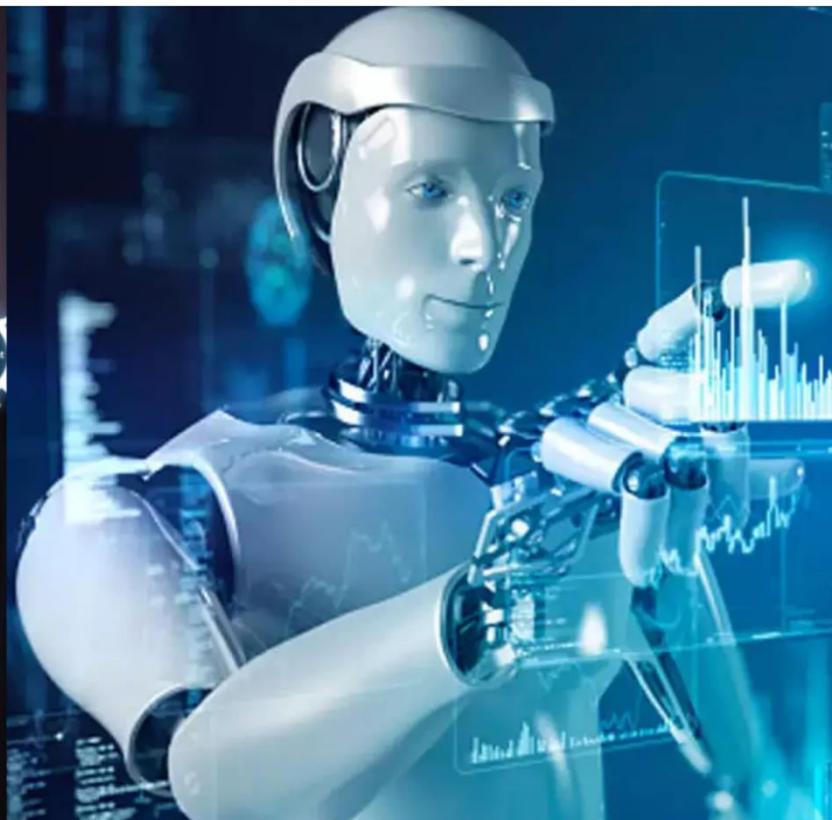




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# A Computational Model to Evaluate: Language Choice in Code-Mixed Odia Lyrics

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**ABSTRACT:** Language choice in a multilingual society depends on various precipitating factors. To evaluate the language choice tendency of speakers in a multilingual speech area, a structural approach to the analysis of desired texts can be adopted. In this paper we have proposed a three-layered model, to evaluate the Language choice tendency of Odia lyricists through corpus analysis. We have taken more than eight hundred Odia lyrics for our study. The procedure for analysis of corpus includes three major steps. The first step is - the creation of a dataset for Odia lyrics. The second is the identification of languages used in that dataset through the deep learning model. The last step is, evaluating the matrices that are indicators of language choice by speakers. Here we have taken Guzman's six matrices which are very helpful to study language choice by lyricists. These metrics are M-Index, Language Entropy, I-index, Span Entropy, Memory, and Burstiness. These indices are arranged in a layered manner for our structural approach to studying language choice. The uppermost macro layer is the global process of code-mixing that can be arrived at through Word count analysis indicated by M-Index. The Middle-Hidden layer involves a measure of uncertainty or randomness which can be evaluated through Language Entropy and Integration-Index. Time-dependent indicators like burstiness, span entropy, and memory are the bottom and finer layers of Code-mixing indicators among various natural languages.

