Natural Language Processing
Report

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201501029

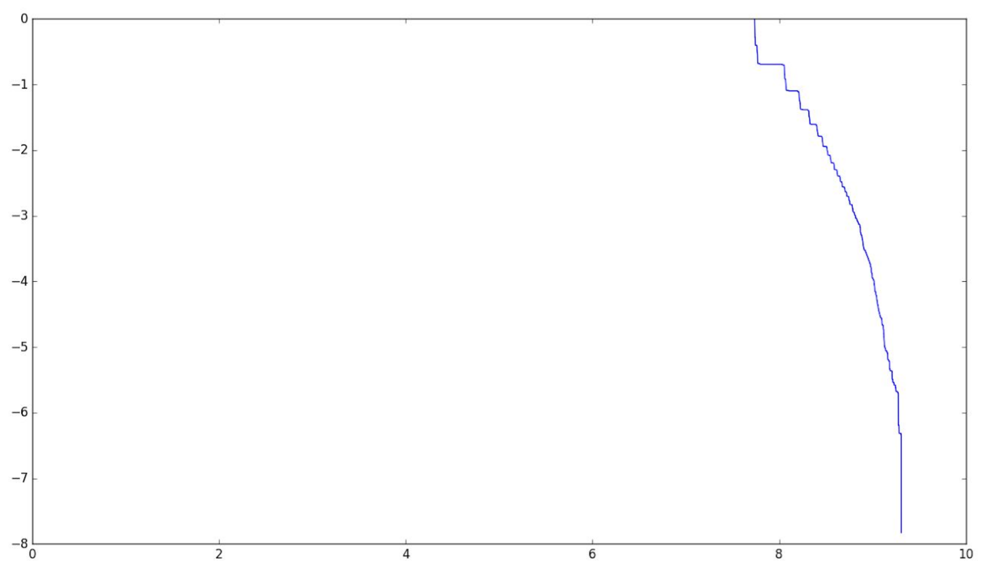
1. *Implement unigram, bigram and trigram language models.*
Implementation of the language models has been done in the code,
Steps require:

```
corpus=tokenise(file)
unigrams,unigrams_prob=get_unigrams(corpus)
bigrams,bigrams_prob = get_bigrams(corpus,unigrams)
trigrams,trigrams_prob = get_trigrams(corpus,bigrams)
```

2.Plot log-log curve and zipf curve for the above:
Using

```
plot(sort_dict(unigrams_prob))
plot_log_log1(sort_dict(unigrams_prob))
```

Different plots we got:
normal_bigram_log_anime



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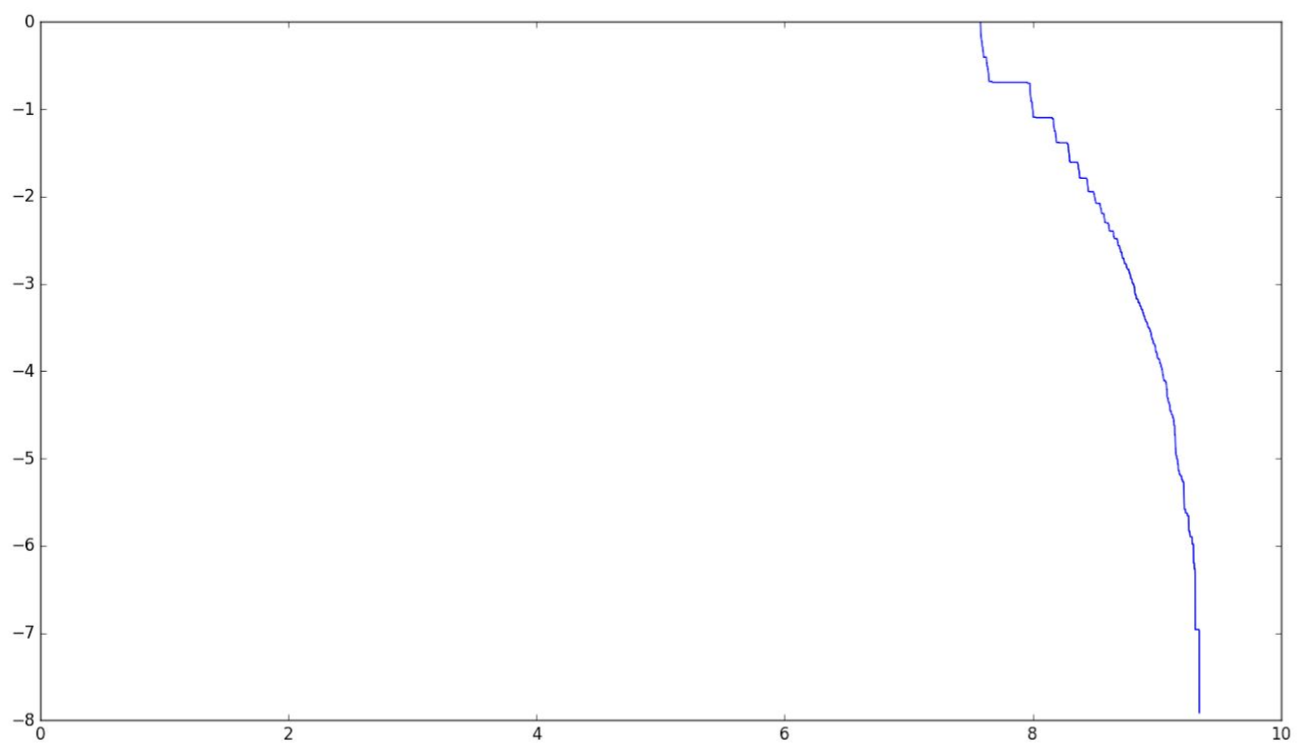

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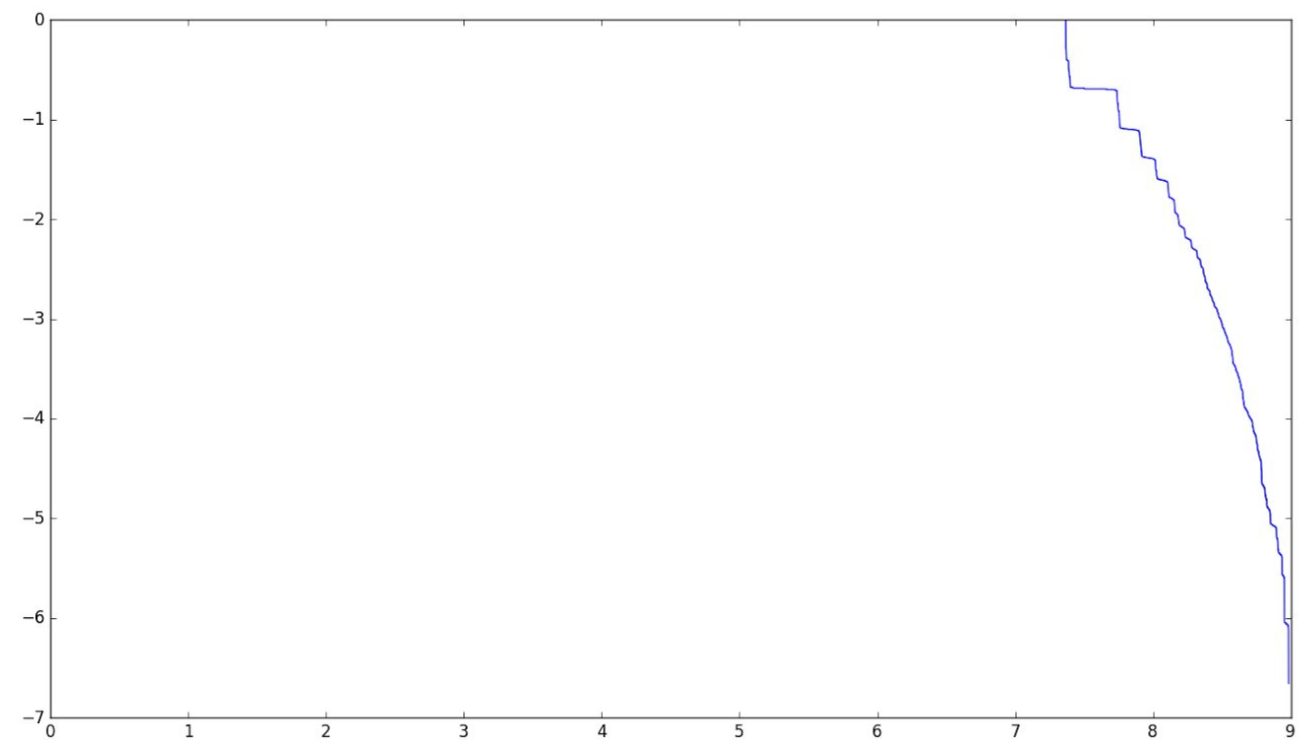
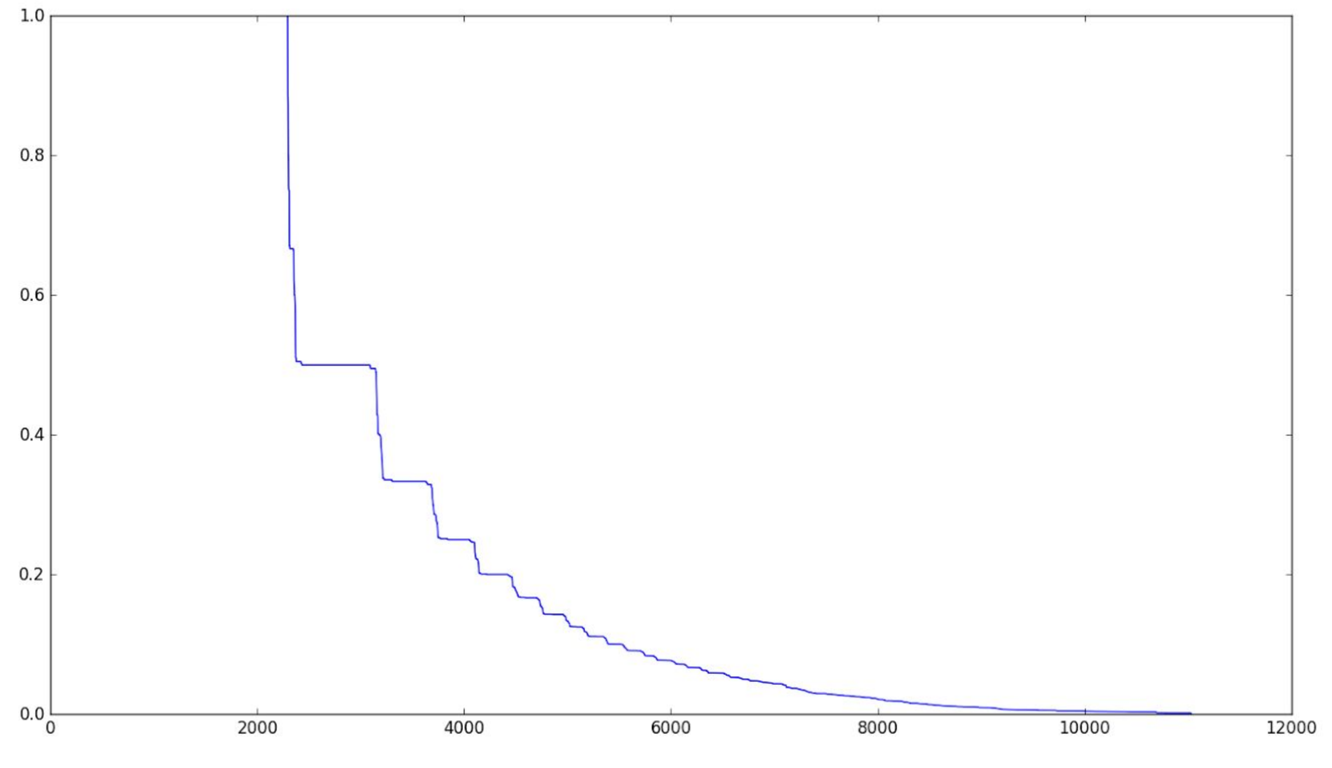


normal_bigram_zipf_anime



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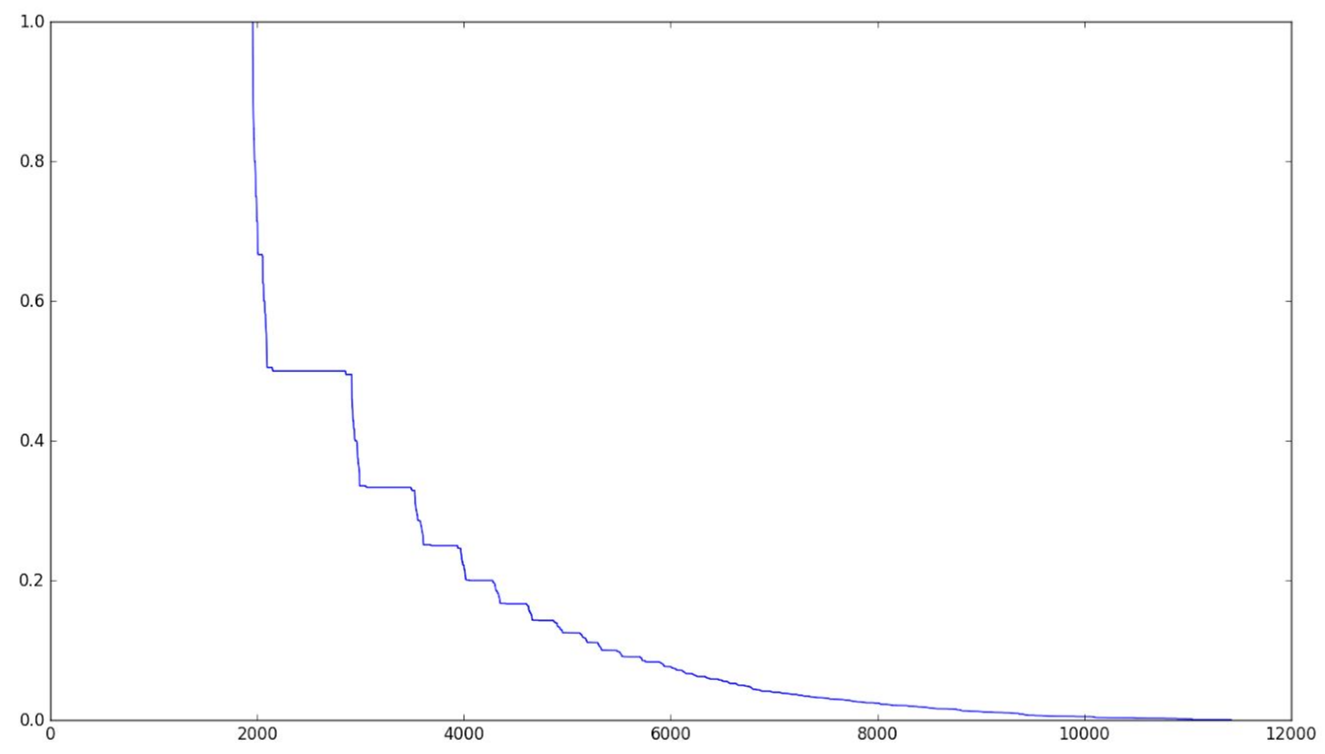

