched with automated entries of the same speaker to check for any mis-mapping of speaker.
- Metadata like Gender, age group, District etc are selective part of manual data entry and could be prone to errors so verification is needed.
- Metadata like Dialect entry, place, etc are keyed in by manual data entry and could be prone to errors like typo errors so verification needs to be done.
- The audio segments could be duplicated because of system/network errors and need to be checked.
- At the time of data segmentation, one might have saved the whole file instead of selected part. Such case needs to be checked.
- Some audio segments may not get migrated to the system because of wrong naming conventions. Such segments will be handpicked and corrected and migrated into the system.

7 NEPALI RAW SPEECH CORPUS

7.1 INTRODUCTION

Nepali is the principal and administrative language of Darjeeling and Sikkim. Nepali is written in Devanagari Script, from left to right direction. It also called Nagari. Nagari script has roots in the ancient Brāhmī script family. It has long been used traditionally by religiously educated people in South Asia. The Devanagari script is used for over 120 languages, and those are Nepali, Hindi, Marathi, Bhojpuri, Maithili etc. It closely related to the Nandinagari script commonly found in numerous ancient manuscripts of South India. The script is also used to write several minority languages of Nepali community such as Magar, Bhujel, and Thami etc.

Nepali text corpus is collected from various libraries of Darjeeling, Sikkim, Assam, and Uttaranchal. Mostly from Kurseong, Mirik, Kalimpong, Silgadhi, Gangtok Guwahati, Almora, Mussoorie. The greater part of the text has been taken from Darjeeling General Library, Sonada Library, Mirik Public Library, Kalimpong City Library, NERLC (North-East Regional Language Centre, Guwahati) Library. LDC-IL tried to cover the entire category in its standard list. Some categories like novel, short stories has huge amount of books but some categories like physics, chemistry, economics, agriculture has very less amount of books. Literary texts are easily available in Nepali but getting scientific text is very difficult. Some categories like epigraphy, finance, oceanology text are too rare in Nepali.

LDC-IL divided the Nepali speaking areas into these three regions and collected speech data from each. After determining the regions for fieldwork, the dataset is prepared from which the prompt sheets were generated.

Places from which LDC-IL Nepali Speech Data is collected in Each Region is listed in the table below:

Region→	Darjeeling	Assam(North-East)	Uttranchal
Places →	1. Darjeeling 2. Dooars 3. Silgadhi	1. Guwahati 2. Udalguri	1. Deheradun 2. Pithoraghar

Table 6: Dialects and Places Covered for Nepali Speech Data

8 DATASET PREPARATION FOR NEPALI

For the selected Regions, Darjeeling, Dooars, Silgadhi, Guwahati, Udalguri, Deheradun and Pithoraghar LDC-IL prepared the following dataset by which the prompt sheets were prepared.

Content Type	Count
Creative Text	6
Date	3
Command and Control Words	74
Most Frequent Words	1290
Person Name	510
Place Name	324
Sentences	200

Table 7: Representation of Content Type

Distinct News Items were prepared to get the audio recording of contemporary text. Each prompt sheet had a distinct news item and selected part of the dataset prepared as follows.

Content Type	Content in each typical prompt sheet	Content selection type
Contemporary Text	1 Text	Distinct Text
Creative Text	1 Text	Random Text selected from dataset*
Sentences	25 Sentences	Random set selected from dataset*
Command and Control Words	30 Words	Random set selected from dataset*
Person Names	20 Words	Random set selected from dataset*
Place Names	10 Words	Random set selected from dataset*
Most Frequent Words	30 Words	Random set selected from dataset*
		*randomly selected by machine

Table 8: Representation of Prompt Sheet

The full set of

1. Phonetically Balanced Vocabulary of 416 Words
2. Form and Function Words of 186 words
3. Most Frequent Wordlist 1278

were also carried to the field to get recorded by selected individuals.

Once all these preparations were made, the investigator started collecting the data. The Collection of data is carried out in three phases.