**KEYWORDS:** Language-choice, Language-Entropy, Multilingualism, Code Mixing/Switching, Memory, Burstiness

## I. INTRODUCTION

Language choice is uncertain in a multilingual language system. Such uncertainty can be equated to the entropy of that language. In the classical thermodynamic concept, Entropy is a measure of randomness or degree of disorderliness of a system (Rankine,1850) which can be measured through physical variables. Microscopically it corresponds to the motion of internal particles within a system. In statistical mechanics, it is an indicator of 'Spontaneity' and 'Mixedupness' (Gibbs). Natural processes always increase randomness and disorderliness in a system. It tries to bring more probability combinations within a system and hence moves in those directions where the spontaneous act is possible. Code mixing between languages is a natural process. It depends on the uncertainty factor or spontaneity of the language to be used by the speaker. When the change in Language entropy is on the positive side the probability of mixing language is higher. Hence Code mixing can be termed as a spontaneous natural process where languages are mixed up to bring more randomness in combined usages of languages. In his paper "A mathematical theory of Communication" (Shannon,1948) first introduced the concept of information entropy. Shannon's entropy is analogous to uncertainty or the choice of language in a multilingual setup. Entropy helps to understand the underlying principles in natural languages. For example-relationship between word frequencies, predictability, and the length of words compromises between word structure and sentence structure (Bentz,2017). It also helps to decode how words, sub-words and character embedding occurs in sentences when language mixes. Along with other metrics like M-Index, Integration index, Span entropy, and memory- Language choice can be structured as a three-layered system for studying code-mixing.

Odia is spoken by approximately four crore people and Odisha is the first state in India to be organized as a state linguistically. In 1803 Odisha state came under British Rule and for more than 200 years Odia got exposed to the English language, culture, education, and almost all fields of life. But after independence Hindi became the national language and was fostered by the central government. In Odisha, English remained the official language for all time. Odia was recently enacted to be used as an official language. Odia has proved its ancient classical legacy to have more than 1500 years of continuous history due to its rich antiquities, inscriptions, and scriptures available.

The lyrical journey of the Odia language traces back to the origin of the Jagannath cult in Odisha (Jnana and Drusti). Through theaters, folk songs, folk dance, and folk theaters (Pala, Kirtan, Bhajan, Gitinatya, etc.), mythological-social stage plays have flourished through centuries. Interestingly, the first song was recorded in Odia in the year-1908(Surya Deo, 2019). However, cinematic representation of Odia lyrics started with the talkative movie "Sita Bibaha " (Sita's marriage) which was a drama written by Kamapal Mishra and directed by Mohan Sundardev Goswami in 1936 (Roy, 2017). Odia has many regional dialects like Sambalpuri, Berhampuri, Baleswari, Koraputia, Desia, and Sundargadi. Sambalpuri is the western dialect/variety of Odia language spoken in the western part of Odisha state and has a significant contribution to lyrical songs in Odia language apart from standard Odia (Behera et al., 2015). Language alternation is a frequently observable phenomenon in Odia society. People in multicultural setups undergo a functional level cognitive switching from one language to another for responding better to their environmental needs. Varieties of language in a language system make them available as linguistic items which may have different social origins and links that develop in a person. Such varieties of language do not store in a rigid system but remain as a loose available choice to the speaker. If some lexical gaps are haunting speakers at a particular time of speech, he fills such gaps with another language. Odia lyrics help to know the pattern of language mix in various levels of word, sentence, and semantic needs.

#### 1.1 Reason for Code-mixing of Hindi and English in Odia

Hindi is the National language of India and the Broadcasting Language. Educational boards, National-Institutes, Organizations, All India services, committees, Railways, and Media are promoting Hindi in Odisha. Hindi movies are much-watched cinematic performances in Odisha-Two regional Hindi-speaking states border western Odisha which has become a physical gateway to Hindi. Western Variant of the Odia language is borrowing heavily from Hindi vocabulary and adopting it very fast. Sambalpuri, Sundargadi, and Balangir variants of the Odia language have more influence on Hindi Mixing or switching than the standard Odia language. The speaker's situational use of Hindi as per their need. Influence of Hindi On Odia speech community Western Odisha is flooded by neighboring Hindi communities, traders communities, and visitors. Huge Educational/vocational/engineering colleges attract people in neighboring states to have their education here. Adolescent people learn from peer groups and adopt Hindi quickly. Hindi songs and movies are more watched and heard than Odia movies and songs. Radio jockeys are well conversant in Hindi as their many promoters were national. Mostly the speakers and addresses are Lovers or spouses with an emotional appeal to each other. Due to having emotional content between the two speakers, the speech environment mostly is informal. Interestingly the romantic appeals are borrowing Hindi -' Speech Formulas' (Pawley, 1985) readily available in pre-fabricated, socially negotiated form as multimorphic sentences or phrases.