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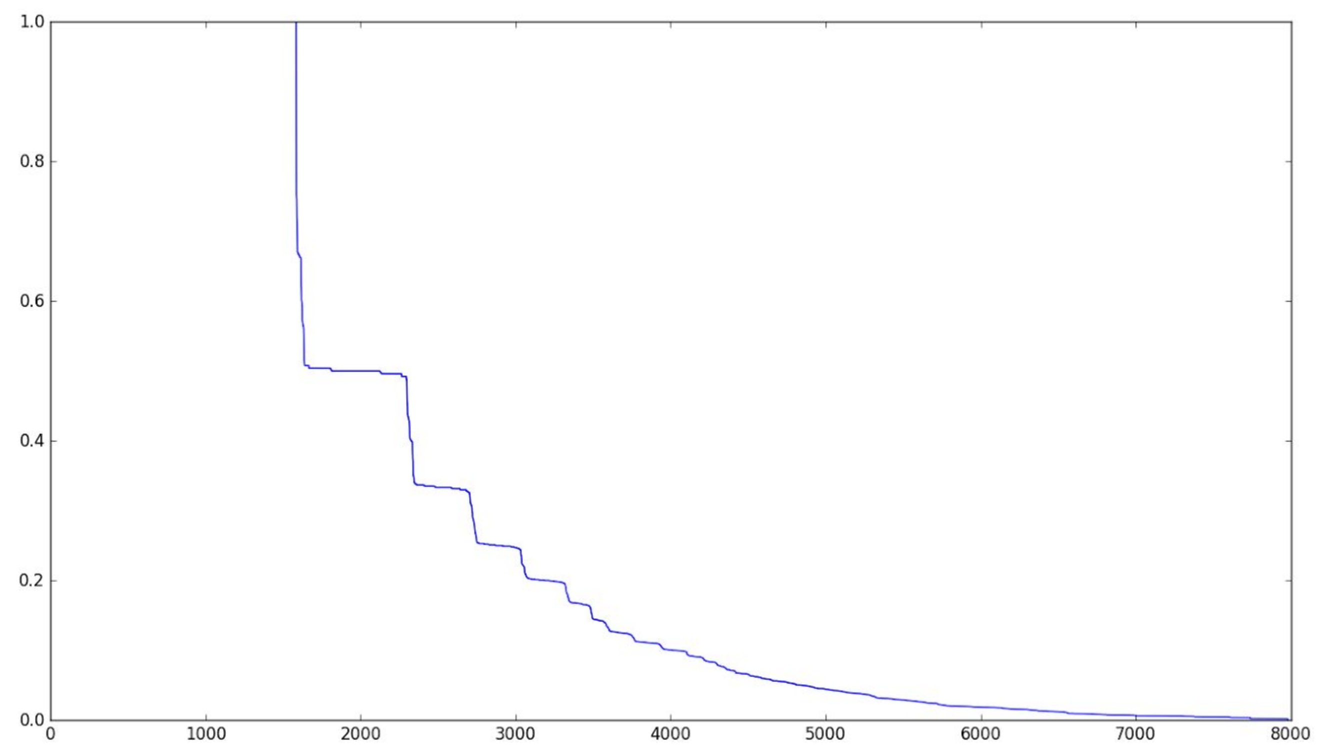

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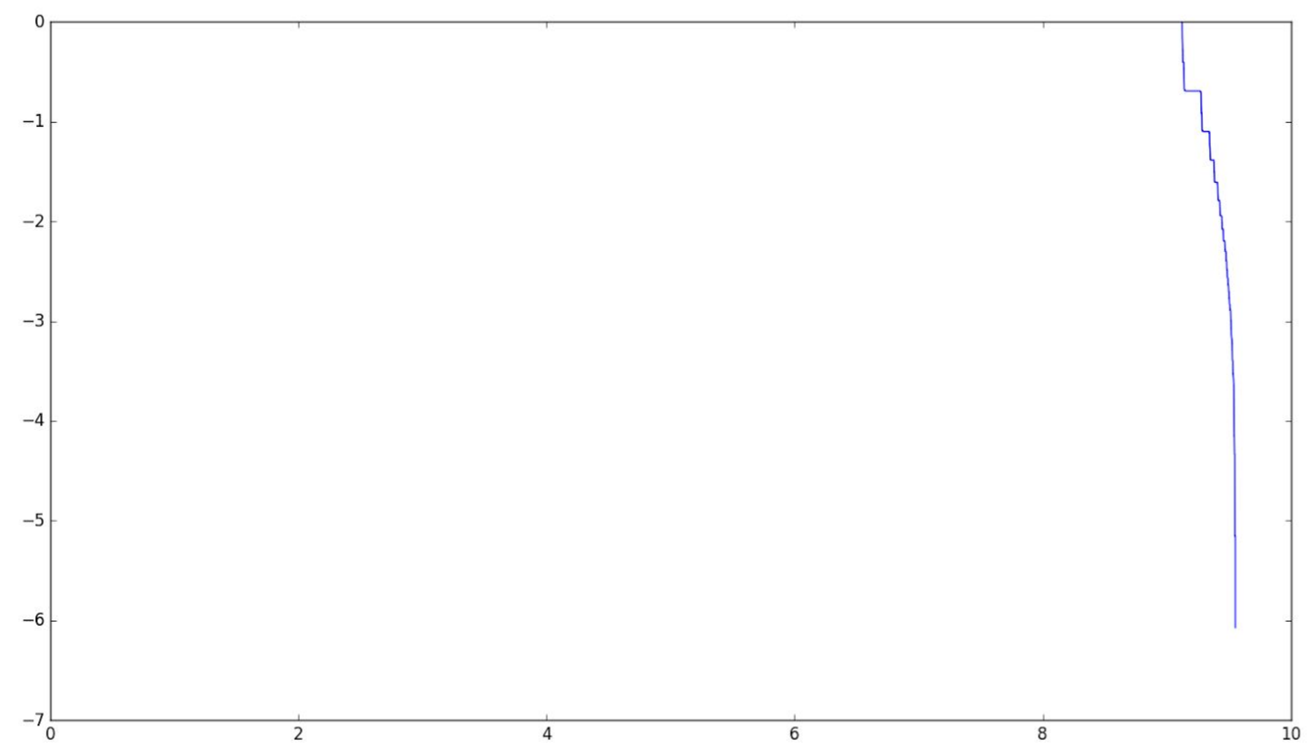

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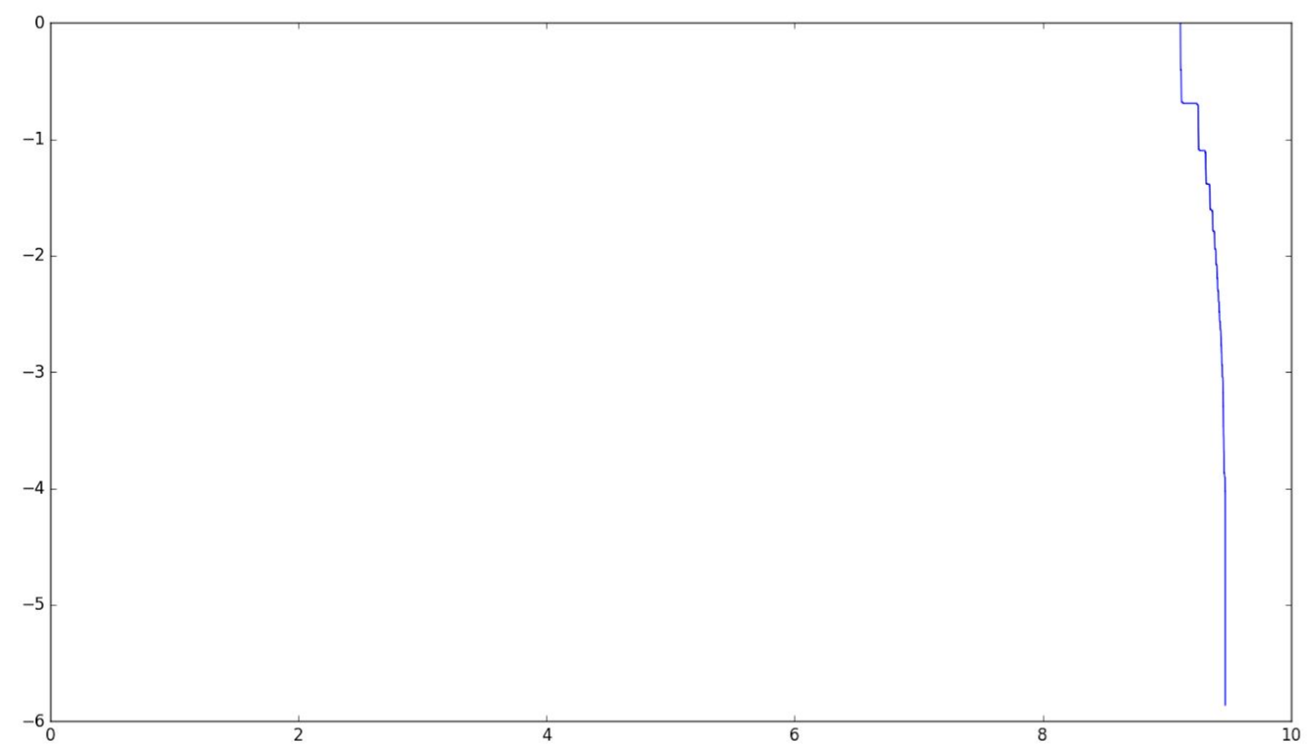

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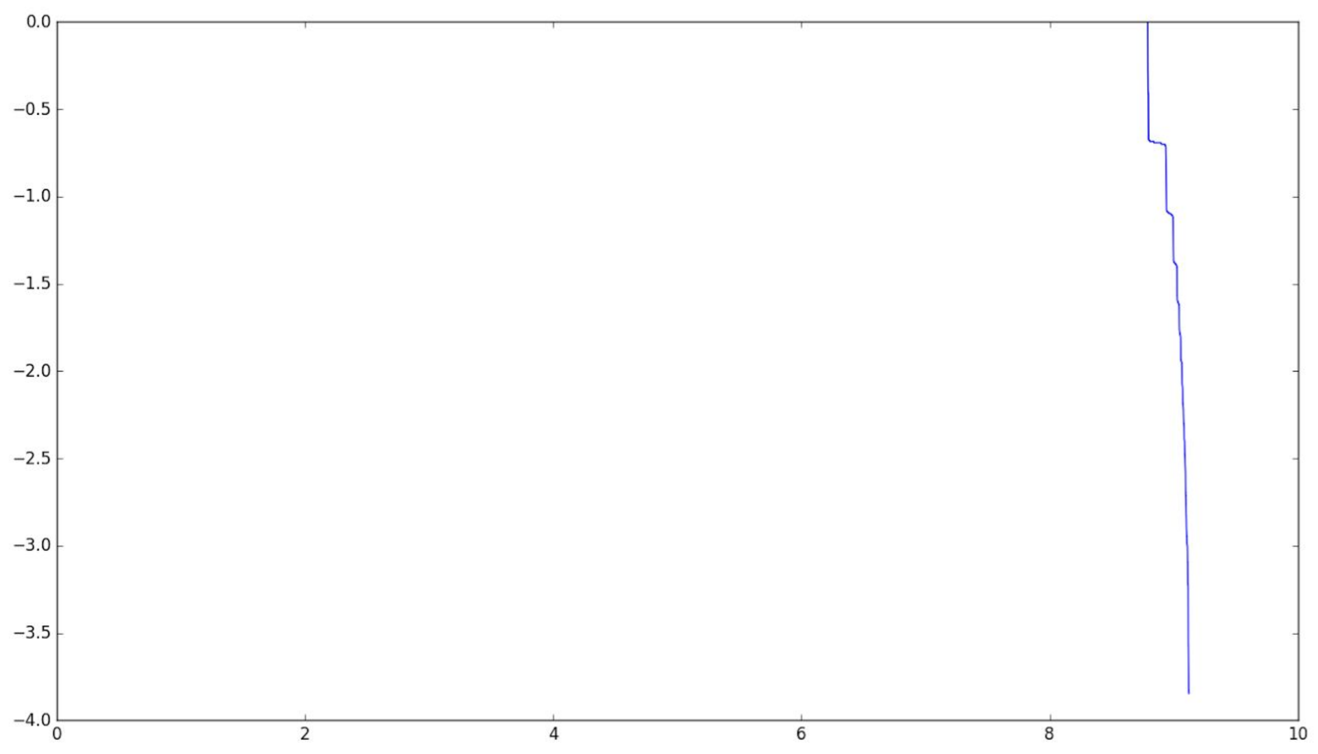

