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Analysis

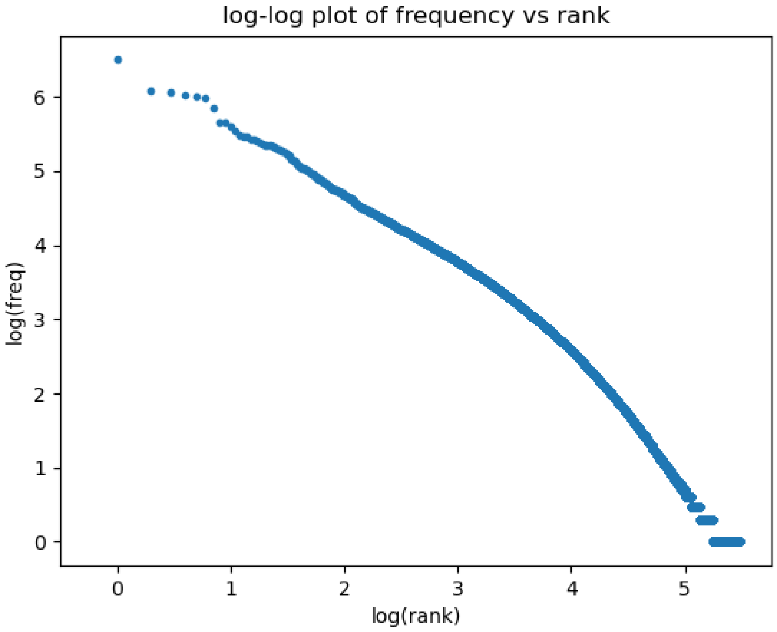
Zipf's Law

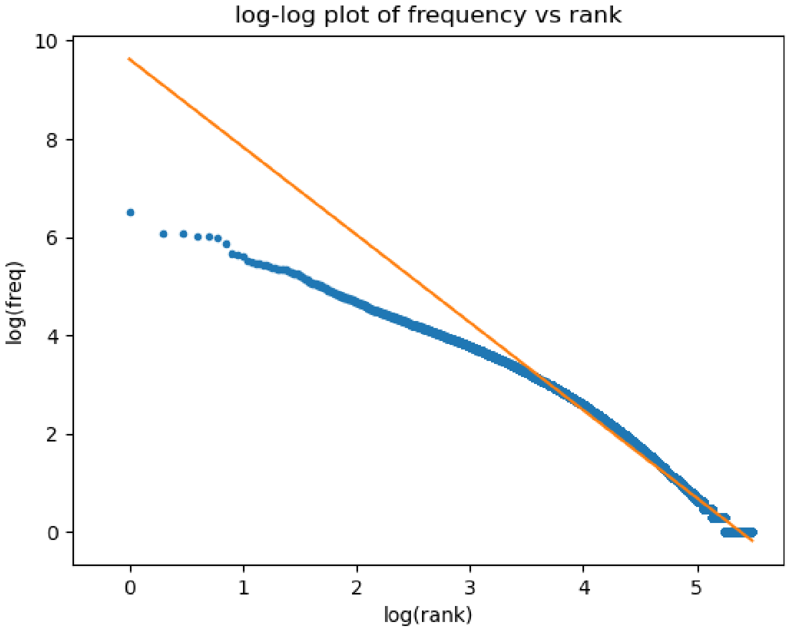
> [!NOTE] Code related to this can be found in directory `zipfs-law`

English Zipf

For the English Dataset, it doesn't seem to follow zipf's law precisely.

Using, ignoring numbers and punctuation (except the hyphen), here is the log-log plot of frequency vs rank,





and now with a best-fit line

For a dataset following Zipf's law, the log-log plot should have been almost linear, but here the R^2 value is around 0.9828 . . .

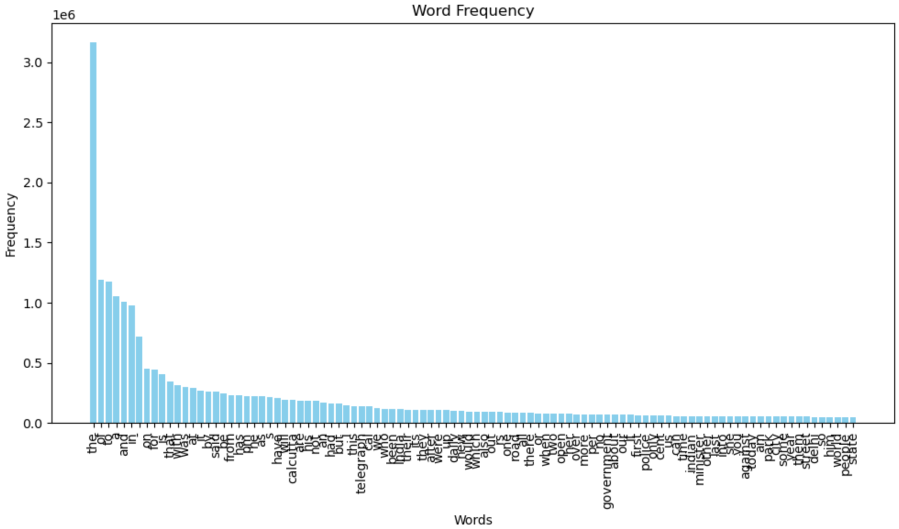


Figure 1: most common words

Here are the 40 most common words in the collection with their frequencies:

Term	Frequency
the	3165967
of	1191753
to	1173978
a	1052318
and	1009427
in	975690
-	718358
on	452788
for	446121
is	405643
that	340393
with	310592
was	295030
at	291176
it	268103
by	261282
said	256954
be	241164
from	232918
has	226159
pm	221154
he	218450
as	218228
s	217175
have	208039
will	194965
calcutta	192773
are	185001
his	183397
not	182055
an	170376
had	161636
but	160628
i	143241
this	139506
telegraph	139167
cal	135123
we	123564
who	118165
been	116681

The tokenization step involved matching with this regex expression `[a-zA-Z\-]+`, which ignores numbers and punctuation (other than the hyphen) and then lowercasing the matches

Some weird tokens are

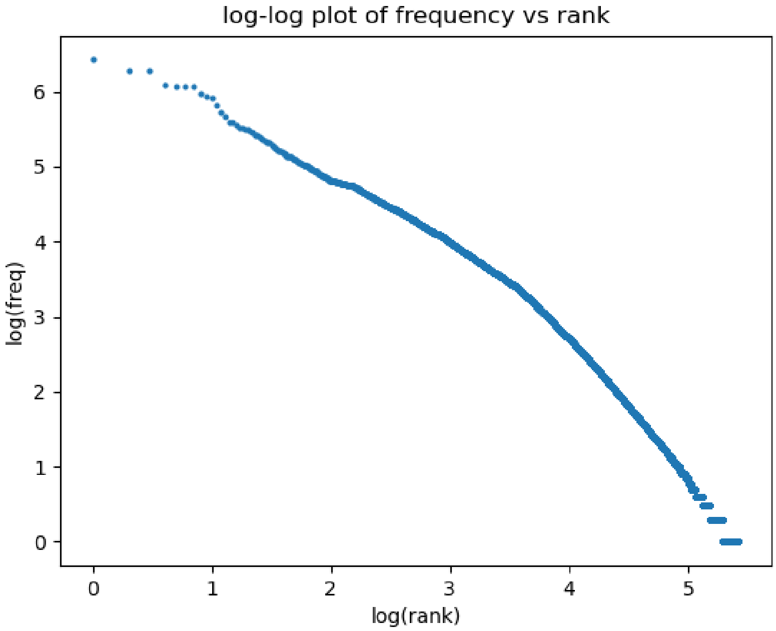
- `-`
  - obviously due to the tokenization scheme
- `s`
  - this weird token occurs so many times, because in the dataset, the words like `that's` look like `that?s`, `country's -> country?s`, `army's -> army?s`

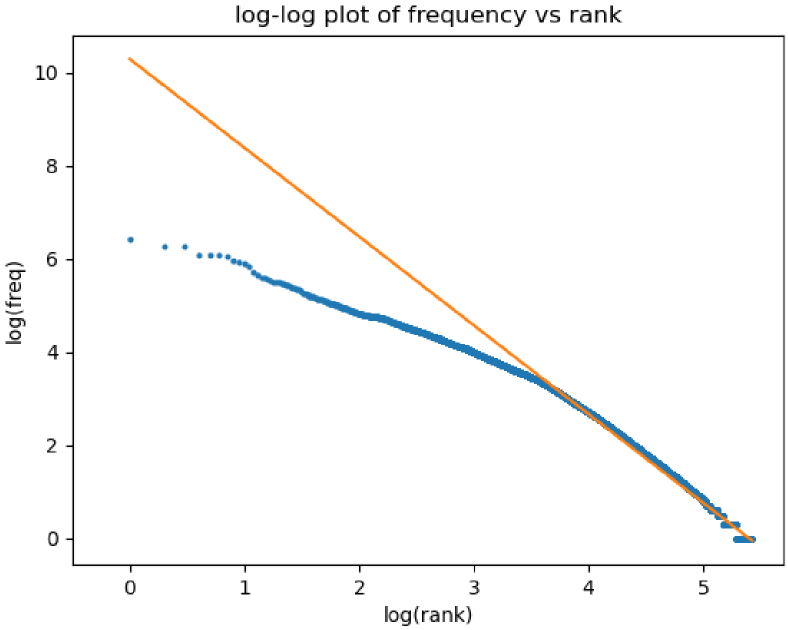
> [!NOTE] Associated code can be found in `english analysis`

Hindi Zipf

For the Hindi Dataset, it doesn't seem to follow zipf's law precisely.