Region/	Year of data collection	Resource Person
Darjeeling-Assam	2009	Samar Sinha
Deheradun-Pithoraghar	2010	Jeena Rai
Darjeeling-Dooars-Silgadhi	2010	Umesh Chamling

Table 9: Fieldwork Details of Nepali Speech Data Collection

9 TRANSLITERATIONS IN LDC-IL NEPALI READ CORPUS

For easy reference and uniformity, the recorded text in the metadata file, is transliterated from Nepali (Devanagari) to Roman letters. Numeric characters were also transliterated from Nepali (Devanagari) to Hindu-Arabic System.
The LDC-IL transliteration scheme of Nepali (in Devanagari scripts) to Roman is given below.

LDC-IL Transliteration Schema Nepali-Devanagari characters to Roman and Nepali Numerals to Hindu-Arabic										
Vowels and Vowel Signs										
अ	आ	इ	ई	उ	ऊ	ऋ	ए	ऐ	ओ	औ
	ा	ि	ी	ु	ू	ृ	े	ै	ो	ौ
A	A	i	I	u	U	x	E	ai	O	au
Consonants								Ayogavaha		
क	ख	ग	घ	ङ				ँ	ं	ः
Ka	kha	ga	gha	ng'a				M’	M	H
च	छ	ज	झ	ञ						
Ca	cha	ja	jha	nj'a						
ट	ठ	ड	ढ	ण						
Ta	Tha	Da	Dha	Na						
त	थ	द	ध	न						
Ta	tha	da	dha	na						
प	फ	ब	भ	म						
pa	pha	ba	bha	ma						
य	र	ल	व	श	ष	स	ह			
Ya	ra	la	va	sha	Sa	sa	ha			
Numerals (Nepali-Devanagari)										
०	१	२	३	४	५	६	७	८	९	
0	1	2	3	4	5	6	7	8	9	

10 SUMMARY OF THE CORPUS

In the sections below, we provide the tabular details of the different content types of the Nepali raw speech corpus based on various yardsticks which can also be filter out from the metadata sheet. These figures may be helpful in tuning the corpus for various purposes of training, testing and evaluating various algorithms as well as provide useful insights into the dataset. The data size is of total duration 87:08:44 (hh:mm:ss) comprising 48975 audio segments.

10.1 SUMMARY OF THE AUDIO SEGMENTS

The table below shows the total number of Audio Segments and their distribution in the Nepali speech dataset.

LDC-IL Nepali Speech Data Status	Gender →	Female			Male		
	Age Group →	16-20 Years	21-50 Years	50+ Years	16-20 Years	21-50 Years	50+ Years
Content Type	Total Segments	Segments	Segments	Segments	Segments	Segments	Segments
Contemporary Text (News)-T1	343	35	122	27	25	94	40
Creative Text-T2	341	35	123	27	24	93	39
Sentence-S	8583	873	3097	669	625	2295	1024
Date-D	1029	102	370	81	75	281	120
Command and Control Words-W1	10308	1050	3718	807	749	2757	1227
Person Name-W2	6878	699	2479	541	500	1839	820
Place Name-W2	3398	349	1206	269	249	918	407
Most Frequent Word-Part-W3A	10292	1050	3724	809	750	2730	1229
Most Frequent Word-FullSet-W3B	2994	0	997	0	0	1997	0
Phonetically Balanced-W4	3321	415	416	0	414	829	1247
Form and Function Word-W5	1488	186	186	0	186	372	558

Table 10: Representation of Audio Segments of Nepali Raw Speech Data

10.2 DURATION OF THE NEPALI RAW SPEECH DATA

The table below shows the duration of each of the content type and their distribution across a few factors in Nepali Raw Speech Data.