In Nationally controlled school environments teacher-pupil interaction, radio stations radio jockeys' interaction and usages, in the Banking system and Service sectors service providers are using Hindi as a customer-friendly language. In most cases, the headquarters of organizations are based in Hindi-speaking Central India, hence all communications are essentially made in Hindi. Many examinations conducted in India have only two choices -English or Hindi. Rastrabhasa Prachar Samiti is a dedicated organizational vehicle that promotes voluntary Hindi courses from the primary level to the research level which is also active in Odisha. So Hindi education is an optional choice in Academics in Odisha schools. Central schools or centrally funded schools are compulsorily using Hindi for their interaction.School/college level exchange programs also add to language contact with Hindi. Aspiration for reality shows, sports, singing, and career achievement needs some Hindi language exposure and usage. Hindi tourists flood Odisha, as it is an incredible pilgrimage in the travel map of India. Airport-railways-Service Providers-Guide-tourist interactions are comfortable when the speaker switches to Hindi. Labor migration from Hindi-speaking lands has increased in the last two decades. Major cities in Odisha have become cosmopolitan areas where the need for a unifying language or language solidarity is required by the speakers. Hindi is a national language, preferred at all social strata levels to communicate with each other.

Indians have been in contact with English for more than 300 years. English is still perceived as an elite language and doubts arise in the speaker about the acceptability of English by the receiver. Colonial-ism, Missionary works, and English education promoted by Britishers as an administrative infuse of English became part of the day-to-day discourse. Now though Odias are a non-native speaker of English still it has produced internationally acclaimed poets and writers in English. Jayanta Mahapatra(Mitra,2012) is a well-read international poet of this soil. Manoj Das(Nayak,2010) is one of the greatest bilingual writers of the land having international fame for his English stories. So Odisha contributed immensely to Anglo-Indian English literature that flourished in India as a part of

Commonwealth literature. Administration, Judiciary, and legislation fully depend on the English language for official purposes. Education, Business, and industry all are English-dominated areas.

So code-mixing from English is inevitable. English is also regarded as a yardstick of intelligence, smartness, socially developed, self-ego, and self-esteem. Even in Odia western vocabulary may sometimes become more popular than its Odia substitute. So there are many political, cultural, psycho-sociological, and anthropological reasons behind the code mixing phenomenon which need a different study. Language entropy between Sambalpuri-Hindi, Odia-Hindi, Sambalpuri-English, and Odia-English will show to what extent the languages are prone to alteration and what is the frequency of use in a corpus. Word Entropy Analysis is the best way to understand the choice of languages.

## 1.2 Purpose

The purpose of the paper is to evaluate trends of 'Language choice' in Odia lyrics through computational methods. Due to Language contact and multilingualism, Odia lyrics have been influenced by various languages. The cinematic/broadcasting journey of Odia lyrics from 1921-1990 witnessed slower code-mixing. After globalization, the code-mixing phenomenon accelerated in Odia lyrics in comparison to previous periods. A Code-mixing identifier and calculator are one of its technical goals.