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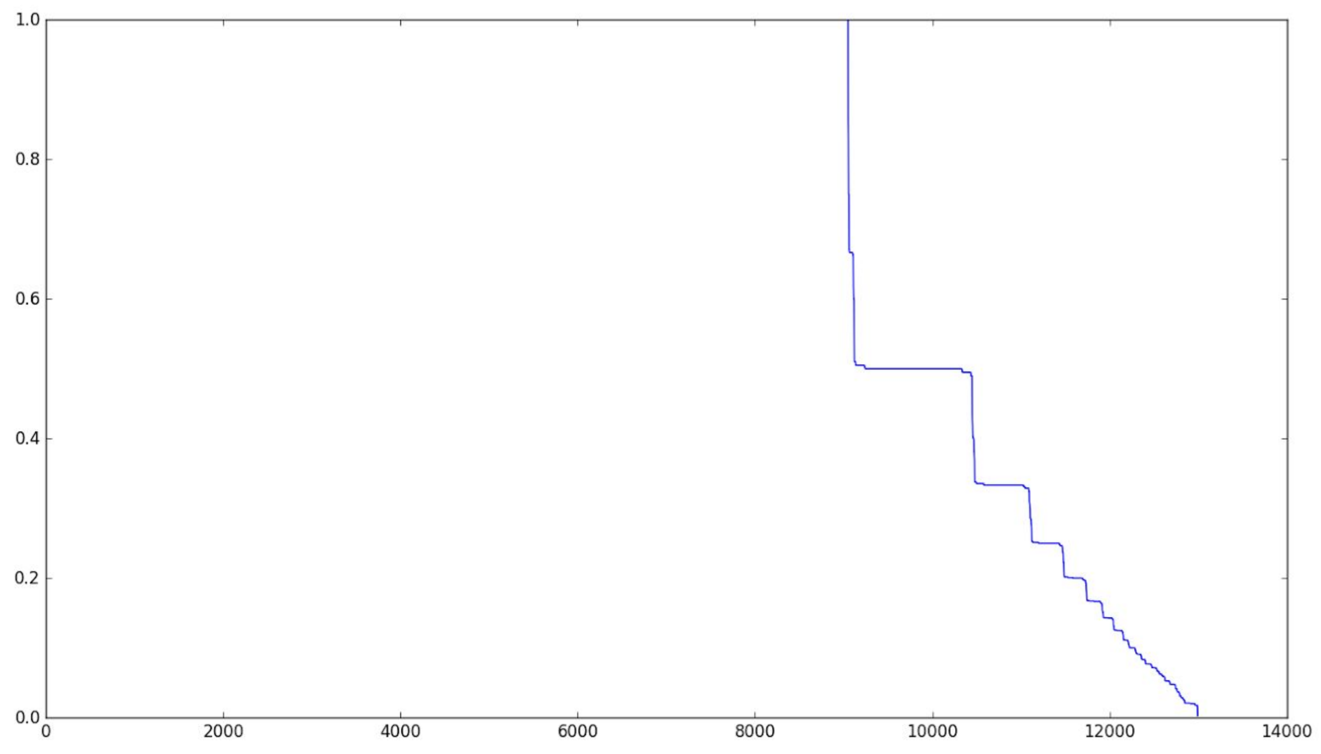

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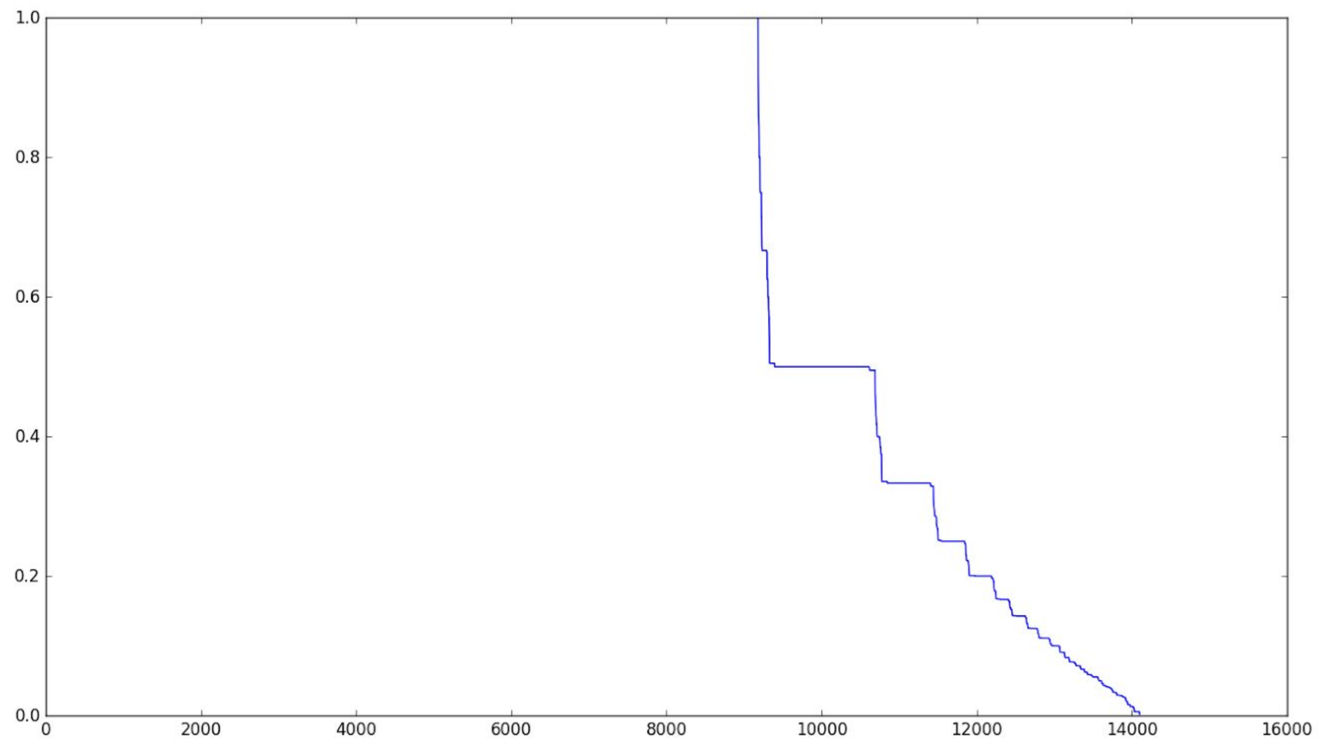

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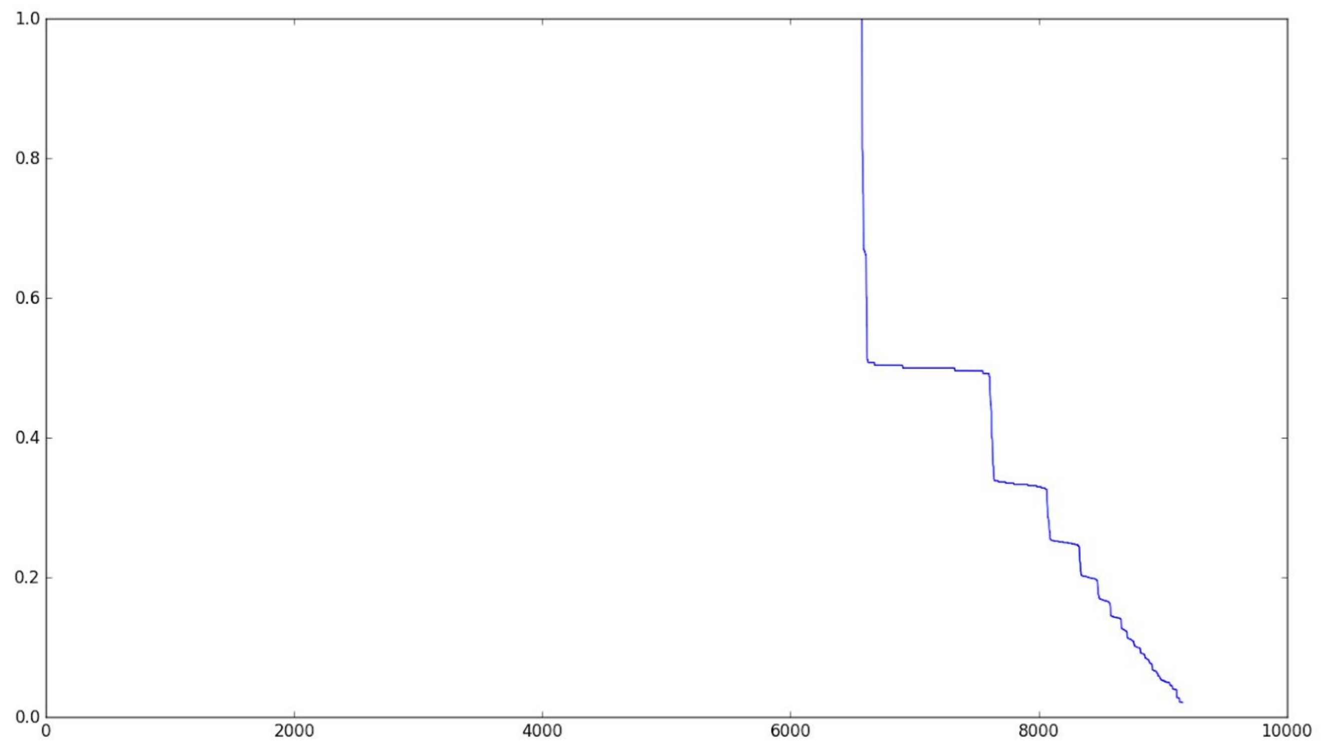

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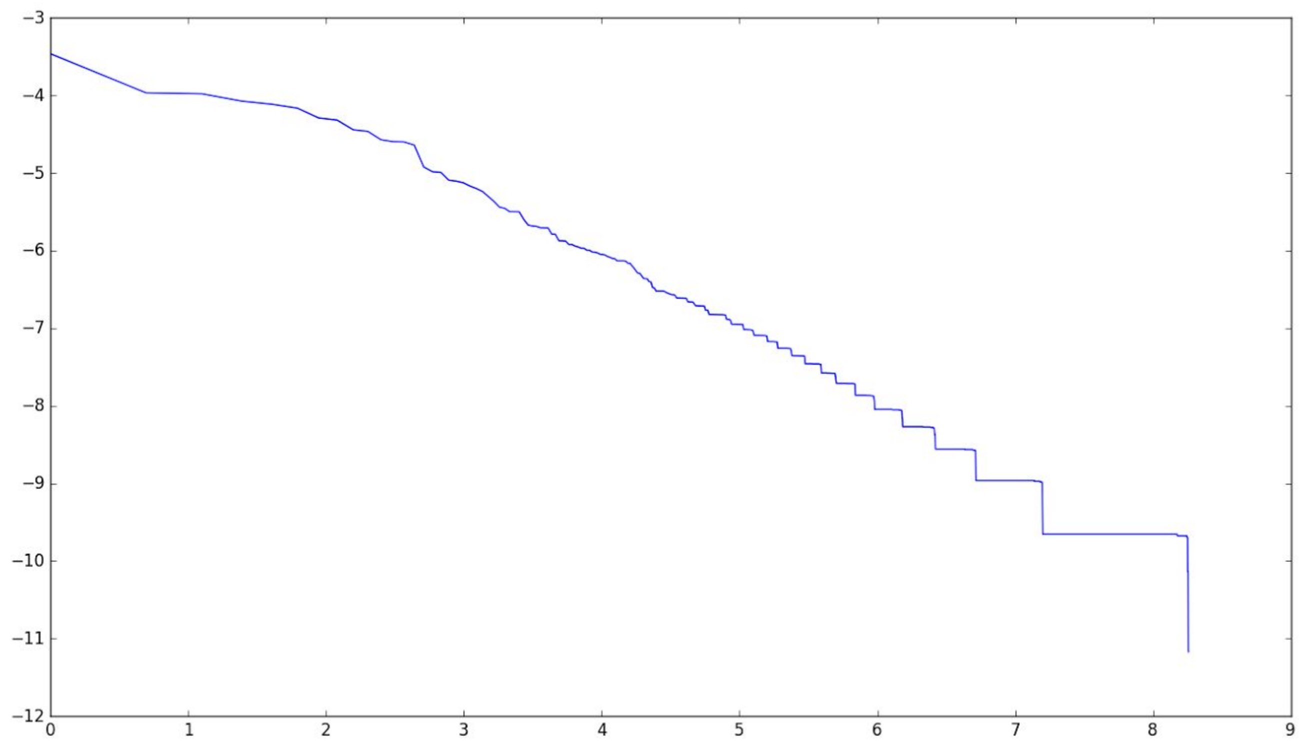

