

How to Cite:

Manjula, T., & Sudha, T. (2022). Recent development in speech recognition systems for Indian regional languages: A review. *International Journal of Health Sciences*, 6(S3), 4840–4845. <https://doi.org/10.53730/ijhs.v6nS3.6967>

Recent development in speech recognition systems for Indian regional languages: A review

T. Manjula

Research Scholar, Department of Computer Science, SPMVV, Tirupathi
Email: komamanjula@gmail.com

Prof. T. Sudha

Professor, Department of Computer Science, SPMVV, Tirupathi, India

Abstract---Mother Language is the important means of communication and speech is its main medium. In human machine interface speech technologies are vastly used and has unlimited uses. Advances of ASRs in English language have lead to the evolution of the Speech recognition systems in other languages also. This paper focuses on the development of SRSs for the Indian regional languages. India is well known for its national integrity. Unity in diversity can also be observed in India in terms of languages used for communication. Many researchers developed Speech recognition systems for different Indian languages. In this paper we provide an overview of recent research works on SRSs for various Indian Languages.

Keywords---speech recognition, SRS, Indian regional languages.

Introduction

Speech is the vocalized form of communication. Communication through speech is natural, fast, easy, hands-free and do not require much technical knowledge. Human computer interaction requires the human to have certain amount of skills for effective use of the primitive devices such as key board and pointing devices. Use of these devices also requires hand-eye coordination. Physically challenged people may have difficulty in using these devices. Blind people are unable to read from the monitor. Speech enables a convenient form of human machine interaction. Moreover current computer interfaces assumes certain level of proficiency in English language. All these issues can be resolved using speech communication.

Human computer interaction is a major issue in the Information technology era. Design of a convenient and user-friendly interface has been an important

technological issue. Machine dependent interfaces limit the usage of computers by the majority of population. Speech enables a suitable form of communication to the human machine interaction. Speech in native languages enables even a common man to get the services of information technology. Speech recognition systems especially developed in native languages helps elderly, blind and physically challenged people closer to the information technology revolution. Speech recognition provides a lot of benefits to the manufacturing and control applications. The telephone applications such as automated dialing, telephone directory assistance, spoken database queries for novice users and voice dictation system like medical transcription systems, Language translation are well known forms of speech communication. Speech enabled applications in public areas such as; railways, airport and tourist information centers might serve customers with answers to their spoken query. Such tantalizing applications have motivated research in automatic speech recognition (ASR) since 1950's. Great progress has been made so far, especially since 1970's, using a series of engineered approaches that include template matching, knowledge engineering, and statistical modeling. Yet computers are still nowhere near the level of human performance at speech recognition, and it appears that further significant innovation requires serious research or studies.

India is well known for its varied heritage. There are hundreds of languages spoken all over India. The languages that have been recognized by the Government of India include besides Sanskrit 21 other regional languages as modern Indian languages: Assamese, Bangla, Bodo, Dogri, Gujarati, Hindi, Kashmiri, Kannada, Konkani, Maithili, Malayalam, Manipuri, Marathi, Nepali, Oriya, Punjabi, Tamil, Telugu, Santali, Sindhi, and Urdu. Automatic speech recognition has tremendous potential in Indian scenario. Although literacy rate of India is above 65%, less than 6% of India's total population uses English for communication. Since the internet has become universal, common man now mainly depend, the same for any sort of information and communication. Therefore it is imperative that the about 95% of our population cannot enjoy the benefits of this internet revolution. If this information is available in local languages, India could also be benefited by this technology revolution and could stand along with developed countries. It would be a vital step in bridging the digital divide between non English speaking people and others. Since there is no standard input for Indian languages, it eliminates the key board mapping of different fonts. In Indian scenario, where there are about 1670 dialects of spoken form, speech recognition technology has wider scope and application. A survey on major research works in the development of automatic speech recognition in Indian language is being presented in this paper.