## 1.3 Related Work

### 1.3.1 Theoretical Approach

- In the article "Sociolinguistics and the ethnography of speaking." Social anthropology and language (Dell Hymes, 1971) author has regarded code mixing as language competency which is affected and shaped by socio-cultural factors.
- In the paper "The Sociolinguistic Significance of Conversational Code-Switching" (Gumperz, 1977) author has found- languages of two grammatical systems are so juxtaposed that there is only an exchange of alternative units but the alienation of the whole language remains as it is.
- Braj B Kachru (1978) has published a paper "Toward Structuring Code-Mixing: An Indian Perspective". He tried to study code-mixing in multilingual societies which have a language hierarchy indicating function-dependent role assignment of languages in South Asia. He has pre-supposed two types of language convergence-One being linguistic interaction in the inner circle of the region and outer linguistic imposition. He was interested to explore how Code-mixing manifests in a linguistic area despite language constraints.
- S.N. Sridhar (1978) attempted empirical study of Code Mixing in Kannada. S.N Sridhar and K.K Sridhar (1980) has done extensive work on syntactic and psycholinguistic study of bilingual code mixing.

### 1.3.2 International Research work

- Michael D. Picone, (2002) in "Artistic code mixing." -has studied the relationship between Lyrics and linguistic theories and concluded that artistic code-mixing is performative rather than contrastive. It is different from conversational code-mixing and involves a high degree of meta-linguistic scrutiny.
- RONI, (2008) in "An analysis of Indonesian-English code mixing used in song lyrics of project pop." has projected that code-mixing in Indonesian lyrics is due to need-based feeling motive and not due to prestige feeling motive.
- Oladosu, M. Ajibola (2011) studied Code-mixing as a sociolinguistic medium in some selected songs in the Nigerian music industry.
- Likhit Phongsathorn, Teeratom, and Pattama Sappapan (2013) in "A Study of English Code-mixing and Code-switching in Thai Pop Songs." searched about nativized English in Thai Pop songs and their hybridization and reduplication.
- Hesti Sri Herawati, (2019) in "Code Mixing and Code Switching in Contemporary Indonesia Dangdut Music: A Sociolinguistic Case of Nela Kharisma Song Lyrics." has particularly focused on a singer and his variation from Javanese-Indonesian and English.
- Rahardjo, Hardianto, (2021) in "The Use of English Words and Sentences in Japanese Anime Songs (Code Mixing and Language Switching in Japanese Anime Songs)" has focused on theme songs from various eras like the 80s, the 90s, and 2000 and above for studying the tendency of code-mixing between Japanese language and English.