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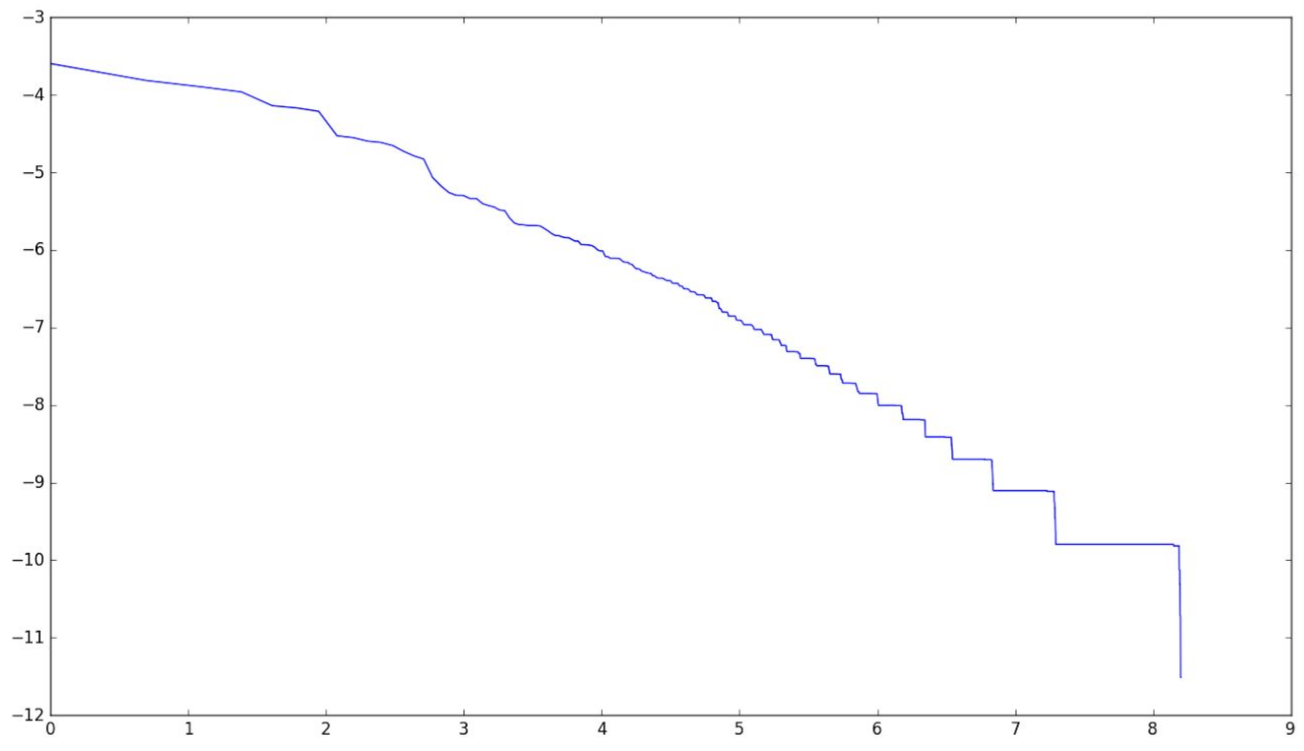

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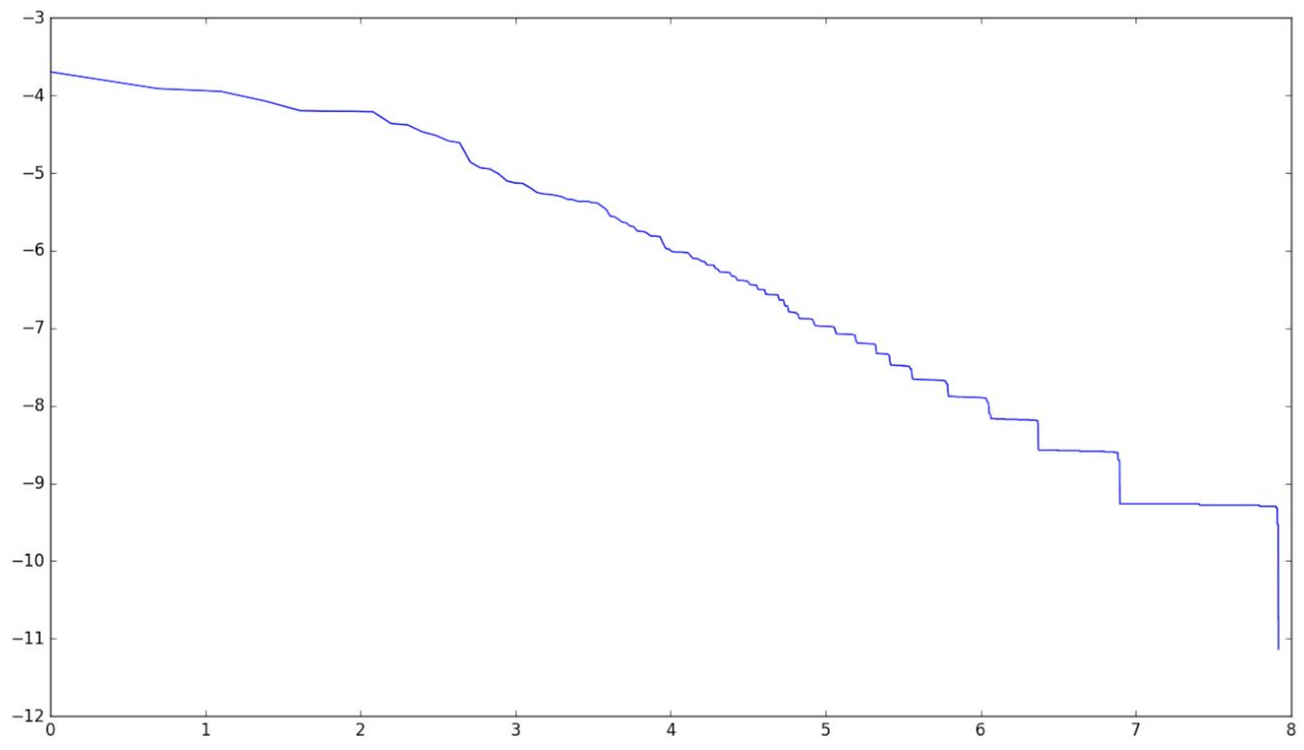

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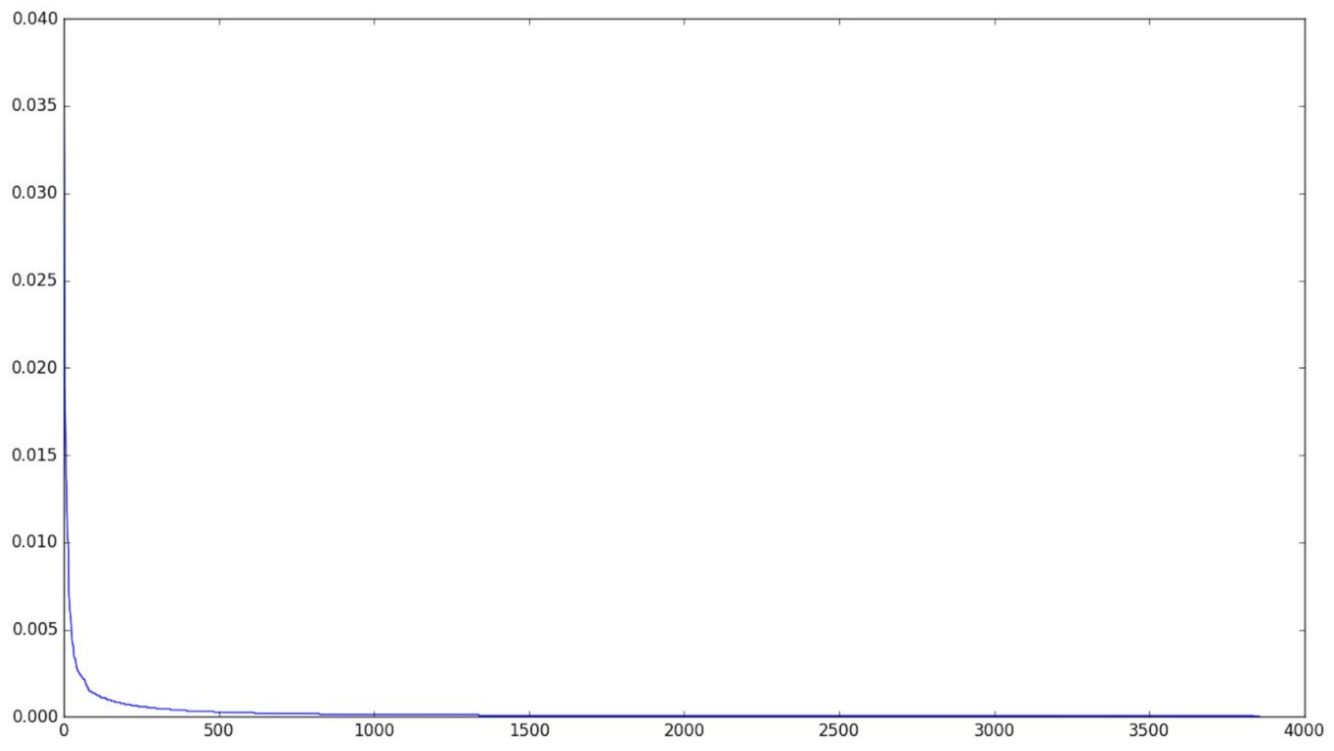

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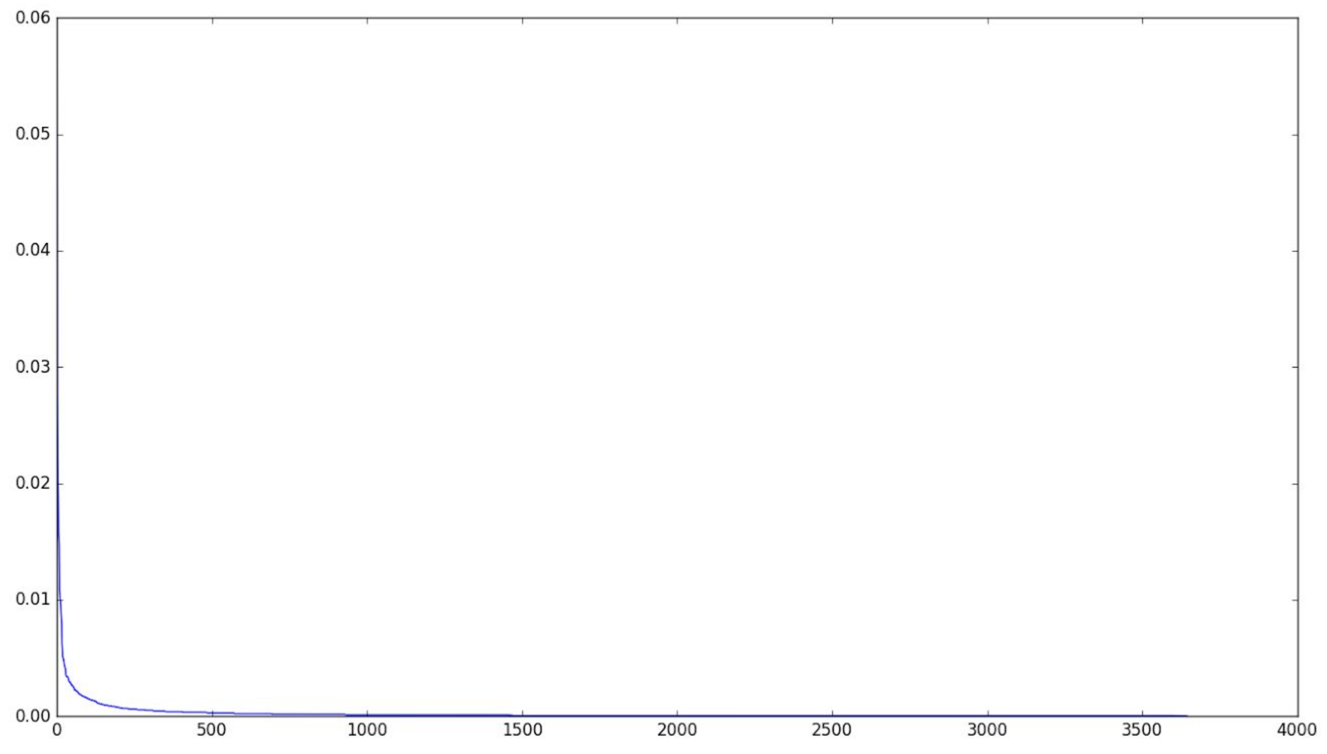
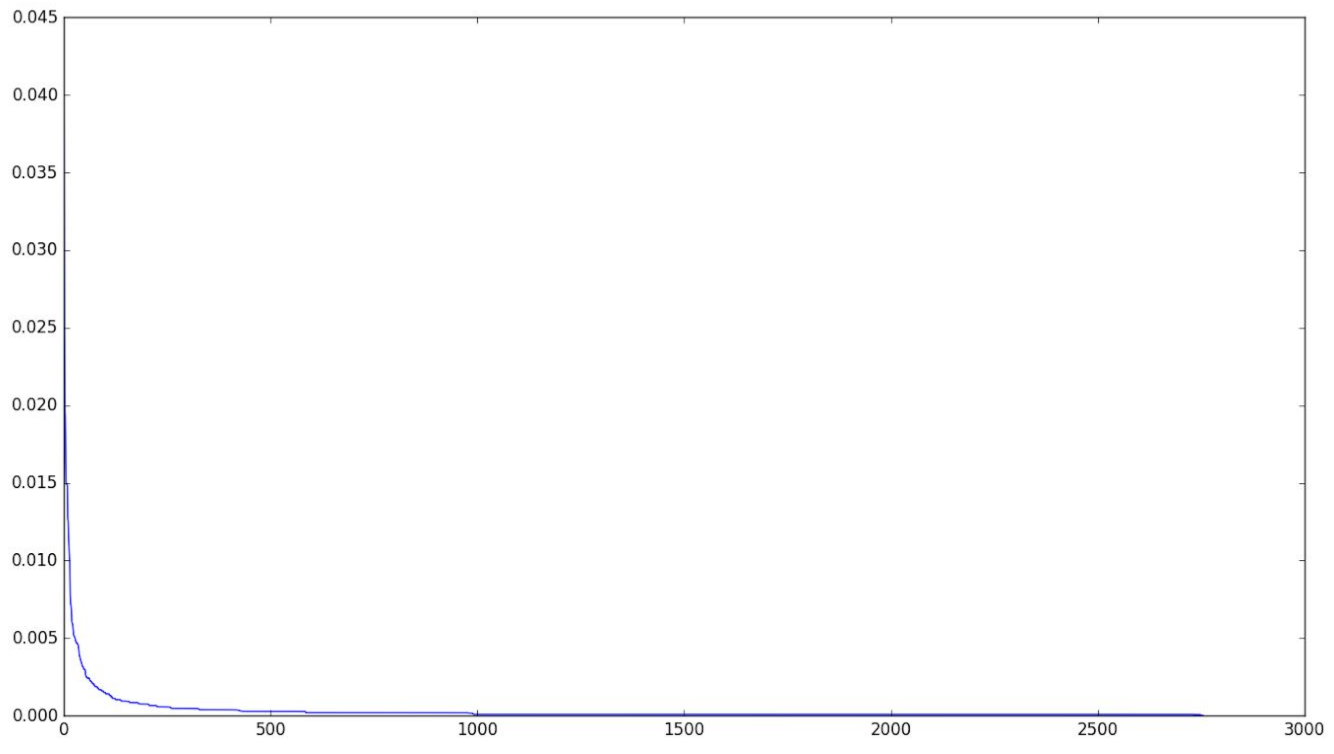