SRS for Indo Aryan languages

The Indo Aryan languages are spoken by 74% of Indians. The Indo Aryan Language group includes the languages Hindi, Assamese, Bengali, Dogri, Gujarati, Kashmiri, Marathi, Nepali, Punjabi, Rajasthani, Sindhi, Odia, Urdu etc. Recent research in Speech Recognition for these languages are given in the table1.

Table 1
Speech Recognition for Indo Aryan Languages

S. No	Author	Research Topic	Month&Year
1	Himanshu Sarma, Navathe Saharia, Utpal Sharma	Development and Analysis of Speech Recognition Systems for Assamese language using HTK	2017
2	Tiken Moriagtham, Partha Pratim Burman, Rupjyothi Gogoi	Speech Recognition Model for Assamese Language Using Deep Neurl Networks	June 2018
3	Jahiriol Islam, Masiath Mubassira, Md Rakibul Islam, Amith Kumar	A Speech Recognition System for Bengali Language Using Recurrent Neural Network	February 2019
4	Sayan Mandal, Sarthak Yadav, Atul Raj	End to End Bengali Speech Recognition	September 2020
5	Vakyansh Harveen Chadha	Dogri Speech Recognition Model	
6	D.Raval	Improving Deep Learning Based ASR for Gujarathi	July 2021
7	Mukhtan Patel, Deepang Raval, Vyan Pathak	End to End ASR for Gujarathi	2021
8	Sandeep Rathore, R.S Jadon	Speech Recognition and System Controlling Using Hindi Language	July 2019
9	Vivek Bharadwaz	An experimental framework of Speaker Independent SRS for Kashmiri Language using Sphinx	July 2017
10	Irshad Ahmed Thuhroo, Rumaan Bashir	Spoken Language Identification System for Kashmiri and Related Languages Using Mel-Spectrograms and Deep Learning Approach	January 2022
11	Ramitha Pradeep Karpe, Nagaraj Vernekar	Konkani Script to Speech Conversion by Concatenation of Recognized Hand Written Konkani Text Using Neural Networks	September 2019
12	Nilesh B, Fal Dessai	Development of a Text To Speech System for Devanagari Konkani	May 2017
13	Pankaj Dwivedi, Amit Jha	Maithili Text to Speech Syatem	July 2019
14	T. Patel, N.Krishna et all	An Automatic Speech Transcription System for Manipuri Language	2018
15	S. Supriya	Speech Recognition Using HTK	June 2018

		toolkit for Marathi Language	
16	B.Bhatta	Nepal Speech Recognition Using CNN, GRU and CTC-ACL	2020
17	Janarthan, Banraja, Kaushal Mishra, Jayshree Rath, Subama Shakya	Nepali SR using CNN and Sequence Models	February 2020
18	Paribesh Regmi, Arjun Dahal, Basanta Joshi	Nepali SR using RNN-CTC Model	July 2019
19	Elina Baral, Sagar Shrestha	Large Vocabulary Continuous Speech Recognition for Nepali Language	December 2020
20	PK Sahu, Biswajit Karan, Jaya Prakash Sahu	Automatic SR based Odia System	January 2022
21	Pridhviraj Mohanty, Ajit Kumar Nayak	N-gram Language Model Based Continuous Voice Odia Digit Recognition	July 2019
22	Yogesh Kumar, Navdeep Singh	An ASR System for Spontaneous Punjabi Speech Corpus	May 2019
23	Virenday Kadyan, Sd Shanwazuddin, Amitoj Singh	Developing Children's SRS for low Resource Punjabi Language	July 2021
24	Muddasar Laghari, Md Junaid Tahir, Abdullah Azeem, Waquar Riaz, Yi Zhou	Robust Speech Emotion Recognition for Sindhi Language based on Deep CNN	May 2021
25	Md Saim Younus Hashmi, Dil Nawaz Hakro, Anjali Mandhan	Offline Sindhi SR	November 2019
26	Javed Ashraf, Naveed Rao, Naveed Khattk, Athar Moshin	Spontaneous Independent Urdu SR Using HMM	June 2019

SRS for Dravidian languages

The Dravidian Group of languages are spoken by 25% of Indians. These languages include Tamil, Telugu, Kannada and Malayalam. Recent developments in SRS research for the four Dravidian languages are given in the table 2.