## 1.3.3 Indian Research work

- Rajendra Singh, (1985) in "Grammatical constraints on code-mixing: Evidence from Hindi-English." is a psycholinguistic and neurolinguistic study of code-switching among bilinguals.
- Kamwangamalu, Nkonko Mudipanu (1989) In "Code-mixing and modernization." has focused on the neglected dimensions of Code-mix as a cross-cultural function.
- Saroj, Thakur, Kamlesh Dutta, and Aushima Thakur (2007) in "Hinglish: code-switching, code-mixing, and indigenization in a multilingual environment." have tried to investigate how Indianization of English through code mixing and switching created a variant language called Hinglish.
- Bali, Kalika, et al. (2014) "I am borrowing ya mixing?" is an analysis of English-Hindi code mixing in Facebook." published in the Proceedings of the first workshop on computational approaches to code-switching.
- Dey, Anik, and Pascale Fung "A Hindi-English Code-Switching Corpus." has studied code-mixed interview data of students creating a speech corpus to investigate the rules and constraints of code-mixing.
- Code-switching and Code mixing in Kashmiri: A Linguistic Overview. Nisar Koka(2014) The paper is about Code mixing seen in Kashmiri speech community where the main aim was to study Kashmiri-Urdu and Kashmiri-English switching phenomenon.
- Bhat, Sapna, and Shyamala Chengappa. (2013) In "35 Language-mixing in bilingual aphasia: an Indian perspective." argued Code mixing is a consequence of Linguistic deficiency at different levels like syntactic, phonological, etc.
- Kiddinapillai Sanmuganathan(2018), in "A sociolinguistic study on Tamil English code-mixing among urban bilinguals - A study on pedagogical perspective." studied English mixed Tamil in Jaffna, a city in Sri Lanka.
- Ahmad, Iesar (2019) in "The Politics of Code Switching and Code Mixing: A Critical Study of Arundhati Roy's Novel the Ministry of Utmost Happiness in the Postcolonial Discourse Perspective." studies the postcolonial discourse of writers showing language hybridity and cultural sincerity challenging the dichotomy and binary split between western and oriental discourse.
- "Main ho gaya single I wanna mingle...: An evidence of English code-mixing in Bollywood songs lyrics corpora." (Subhash Chandra, in 2014)has studied Code mixed 3784 nos. of Bollywood lyrics and created corpora.
- Poonam Sethi in "A Study of Code-Switching and Code-Mixing of English in Punjabi lyrics and their Socio-cultural implication.")has studied language hybridization through Code mixed Punjabi-English Lyrics.
- "Acute sporadic English in Bollywood film songs' lyrics: (Subhash Chandra, et al.,2016) is a textual evidence-based analysis of code-mixing in Hindi."
- "Unraveling the English-Bengali code-mixing phenomenon."(Arunavha Chanda et al., 2016) used two datasets FIRE 2013 and their dataset of Facebook corpus to POS tag it and to use it for sentimental analysis.
- "Addition of code-mixed features to enhance the sentiment prediction of song lyrics." (Reddy, Gangula Rama Rohit, and Radhika Mamidi.,2018)have created the Telugu-English code-mixed Corpus for their Sentimental analysis.
- "Effects of code mixing in Indian film songs."(Ali, Muhammad Mooneeb, et al.,2019) paper made a survey among youths of Lahore about the reason for Code mixing in Indian film songs.
- "Code-mixing, Digital Media and Negotiated Identity of the Urban Youth in India"(Om Prakash, and Akansha Kapoor, 2020) showed language hybridity, a sociolinguistic phenomenon that creates a new restricted code for linguistic interaction.

## 1.3.4 Odia research work

Automatic Hate Speech Detection in English-Odia Code Mixed Social Media Data Using Machine Learning Techniques (Sudhir Kumar, et al., 2021) The paper has proposed a hate speech detection model for English-Odia code mixed data from Facebook.

## II. METHODS

Lyrical data is collected along with metadata from the internet, web portals, you-tube, and books. Then lyrical data is transliterated into English. The metadata categories that are to be collected along with lyrics are:

- Title of Lyrics, Dialect, Period, Singers, Gender of Singers,
- Music Director, Gender of Music, Director,
- Lyrics Author, Gender of Lyrics Author,
- Director, Gender of Director, Producer, Gender of Producer,
- Movie or Album, Year of Release.

All these data are useful for the creation of a Dataset.

We collected Odia songs mainly from the Odia song lyrics websites and books and preprocessed them for experiments and released the corpus. The collection of song lyrics data and metadata from the web (e.g. lyric wiki, lyrics websites) was already followed by many researchers in multiple languages which we have followed (Kilgarriff and Grefenstette, 2001; El-Haj, 2020; Fell et al., 2020b). Apart from this we also collected data from lyrics books written by two lyricists Late Akshaya Mohanty and Devdas Chhotray. The main source of the song are:

- Akhaya Mohanty Ka Gita Khata
- Cinema Gita By Devdas Chhotray
- Odia Movie songs-Odia Cinema Gita-1936-1969 (Volume-I) Compiled by Surya Deo
- Odia Cinema Gita-1970-78 (Volume-II) Compiled by Surya Deo
- <https://allodialyrics.com>
- <https://odia-lyrics.blogspot.com>
- <https://odialive.com>
- <https://lyricstranslate.com>
- <https://sambalpurisongslyrics23>
- [www.allsambalpurilyrics.com](http://www.allsambalpurilyrics.com)