normal_unigram_zipf_news

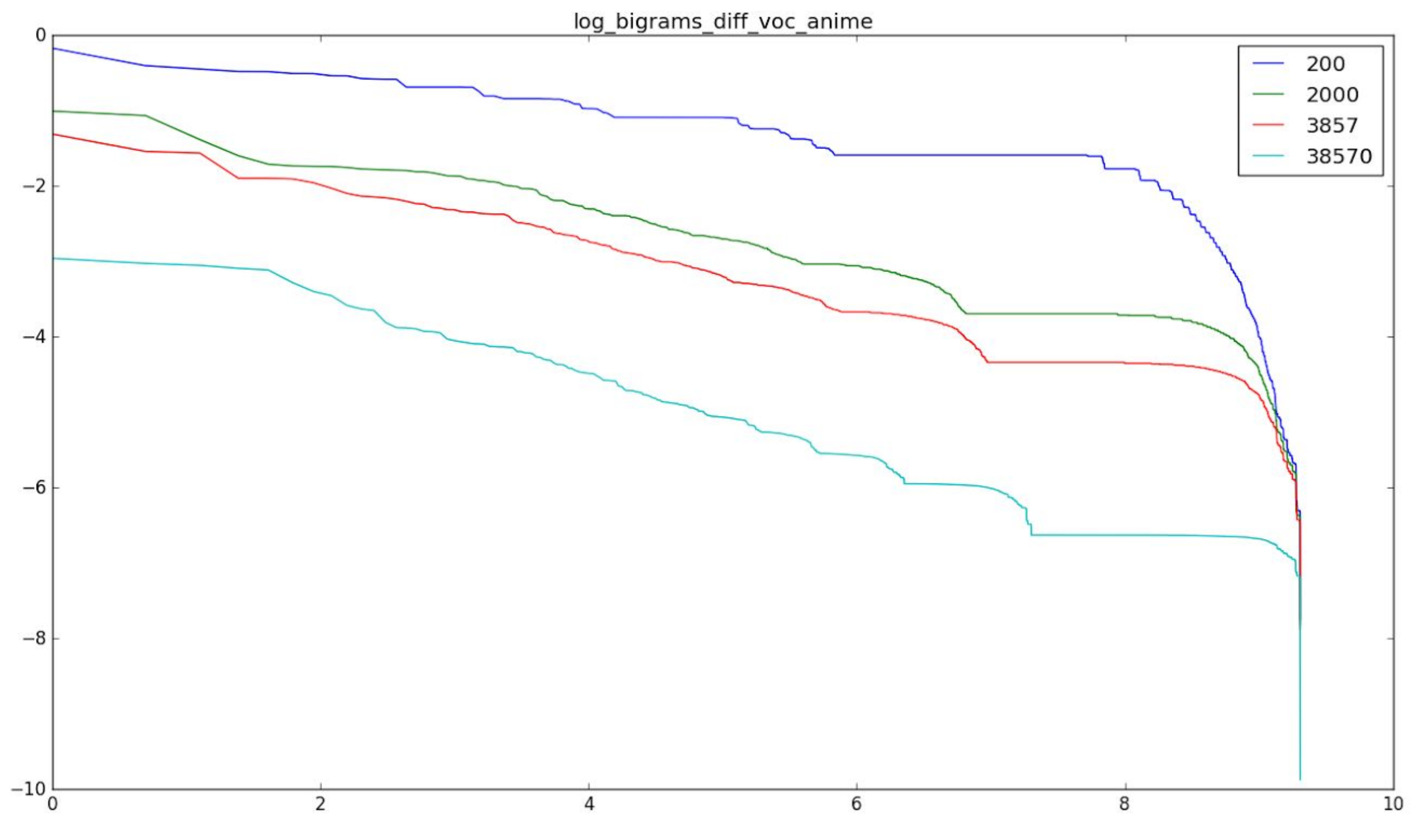


3.*Implement laplace smoothing. Compare the effect of smoothing on different values for V (200, 2000, current size of vocabulary, 10*size of vocabulary). Plot these to compare.*

```
laplace_unigrams_prob = get_laplace_unigrams(unigrams,200)
laplace_unigrams_prob2 = get_laplace_unigrams(unigrams,2000)
laplace_unigrams_prob3 = get_laplace_unigrams(unigrams,len(unigrams))

laplace_bigrams_prob1 = get_laplace_bigrams(unigrams,bigrams,200)
laplace_bigrams_prob2 = get_laplace_bigrams(unigrams,bigrams,2000)
laplace_bigrams_prob3 = get_laplace_bigrams(unigrams,bigrams,len(unigrams))
laplace_bigrams_prob4 = get_laplace_bigrams(unigrams,bigrams,10*len(unigrams))

laplace_trigrams_prob1 = get_laplace_trigrams(unigrams,bigrams,trigrams,200)
laplace_trigrams_prob2 = get_laplace_trigrams(unigrams,bigrams,trigrams,2000)
laplace_trigrams_prob3 = get_laplace_trigrams(unigrams,bigrams,trigrams,len(unigrams))
laplace_trigrams_prob4 = get_laplace_trigrams(unigrams,bigrams,trigrams,10*len(unigrams))
```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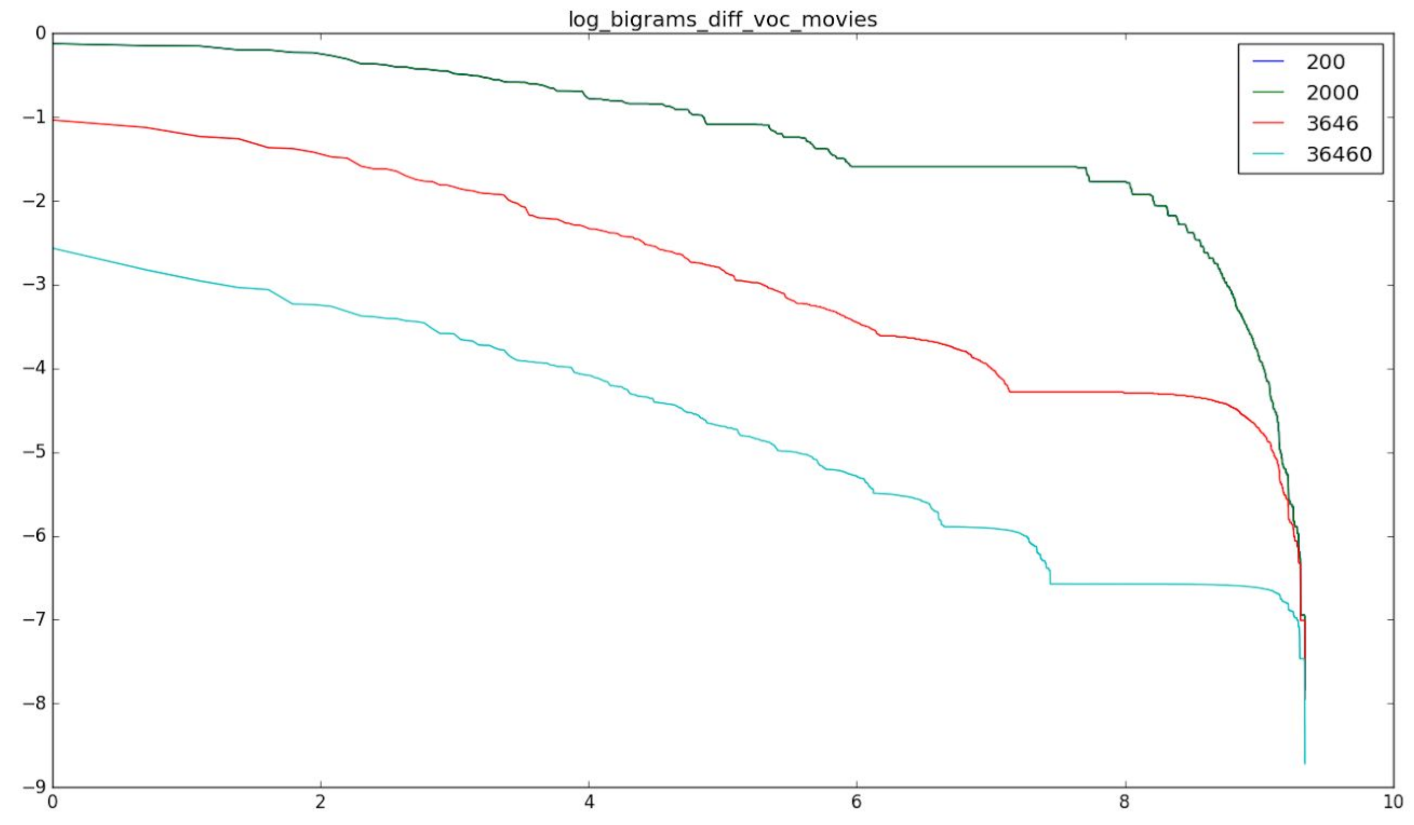
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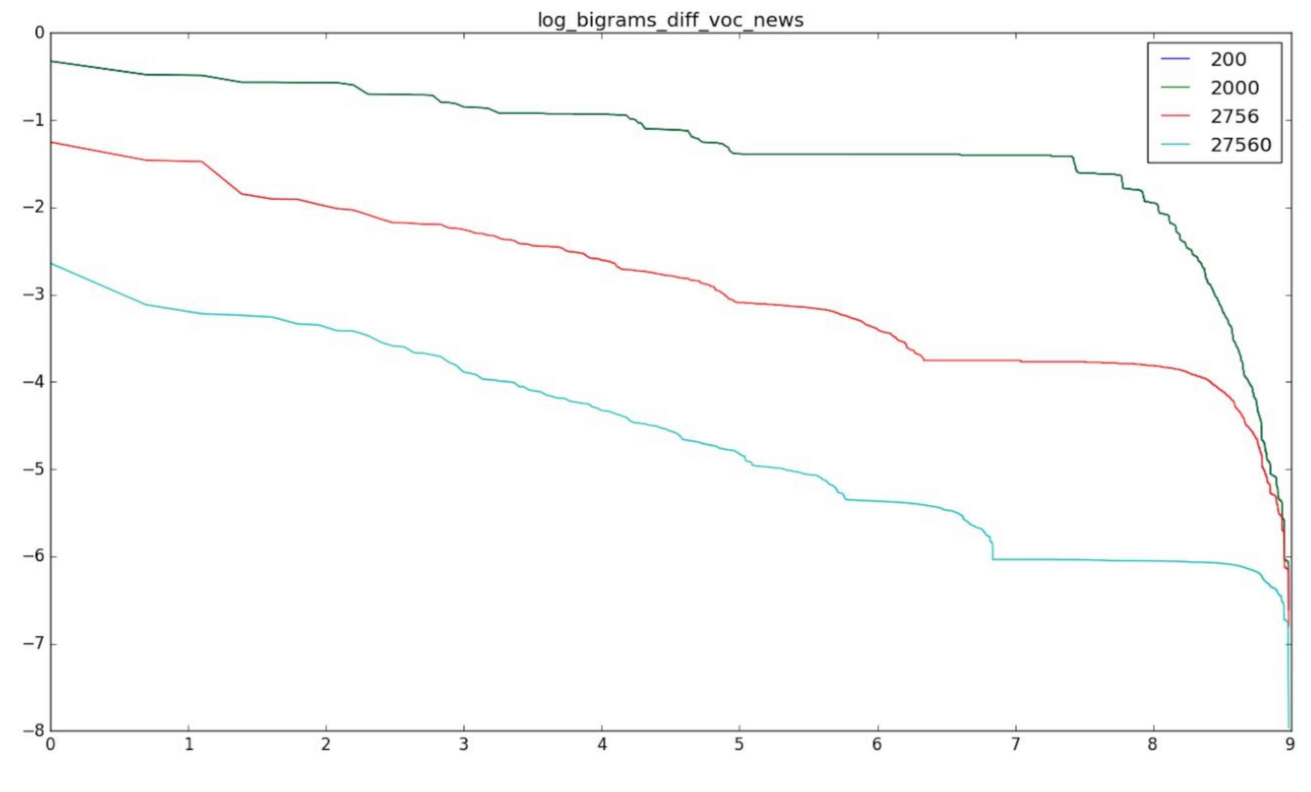
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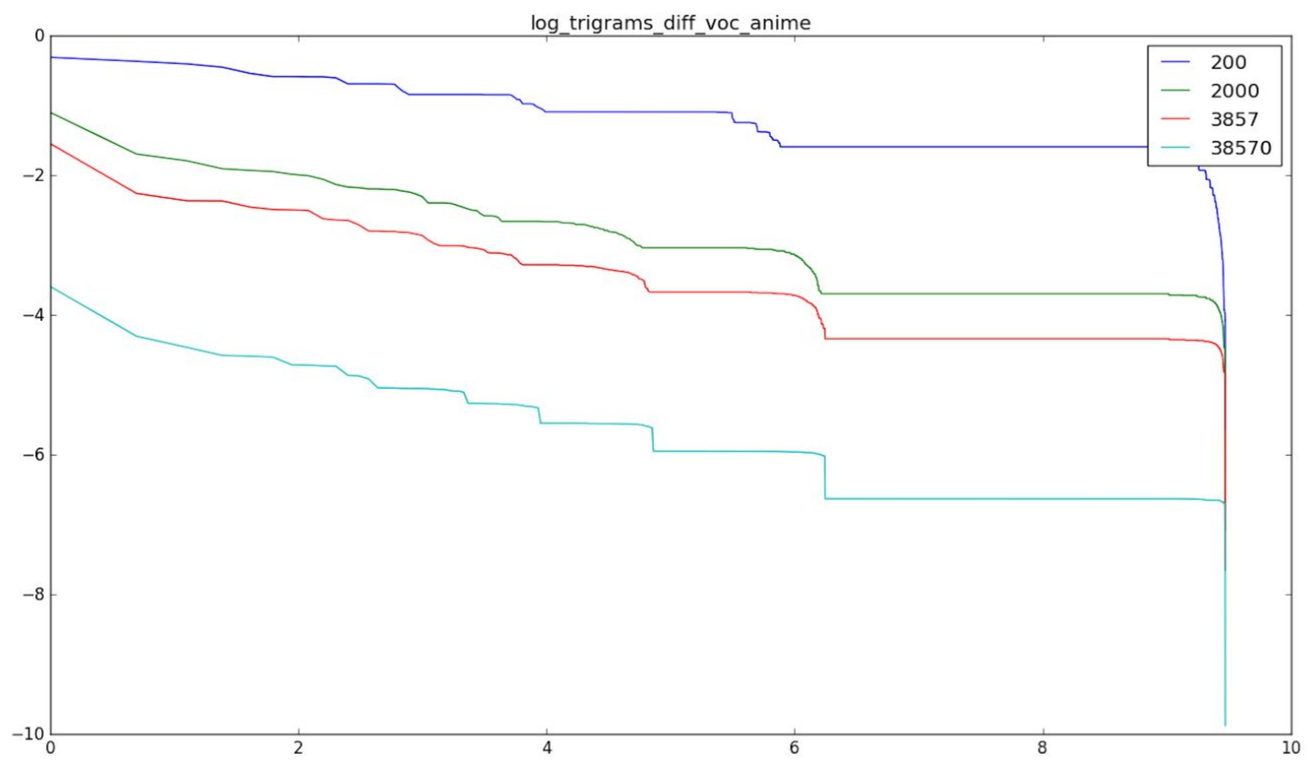

