

CS689: COMPUTATIONAL LINGUISTICS FOR INDIAN LANGUAGES LANGUAGE

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Tue 10:30–11:45, Thu 12:00–13:15 at KD102

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- **Empiricist** view: language is learnt by exposure to usage
 - Pattern recognition, association, and generalization happen gradually
 - **Statistical NLP**

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- **Discourse**: organization or flow of knowledge and thought

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- English pronunciation arbitrariness
 - Compare with “but” versus “put”: ‘u’ sounds differently
 - Characters ‘c’ and ‘k’ sound the same: “cake”
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- “What You See Is What You Pronounce” (WYSIWYP) for Indian languages
 - Elaborate and scientific *varna* system
 - 5×5 for the *varga varṇas*
 - Rows for different pronunciation locations
 - Columns for voiced/unvoiced, aspirated/unaspirated, nasal/non-nasal distinctions

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After zis fifz yer, ve vil hav a reli sensibl riten styl. Zer vil be no mor trubl or difikultis and evrivun vil find it ezi to understand ech ozer. Ze drem vil finali kum tru! And zen world!

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- **Vocabulary** is the count of *unique* tokens
 - Mostly measured for a **corpus**
 - Sanskrit as a language has an infinite vocabulary

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Word	Freq.
the	3332
and	2972
a	1775
to	1725
of	1440
was	1161
it	1027
in	906
that	877
he	877
I	783
his	772
you	686
Tom	679
with	642

- Corpus is *Tom Sawyer* by Mark Twain (total: 71,370)

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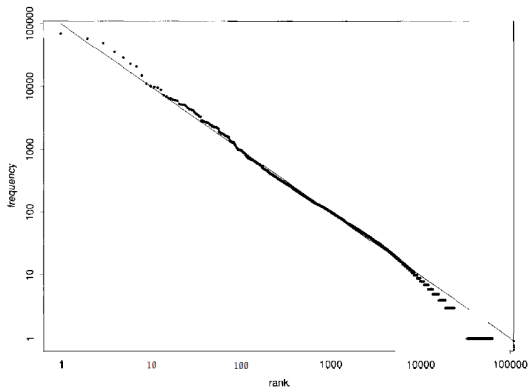
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- For *Tom Sawyer* corpus

Word	Freq. (f)	Rank (r)	$f \cdot r$	Word	Freq. (f)	Rank (r)	$f \cdot r$
the	3332	1	3332	turned	51	200	10200
and	2972	2	5944	you'll	30	300	9000
a	1775	3	5235	name	21	400	8400
he	877	10	8770	comes	16	500	8000
but	410	20	8400	group	13	600	7800
be	294	30	8820	lead	11	700	7700
there	222	40	8880	friends	10	800	8000
one	172	50	8600	begin	9	900	8100
about	158	60	9480	family	8	1000	8000
more	138	70	9660	brushed	4	2000	8000
never	124	80	9920	sins	2	3000	6000
Oh	116	90	10440	Could	2	4000	8000
two	104	100	10400	Applausive	1	8000	8000

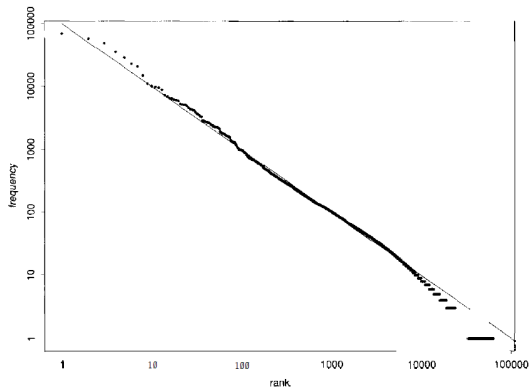
Empirical Evaluation

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- Mostly all right, except for very high and very low ranks