Darling Premare Falling	Desi Toka Style Dekhi
Hai Re Mo Anar Kali	Tate Love Kali
Dekhila Dinu Tate Dil Dei Deli	To Pain Maruchhi Deli
Aare Mo Hero Kouthi Tu Thilu	Aalo Mo Baby Cute Tora Photo
Aakhire Jebethu Misscall Delu	Sarila Mate Tora Icecream Otha
Chhati Re Baje Tring Tring	Tu Mo Sweet Sweet Sweetly.....
Da... Da... Darling Prema Re	Aaji Jaen Mo Pain Tu Thilure Kuanra
Premare ଠୁ Falling	Padi Galu Ebe Dhara
E Katha Market Re Chariaade Halling	Tutu Tara... Mana Mora ଠୁ Pain Awara
Pyar Bali Figure Tora De Chulubuli	Aalo Mo Rangeli Para
Dekhu Dekhu Fida Mun Heli	To Bina Eka Mun Rahi Paru Nahin
Kari Ne To Heroin.....	Udeine Ne Mate Superman Hei

Fig. 1.: Illustration of Code-Mixed Odia lyric (Word Color:-Red-Hindi, Blue-English, Black-Odia)

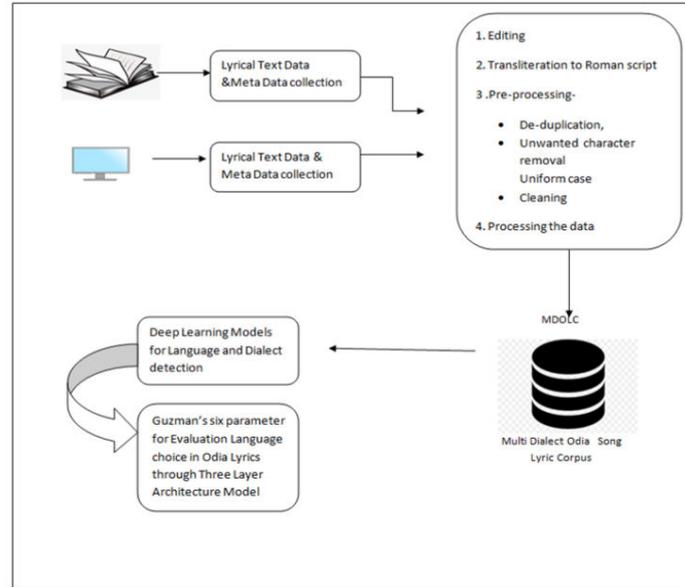
Books serve as a reliable source of song lyrics, but unfortunately, they are not made digital (Bakli-walet et al., 2016; Premjith et al., 2016). OCR technology has greatly improved, which has allowed the digitalization of large amounts of textual resources such as books, old newspapers, ancient manuscripts (Dhondt et al., 2017)]. That is to say, it should be

borne in mind that there are often errors in the scanned texts as the OCR system sometimes does not recognize the letters correctly or misinterpret.

```
<Song ID>1</Song ID>
<Title>mushkil hai jeena</Title>
<Dialect>odia</Dialect>
<Period>after year 1990</Period>
<Singers>babushan & diptirekha</Singers>
<Gender(Singer)>male & female</Gender(Singer)>
<Music Director>prem anand</Music Director>
<Gender(Music Director)>male</Gender(Music Director)>
<Lyrics Author>subrat swain</Lyrics Author>
<Gender(Lyrics Author)>male</Gender(Lyrics Author)>
<Director>ashok pati</Director>
<Gender(Director)>male</Gender(Director)>
<Producer>binni samal & nihar samal</Producer>
<Gender(Producer)>female & male</Gender(Producer)>
<Movie_Album>ajab sanjura gajab love</Movie_Album>
<Year>2017</Year>
<lyrics>
  <s>otha tora madusala</s>
  <s>mitha mitha mahu jhara</s>
  <s>mahu bina prajapati rahi parena</s>
  <s>mushkil hai jeena tere bina</s>
  <s>akhi tora swapana jhara</s>
  <s>tofa tofa janha tara</s>
  <s>janha bina rati jama soi parena</s>
  ...
  ...
  ...
</lyrics>
```