log_trigrams_diff_voc_anime
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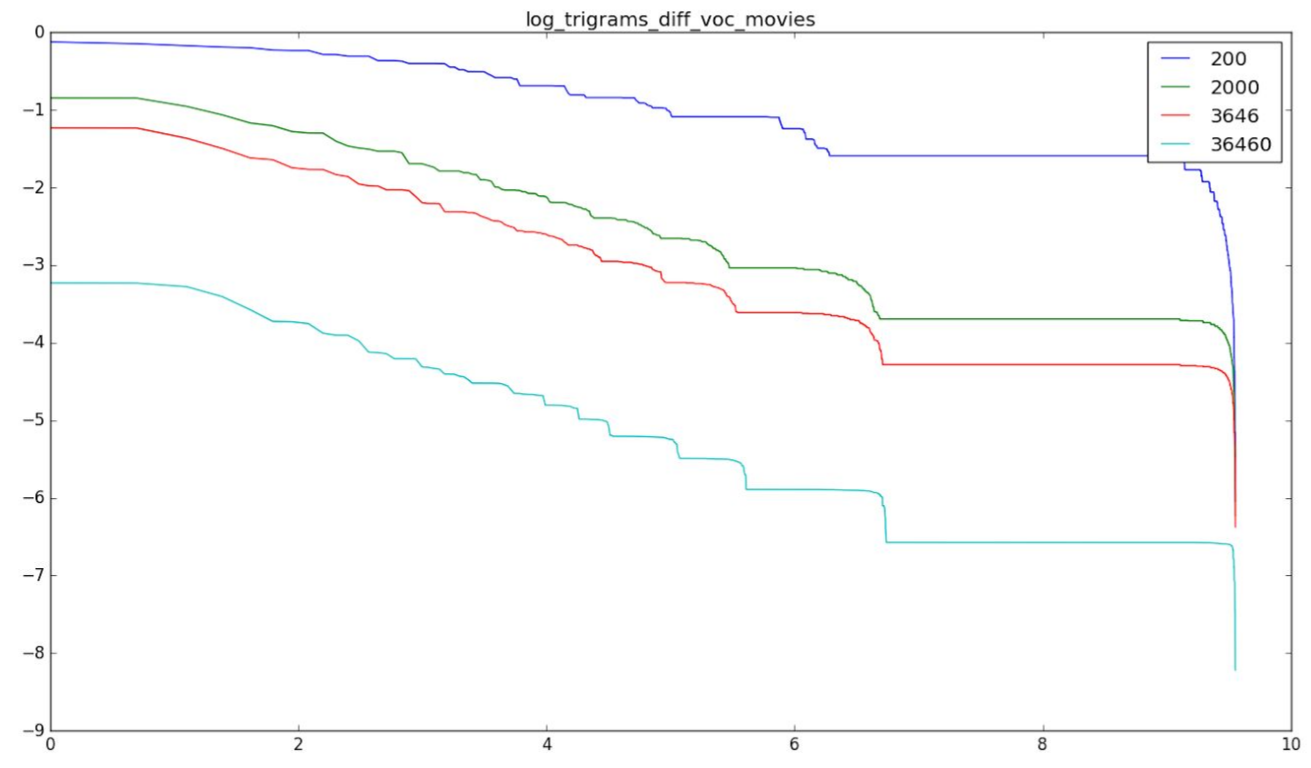

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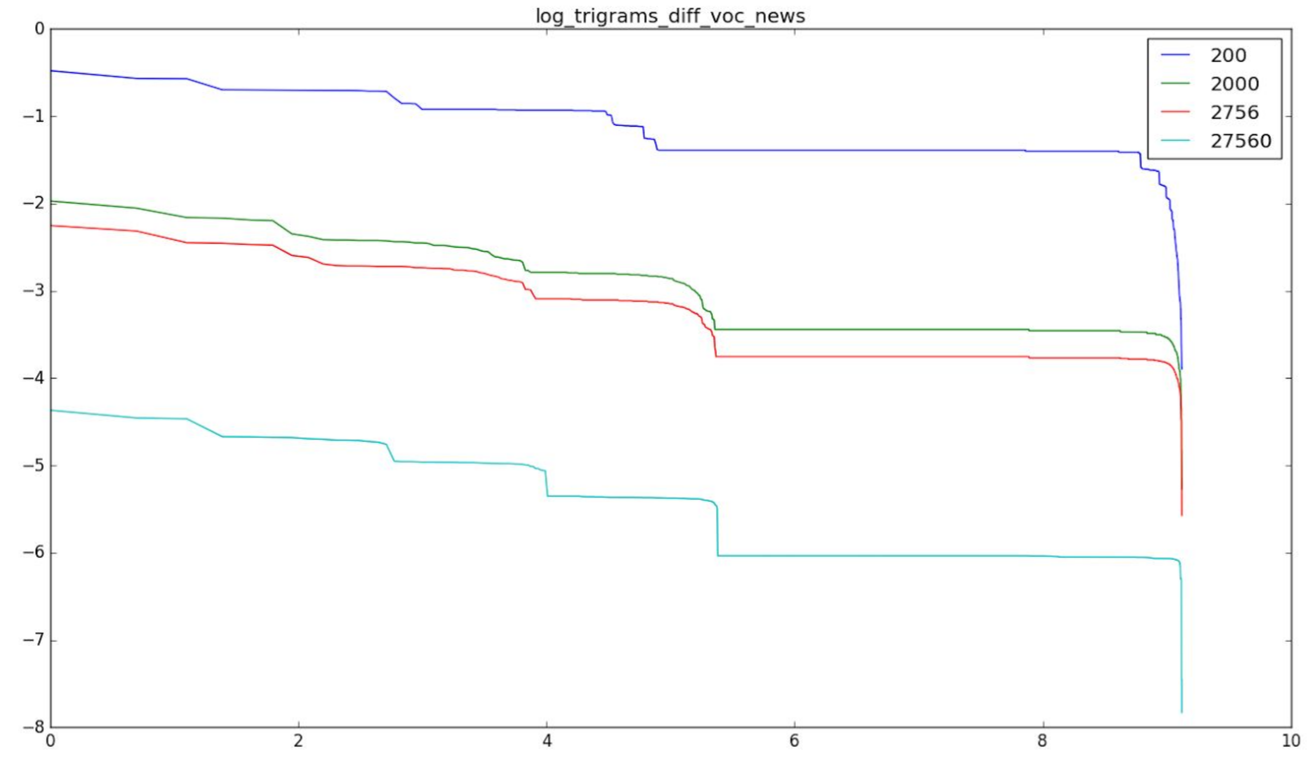