LDC-IL Nepali Speech Data Status	Gender →	Female			Male		
	Age Group →	16-20 Years	21-50 Years	50+ Years	16-20 Years	21-50 Years	50+ Years
Content Type	Total Duration	Duration (hh:mm:ss)	Duration (hh:mm:ss)	Duration (hh:mm:ss)	Duration (hh:mm:ss)	Duration (hh:mm:ss)	Duration (hh:mm:ss)
Contemporary Text (News)-T1	14:33:19	1:32:56	5:00:56	0:55:18	1:12:57	4:19:21	1:31:51
Creative Text-T2	19:46:34	2:21:33	7:00:18	1:23:42	1:37:47	5:20:42	2:02:32
Sentence-S	13:39:39	1:30:12	4:57:53	1:04:38	0:59:05	3:33:58	1:33:53
Date-D	0:57:15	0:05:18	0:20:28	0:05:09	0:03:53	0:15:29	0:06:58
Command and Control Words-W1	8:44:19	0:49:09	3:08:49	0:40:47	0:38:18	2:25:08	1:02:08
Person Name -W2	9:15:04	0:55:27	3:22:09	0:46:29	0:39:25	2:25:53	1:05:41
Place Name-W2	3:20:06	0:19:11	1:12:02	0:15:53	0:14:41	0:55:05	0:23:14
Most Frequent Word-Part-W3A	8:51:06	0:49:06	3:12:14	0:40:46	0:39:23	2:26:24	1:03:13
Most Frequent Word-FullSet-W3B	3:41:39	0:00:00	00:50:16	0:00:0	0:00:0	2:51:23	0:00:0
Phonetically Balanced-W4	3:00:08	0:19:02	0:20:15	0:00:0	0:16:25	1:02:05	1:02:21
Form and Function Word-W5	1:19:35	0:08:54	0:09:28	0:00:0	0:07:41	0:26:26	0:27:06

Table 11: Representation of Nepali Raw Speech Data Duration

10.3 DISTINCT SET

The Distinct Set usually contains data which is distinct to each speaker and is rarely repeated. The LDC-IL speech dataset contains newspaper extracts which are read by each speaker.

10.3.1 Contemporary Text (News) -T1

Distinct Text Extracts from Newspapers are recorded from the informants to get the Nepali speech data of contemporary text. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	60	35	25	12	12	10	8	13	5
21 To 50	216	122	94	58	32	40	30	24	32
50+	67	27	40	9	16	17	13	1	11
Total	343	184	159	79	60	67	51	38	48

Table 12: Representation of Nepali Contemporary text (News)

10.4 RANDOM SET

The Random Set data comprises of content types which are sampled by machine for each speaker. They are sampled from collection of master datasets available. The random sets are given below:

10.4.1 Creative Text-T2

One randomly selected text of literature out of 6 texts from the prepared Nepali dataset is recorded from the informants to get the speech data of Creative text. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	59	35	24	12	11	10	8	13	5
21 To 50	216	123	93	59	31	41	30	23	32
50+	66	27	39	9	15	17	13	1	11
Total	341	185	156	80	57	68	51	37	48

Table 13: Representation of Nepali Creative Text

10.4.2 Date Format-D

The answer of 3 questions is collected from each speaker to get the Nepali date format of the informants. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	177	102	75	36	36	30	24	36	15
21 To 50	651	370	281	175	95	123	90	72	96
50+	201	81	120	27	45	51	42	3	33
Total	1029	553	476	238	176	204	156	111	144

Table 14: Representation of Nepali Date format

10.4.3 Sentences-S

The sentences content type contains a list of sentences that is a representation of almost all the phonemes occurring in Nepali. 25 Randomly selected Sentences are recorded from a list of 200 sentences. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	1498	873	625	300	300	250	200	323	125
21 To 50	5392	3097	2295	1474	801	1023	744	600	750
50+	1693	669	1024	224	400	420	349	25	275
Total	8583	4639	3944	1998	1501	1693	1293	948	1150

Table 15: Representation of Nepali Sentences

10.4.4 Command And Control Words-W1

The command and control words content type contains a list of 74 words that is a representation of almost all the command and control words occurring in Nepali. 30 randomly selected words of the list are recorded from each informant. Each word is uttered three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	1799	1050	749	360	360	300	240	390	149
21 To 50	6475	3718	2757	1769	960	1229	901	720	896
50+	2034	807	1227	269	480	508	417	30	330
Total	10308	5575	4733	2398	1800	2037	1558	1140	1375