Here is the log-log plot of frequency vs rank,





and now with a best-fit line

For a dataset following Zipf's law, the log-log plot should have been almost linear, but here the R^2 value is around $0.9768\ldots$

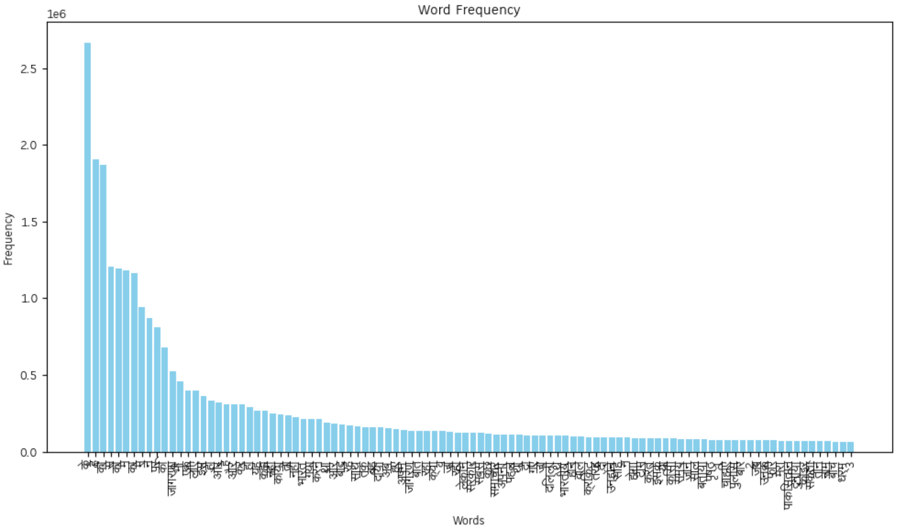


Figure 2: most common words

Here are the 40 most common words in the collection with their frequencies:

Term (wxn)	Frequency
ke	2666812
hai	1903989
kI	1868646
se	1204763
ko	1193956
me	1180160
kA	1161792
meM	942672
ne	872033
para	809653
ki	677851
jAgaraNA	521605
bhI	459633
eka	395570
lie	395319
isa	363829
hI	334565
aura	320864
haiM	308684
aAaira	307561
kara	306016
ho	290355
yaha	268787
kahA	266529
nahIM	249308
kiyA	243252
to	234119
nahI	225234
bhArata	215572
gayA	214916
karane	213012
thA	190662
aaura	185410
bAda	174859
rahe	168503
sAtha	164968
taka	161141
vaha	161001
diyA	156540
aba	152971

The tokenization step involved matching with this regex expression `\w+` along with `UNICODE` flag set, which doesnot ignore numbers and punctuation

> [!NOTE] Associated code can be found in `hindi analysis`

Stemming

English Stemming

Porter stemmer was used for this english stemming. It was taken from the *`snowball project`*.

Detailed stemming description can be found in *stemming/porter.sbl*

Steps of the Algorithm:

1) Deals with plurals and past participles.
    - Removes common endings like -SSES, -IES, -ED, -ING, and modifies endings based on conditions.
2) Targets specific suffixes that indicate derivational forms.
    - Examples include -ATIONAL -> -ATE, -TIONAL -> -TION, etc.
3) Further reduces words by removing suffixes like -ICATE, -ATIVE, -ALIZE, etc.
4) Focuses on removing additional suffixes based on the measure of the stem.
    - Examples include -AL, -ANCE, -ENCE, -ER, etc.
5) Final tidying up of the stem. Removes trailing -E based on conditions related to the measure.

Hindi Stemming

The Hindi stemmer was taken from *`here`*

Detailed stemming description can be found in *stemming/hindi.sbl*

In *`WX Notation`*, the stemmer is implemented by simply removing from each word the longest possible suffix from this list:

A	AeM	awA	Ane	egA
i	AoM	awI	UMgA	egI
I	iyAM	IM	UMgI	AegA
u	iyoM	awIM	AUMgA	AegI
U	AiyAM	awe	AUMgI	AyA
e	AiyoM	AwA	eMge	Ae
o	AMh	AwI	eMgI	AI
eM	iyAMh	AwIM	AeMge	AIM
oM	AiyAMh	Awe	AeMgI	ie
AM	awAeM	anA	oge	Ao
uAM	awAoM	anI	ogI	Aie
ueM	anAeM	ane	Aoge	akara
uoM	anAoM	AnA	AogI	Akara

The *snowball* file for this can be found `here`

Analysis and Results

The script `analyze.sh` was written to record the process used to extract the required stats.

Scripts `gen-hindi-terms.py` and `gen-english-terms.py` were used to extract words from document collection.

Type	Count
Unique hindi	268089
Stemmed unique hindi	215072
Unique english	250704
Stemmed unique english	194800

All code and intermediate files can be found in directory `stemming`