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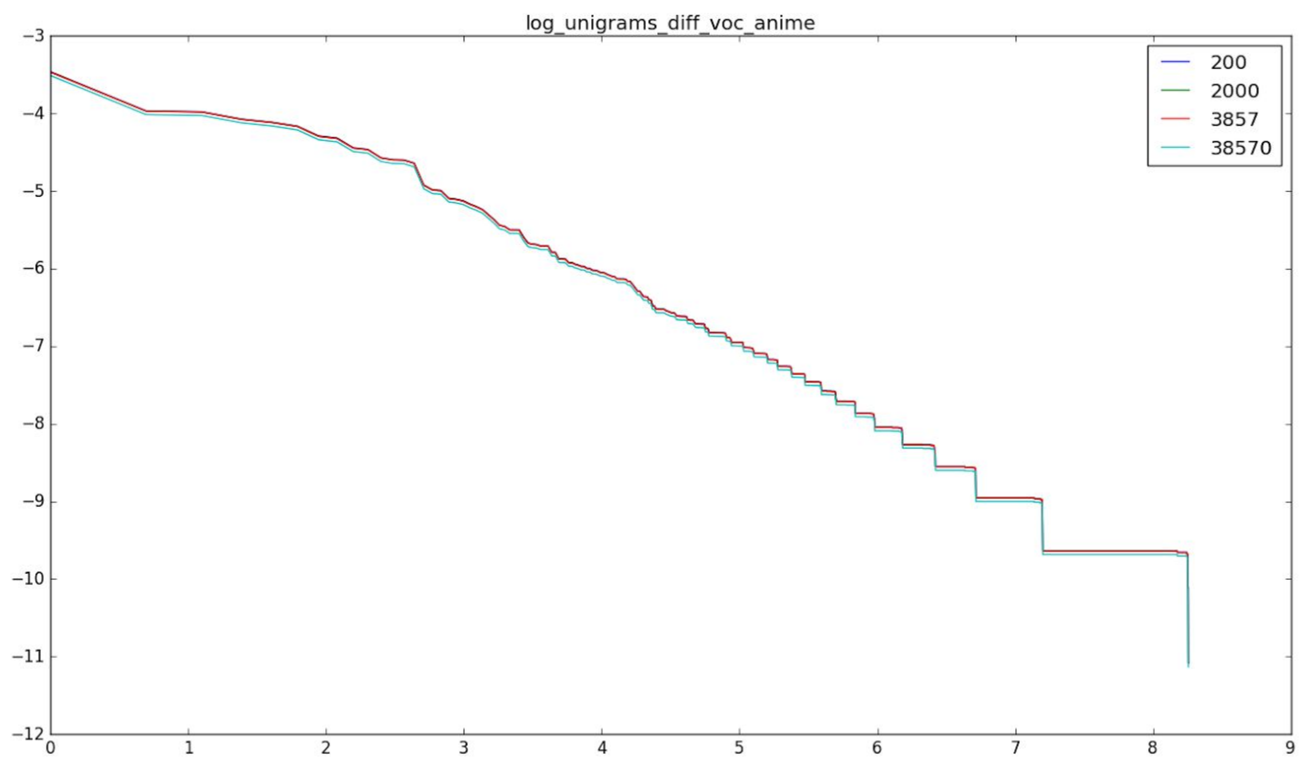
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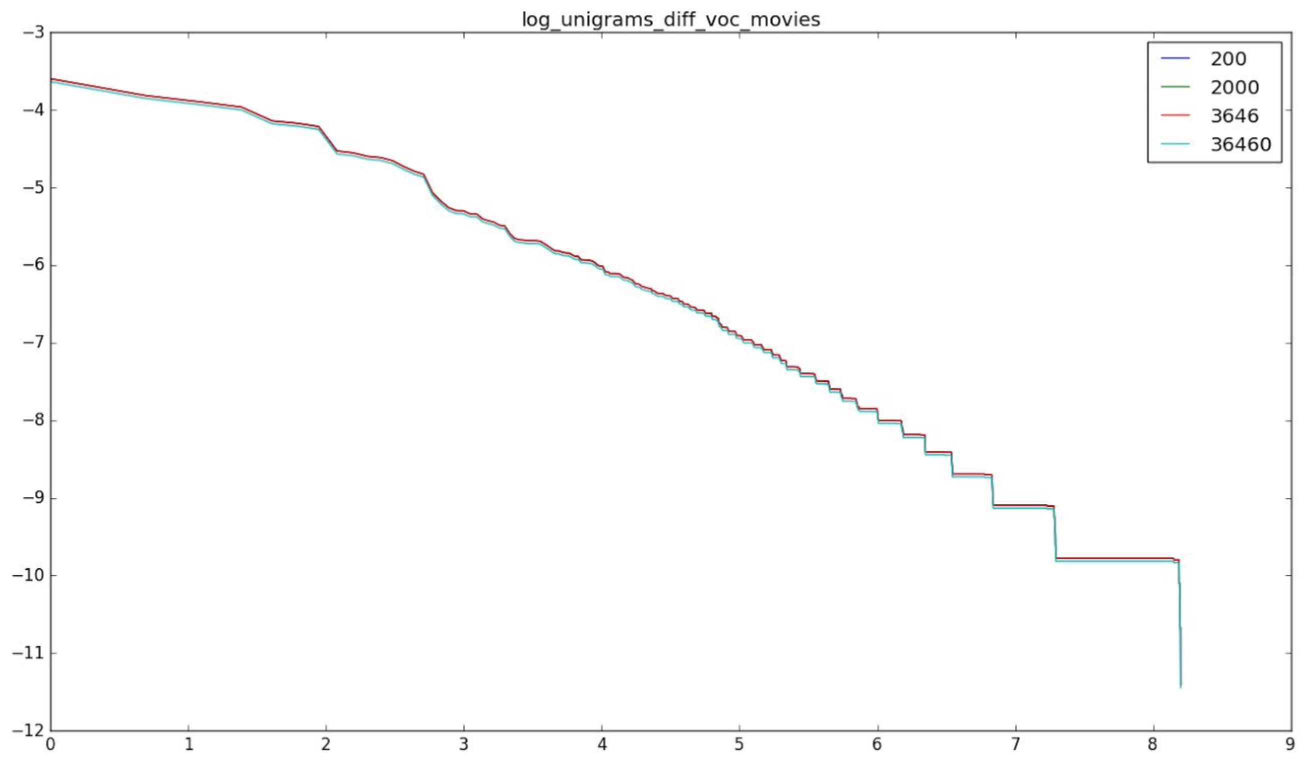
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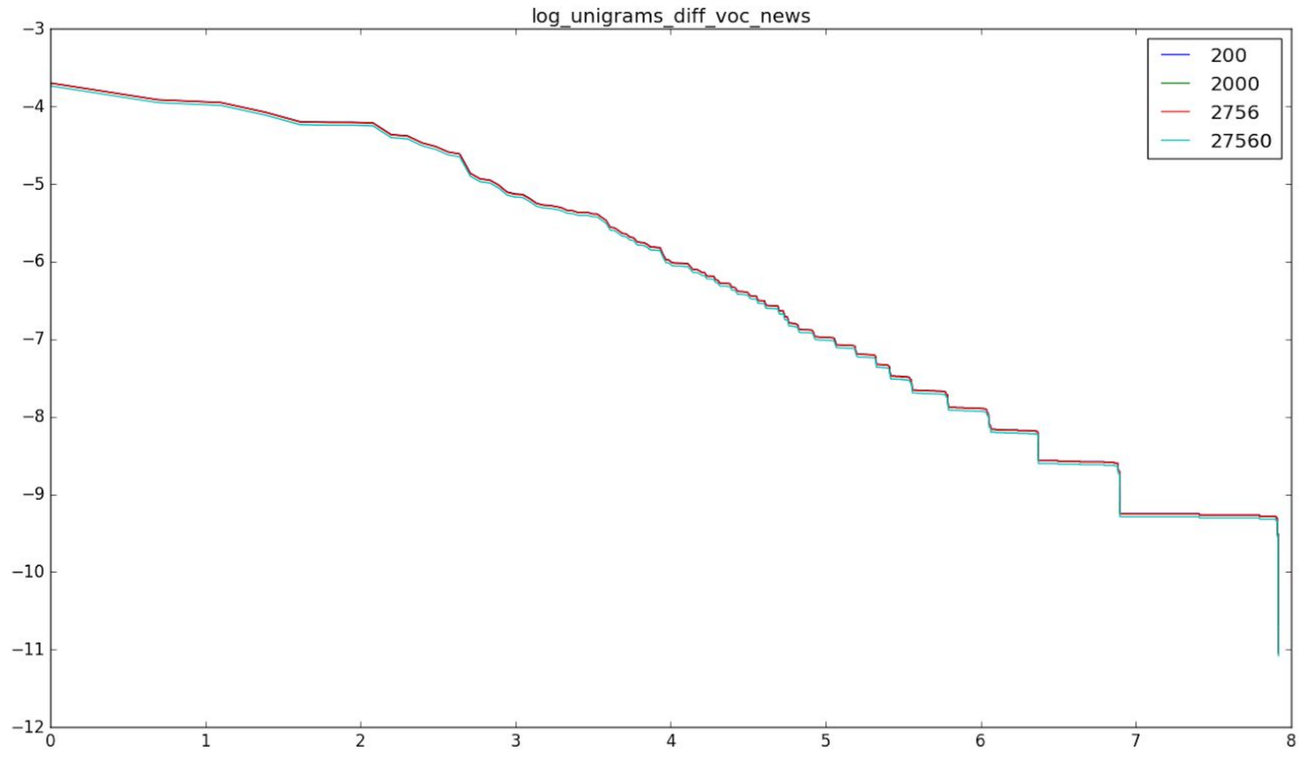
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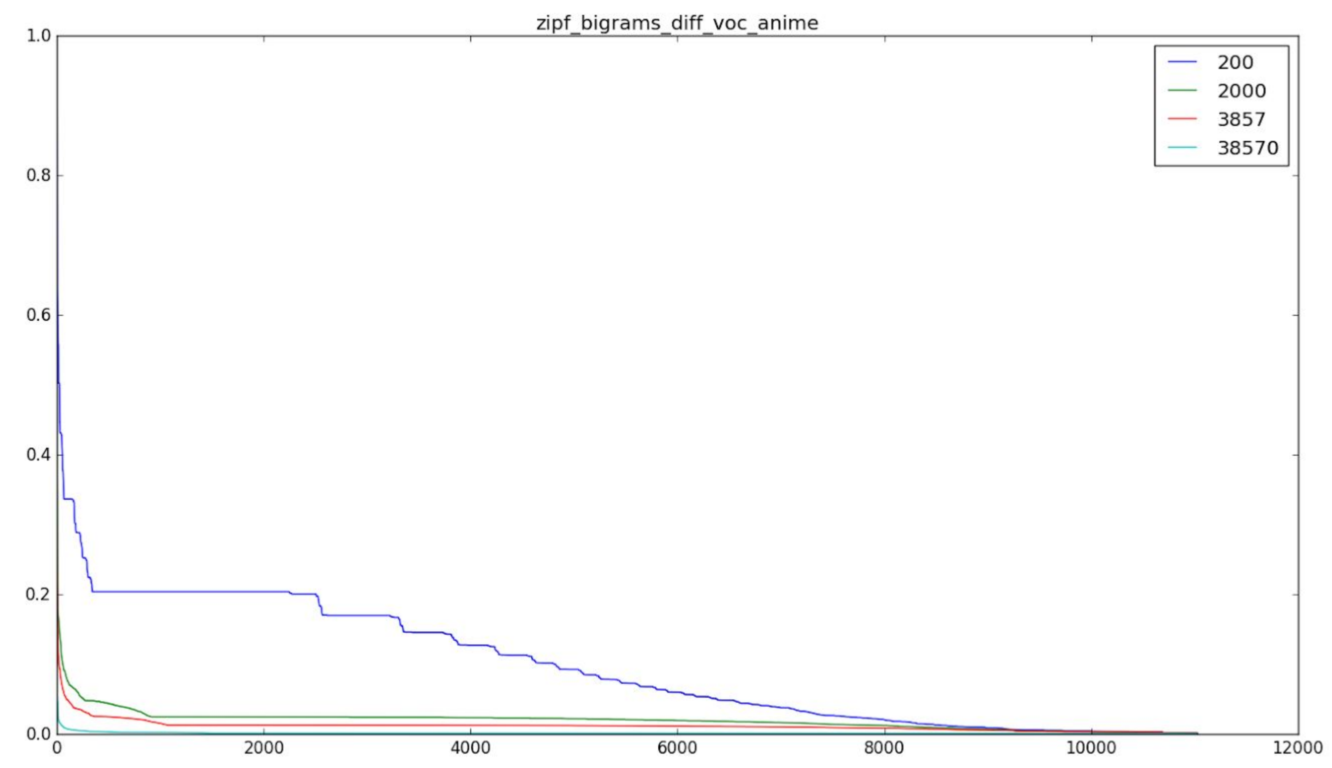
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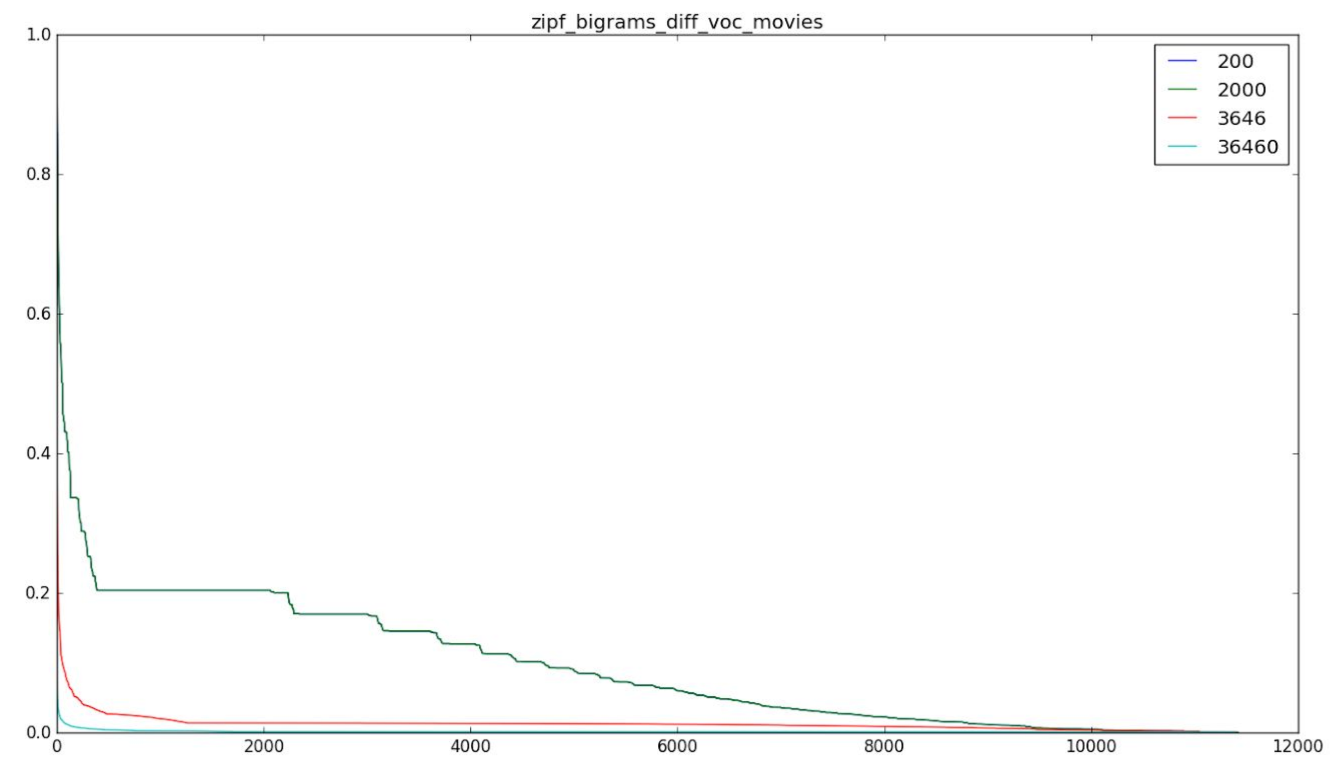