Table 16: Representation of Nepali Command and Control words

10.4.5 Person Name-W2

The person name contains a list of 510 popular Pan Indian and regional person name. 20 randomly selected names are recorded from a list of names. Each name is uttered three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	1199	699	500	240	240	199	160	260	100
21 To 50	4318	2479	1839	1183	640	816	598	480	601
50+	1361	541	820	180	320	341	280	20	220
Total	6878	3719	3159	1603	1200	1356	1038	760	921

Table 17: Representation of Nepali Person Names

10.4.6 Place Name-W2

The place name contains a list of 324 popular Pan Indian and regional place name. 10 randomly selected names are recorded from a list of names. Each name is uttered three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	598	349	249	119	120	100	79	130	50
21 To 50	2124	1206	918	586	319	390	299	230	300
50+	676	269	407	90	160	169	137	10	110
Total	3398	1824	1574	795	599	659	515	370	460

Table 18: Representation of Nepali Place Names

10.5 MOST FREQUENT WORD-PART-W3A

The most frequent words-part contains a list of 1290 most frequent words occurring in Nepali. 30 randomly selected words of the list are recorded from each informant. Each word is uttered three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	1800	1050	750	360	360	300	240	390	150
21 To 50	6454	3724	2730	1770	961	1231	899	723	870
50+	2038	809	1229	270	480	509	419	30	330
Total	10292	5583	4709	2400	1801	2040	1558	1143	1350

Table 19: Representation of Nepali Most Frequent Words-Part-W3A

10.6 FULL SET

The full sets are the master set of certain datasets which are read completely from few selected speakers in each group. The full sets are as below:

10.6.1 Most Frequent Word-Full-W3B

The Most Frequent Words contain a list of 1278 most frequent words. In full set all the 1000 words are recorded from the informant. Each word is uttered three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Assamiya		Darjeelinge
		Female	Male	Male
21 To 50	2994	997	997	1000

Table 20: Representation of Nepali Most Frequent Word-Full

10.7 PHONETICALLY BALANCED VOCABULARY-W4

The Phonetically Balanced words contain a list of words where almost all the phonemes of Nepali language have occurred in all the possible positions of a word. In full set all the 416 words are recorded from the informant where they uttered those words three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution of words		Region-wise Distribution			
				Darjeelinge		Assamiya	
		Female	Male	Female	Male	Female	Male
16 to 20	829	415	414	0	0	415	414
21 to 50	1245	416	829	0	413	416	416
50+	1247	0	1247	0	415	0	832
Total	3321	831	2490	0	828	831	1662

Table 21: Representation of Nepali Phonetically Balanced Vocabulary

10.7.1 Form And Function Word-W5

The Form and Function Words contain a list of 186 words which is a representation of almost all the form and function words occurring in Nepali. All the words are recorded from the informant where they uttered those words three times. The distribution of data is as follows:

Age Group	Total Audio Segments	Gender-wise Distribution of words		Region-wise Distribution			
				Darjeelinge		Assamiya	
		Female	Male	Female	Male	Female	Male
16 to 20	372	186	186	0	0	186	186
21 to 50	558	186	372	0	186	186	186
50+	558	0	558	0	186	0	372
Total	1488	372	1116	0	372	372	744

Table 22: Representation of Nepali Form And Function Word

10.8 NATIVE SPEAKERS DISTRIBUTIONS

The following table shows the distributions of Nepali Native Speakers across the regions

Age Group	Total Audio Segments	Gender-wise Distribution		Region-wise Distribution					
				Darjeelinge		Dehraduni		Assamiya	
		Female	Male	Female	Male	Female	Male	Female	Male
16 To 20	61	36	25	12	12	10	8	14	5
21 To 50	219	124	95	59	32	41	30	24	33
50+	70	27	43	9	16	17	14	1	13
Total	350	187	163	80	60	68	52	39	51

Table 23: Representation of Nepali Native Speakers Distributions