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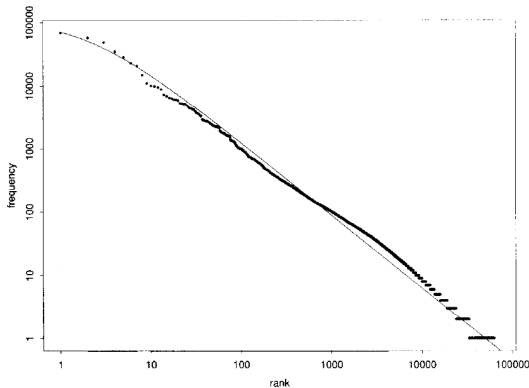
- Generalization of Zipf's law (where $B = 1$, $\rho = 0$)

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- $\rho = 100$, $B = 1.15$, $P = 10^{5.4}$

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- *Word vector* approach
 - Vectors can be added, subtracted, found similarity
 - A word is known by the company it keeps
 - Can a vector “predict” surrounding words?

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- Three types
 - ① Abhidhā अभिधा (or, *primary denotation*)
 - ② Lakṣaṇā लक्षणा (or, *implication*)
 - ③ Vyañjanā व्यञ्जना (or, *suggestion*)

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 - **Śuddhā-lakṣaṇā** (*pure implication*): extension depends on the referent itself
 - *inclusive implication*: “protect curd from crows”
 - *exclusive implication*: “house on Ganga”
 - *implication with partial inclusion*: “cloth is burnt”

- Lakṣaṇā is the *implied* meaning
- Can be of two types
- **Nirūḍha-lakṣaṇā** (*natural/unintentional implication*): original meaning is more or less dissolved and only implied meaning is used
 - kuśāla means “skilled” (no longer “one who can cut kuśa grass”)
- **Prayojanavatī-lakṣaṇā** (*intentional implication*): usage is to intend a particular meaning
 - **Śuddhā-lakṣaṇā** (*pure implication*): extension depends on the referent itself
 - *inclusive implication*: “protect curd from crows”
 - *exclusive implication*: “house on Ganga”
 - *implication with partial inclusion*: “cloth is burnt”
 - **Gauṇī-lakṣaṇā** (*secondary implication*): extension depends on the quality of the referent
 - *imposition of quality*: “moon-like face”
 - *total imposition*: “face is moon”

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- Requires 3 (+ 1) factors
 - **Ākāṅkṣā** आकाङ्क्षा (*expectancy*)
 - **Yogyatā** योग्यता (*congruity*)
 - **Sannidhi** सन्निधि (*proximity*)
 - **Tātparya** तात्पर्य (*intention/purport*)

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- Can be *one-sided*
 - “white cow”: “white” is incomplete, but “cow” is not

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- “go to bring water kitchen” should better have been “Go to kitchen. Bring water.”

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- Logically inconsistent
 - “square circle”

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- “I didn’t beat him”
 - Purport depends on which word emphasis is put on

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- Binary division: grammatical versus ungrammatical
 - “I is the ...” “...seventh letter in the English alphabet”
- Scored: higher the score, the more “grammatical” it is
 - Below some low score, it stops making sense

Tools and Resources

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- IndicNLP AI4Bharat <https://indicnlp.ai4bharat.org/home/> has a lot of resources
 - Corpora
 - ML models

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 - Devanagari:
https://en.wikipedia.org/wiki/Devanagari_transliteration
 - IAST (International Alphabet of Sanskrit Transliteration):
https://en.wikipedia.org/wiki/International_Alphabet_of_Sanskrit_Transliteration
 - ITRANS (Indian Languages Transliteration):
<https://en.wikipedia.org/wiki/ITRANS>
 - ISO 15919 (Transliteration of Indic Scripts):
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 - ISO 15919 (Transliteration of Indic Scripts):
https://en.wikipedia.org/wiki/ISO_15919
- Transliteration tools and resources
 - Python: <https://pypi.org/project/indic-transliteration/>
 - L^AT_EX: <https://github.com/hrishikeshrt/devanagari-transliteration-latex>
 - Webpages: <https://aksharamukha.appspot.com/converter>