Fig. 2.: Odia lyric corpus XML format

2.1 Dialect Detection (Deep Learning model): We can use the Deep Supervised Autoencoder with Bayesian optimizer for the language detection task which was already found effective in language and dialect detection tasks (Parida et al.,2020b; Parida et al., 2020c). Here are Language ids (Output) as per ISO language code -Odia (ori), Sambalpuri (spv), English (en), and Hindi (hi).

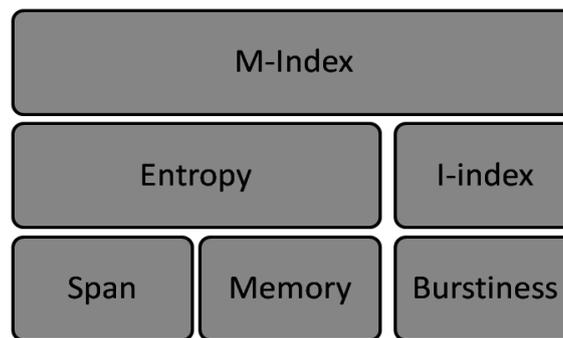


**Fig. 3:** Computational Model for Evaluating Language choice

### 2.2 Code Mixing Parameters Evaluation

A three-layered architecture can be used to evaluate surface to deeper-level code-switching behavior. Six metrics (Guzman,2017) can be placed at various layers. Here Macro-layer is the global process of code-mixing that can be arrived at through Word count analysis by M-Index. The Hidden layer involves uncertainty or randomness evaluated through Entropy measures and integration measures. Time-dependent indicators like burstiness, span entropy, memory are the deep and finer level evaluation or Micro-layer of Code mixing between languages.

In•M-Ind



**Fig. 4** Three-layer Architecture Model

- 1). M-Index-Multilingual Index developed by Barnett et al. from the Gini coefficient is a word-based metaphor for measuring the inequality of the distribution of language tags in a bilingual chorus. For example-in Odia-English, Odia-Hindi, Sambalpuri-English, Sambalpuri-Hindi.
- 2). Entropy - Language entropy specifies how many pieces of information are needed to define the distribution of language tags.
- 3). Integration-Index- I-index describes the potential for change within the text.
- 4). Burstiness – Burstiness (Barabasi and Goh,2008) evaluates whether a change occurs in an explosion or has an occasional character.

- 5). Span Entropy - Span entropy returns how many pieces of information are needed to define a wide range of languages. Because the distribution of language time consists of more potential regions than distributing the language tag, the amount of information required to describe this distribution is much higher.
- 6). Memory: Memory (Barabasi and Goh, 2008) is a measure of the default order of the first order between consecutive languages. In other words, memory measures the length of language that is usually influenced by the length of the previous spaces.

### III. CONCLUSION

This paper is a part of doctoral research. Emotion recognition, Author Attribution, Sentimental analysis, discourse study, psycholinguistic and sociolinguistic studies can be made on this Odia lyrical dataset. The impact of code-mixing on native languages can be studied with more clarity and through pattern analysis. Now English and Hindi are seen as more acceptable alternatives for regional languages in India during communication in natural discourse or on social media platforms. Though in Odisha mix-codes are age-old practices that were previously seen only between Odia and other Indian languages at border regions due to language contact, now the Code-Mixing behavior is frequent, and the mixing of Hindi and English in Odia is much more visible. This research work will help the empirical study of Ambiguities, Fuselects, Speech formulas, and language borrowing between various languages and Odia along with the multilingualism aspect of Odia society.

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