Table 2
Speech Recognition for Dravidian Languages

S. No	Author	Research Topic	Month&Year
1	P.S.Praveen Kumar, Tammiraja Yadava	Continuous Kannada SRS Under Degradation Condition	July 2019
2	Jaya Aishwarya, Poornima Panduranga	Kannada SRS for Aphasi People	December 2018

	K., Sampath Kumar		
3	Rizwana K.T., Md Basheer K.p, Rabiba K.K	Automatic Speech Recognition System for Malayalam Language	June 2019
4	Cini Kurian, Kannan Bala Krishnan	Connected Digit Speech Recognition System for Malayalam Language	2021
5	Ashana M.M, R. Rajan	ASR in Malayalam using DNN-based Acoustic Modeling	December 2020
6	MdHashin Changrampadi, Shahina A,MBadri Narayan, NayeemullaKhan	End to End Speech Recognition of Tamil Language	November 2021
7	Kiran R, Nivedha K., Pavithra Devi S, T.Subha	Voice and Speech Recognition in Tamil Language	July 2017
8	Shivprasad Satia, M. Sadanandam	Identification of Regional Dialects of Telugu Language using text independent Speech Processing Models	June 2020
9	A Praveen Kumar, Ratnadeep Roy, Sanyog Rawat, Prathibha Sudhakar	Continuous Teleugu Speech Recognition through combined Feature Extraction by MFCC and DWPD using HMM based DNN Technique	2017

SRS for Sino Tibetan languages

The Sino-Tibeton Group of languages include Bodo, Manipuri and Maithili Languages. Recent developments in the SRS research for Bodo and Manipuri languages are listed in the table 3.

Table 3
Speech Recognition for Sino Tibetan Languages

S. No	Author	Research Topic	Year
1	Laba Takaria, Akalpitha Das. Achari Pran, Hari Talukdar	Automatic Speech Recognition of BODO Alpha Digits using Hidden Markov Models	-
2	N.Ningthoujam, Prathima V.R.	Designing a Feature Extraction Model for Manipuri Language	2016
3	M. Premi Devi, I. Tickocham Singh, Dr H. Mamatha Devi	Automatic Syllabification Rules for Manipuri Language	2017
4	Patel et all	Development of Large vocabulary SRs with Keyword Search for Manipuri	2018
5	T.Patel, N. Krishna et all	An automatic Speech Transcription Syatem foe Manipuri Language	2018

SRS for Austric and other languages

The Austric Group of languages include Santali Language. Santali language is spoken by the tribal of Bihar, Bengal and Jharkhand. SRSs developed by CDAC for some of the Indian languages also includes Santali. Recent works in Santali are listed in the table 4.

Table 4
Speech Recognition for Austric Languages

S. No	Author	Research Topic	Month&Year
1	Sohan Mia	Describing Phoneme Inventory of Santali Language: A Linguistic Approach	October 2020
2	Arvind Kumar, Rampravesh Kumar, K. Kishore	Performance Analysis of ASR Modules for Santali Language on Kaldi and Matlab Toolkit	November 2020
3	Md. Amir Akkthar, Mohit Kumar, Gadadhar Saho	Automata for Santali Language Processing	September 2017

Conclusion

The presentation of recent research in Indian regional Languages helps the researchers in many domains to promote their application usage among common users and thereby increasing their productivity. In this paper, a concise study has been presented that covers the recent researches done for 22 Indian languages. The relevant research papers have been reported to address the major advancements in the field of Speech recognition for different Indian Languages. This study may provide some important research insight for the researchers in this field.

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