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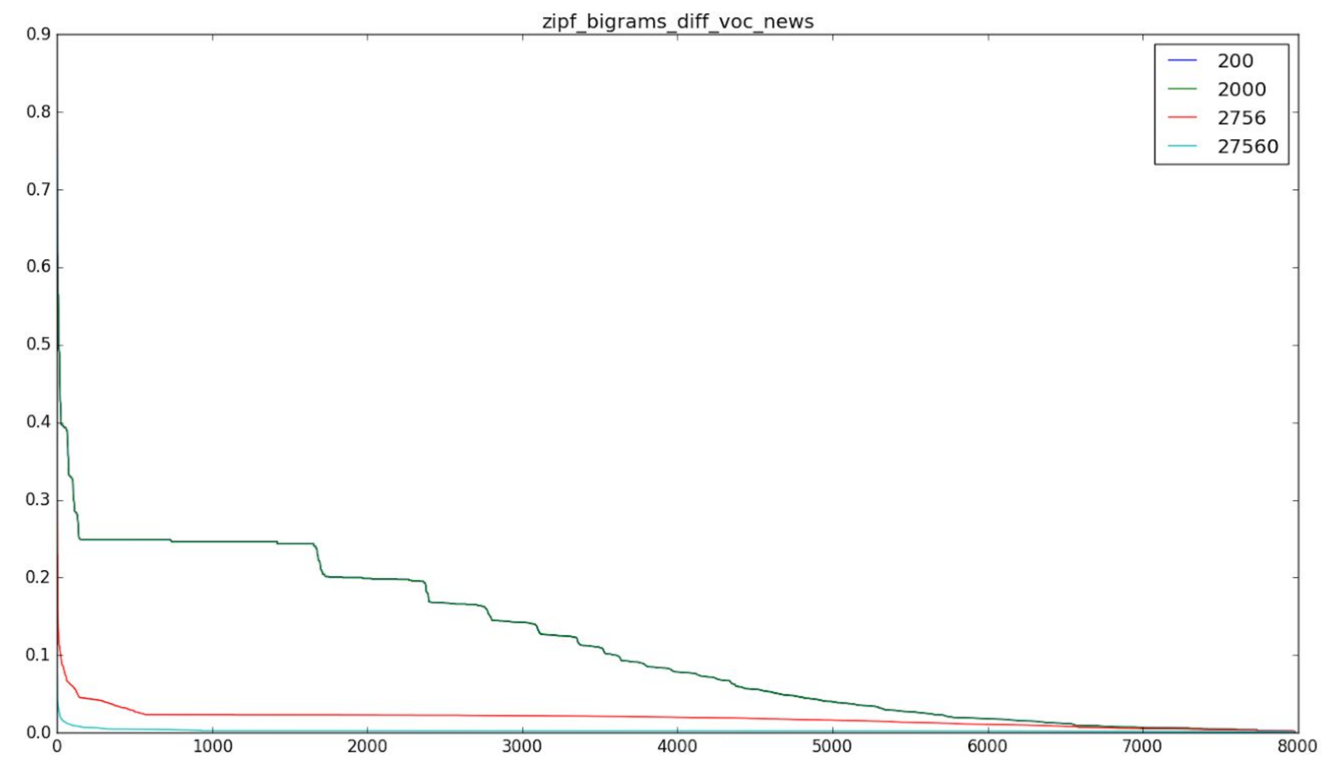
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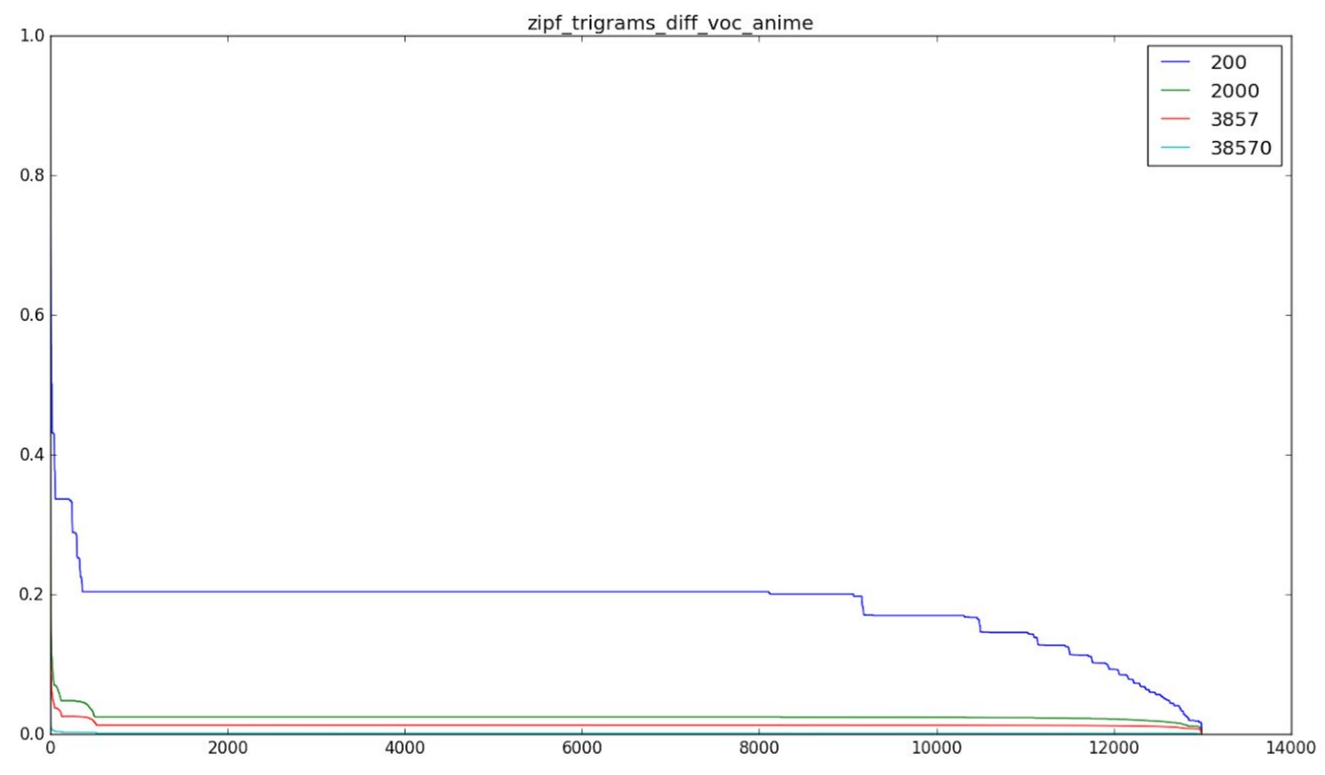
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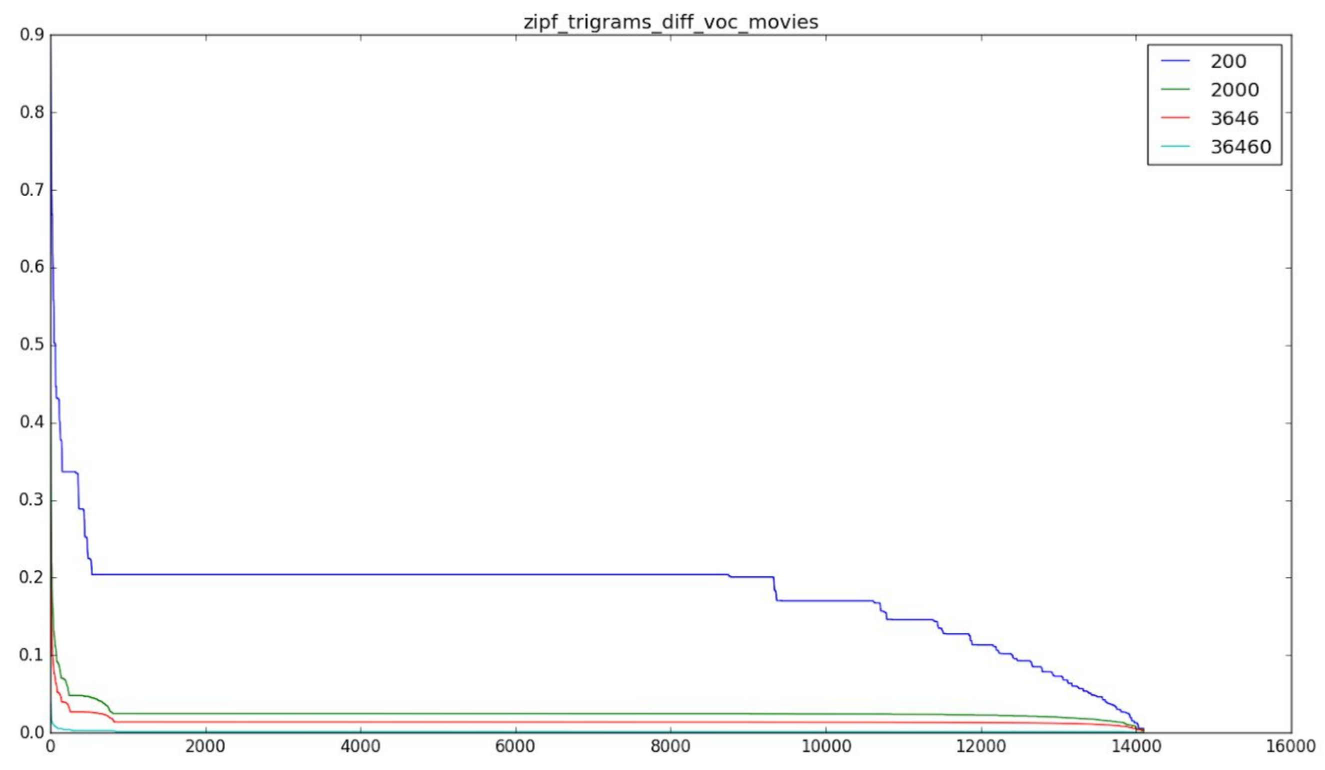
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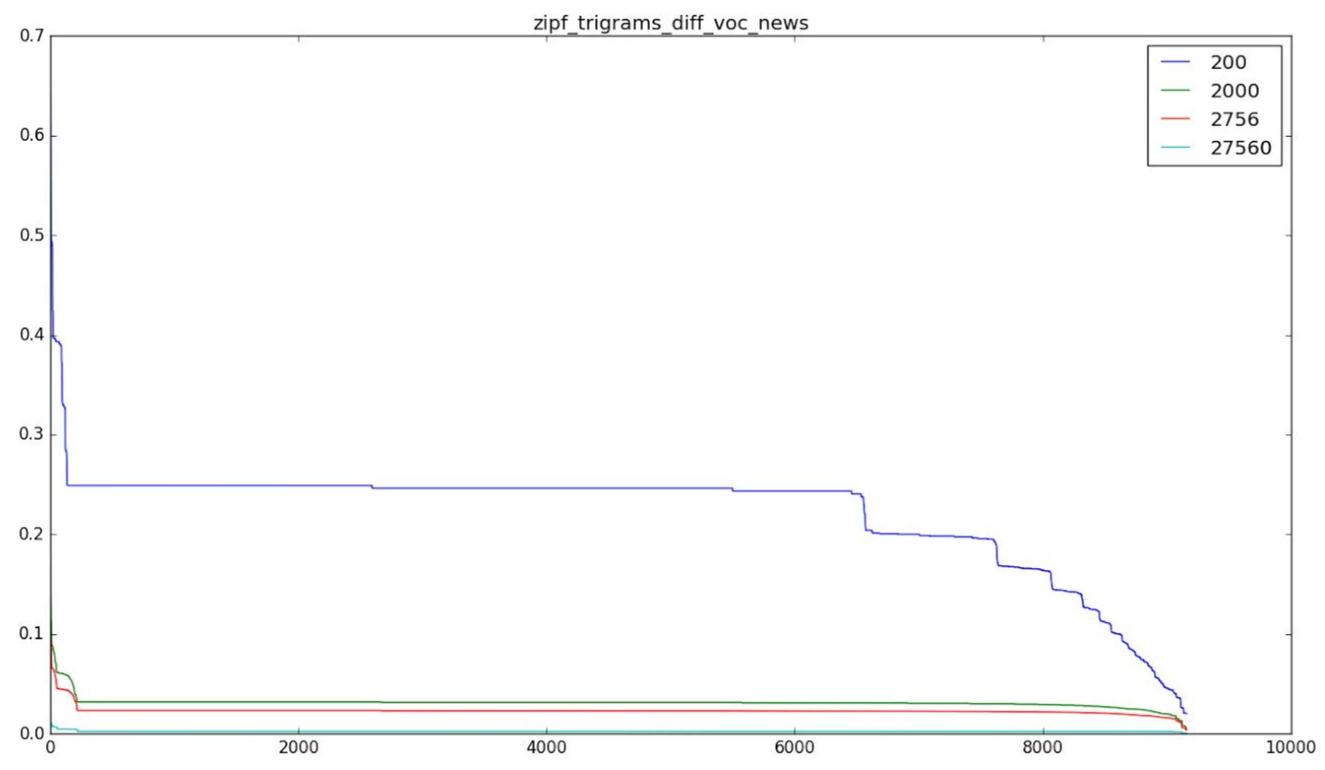
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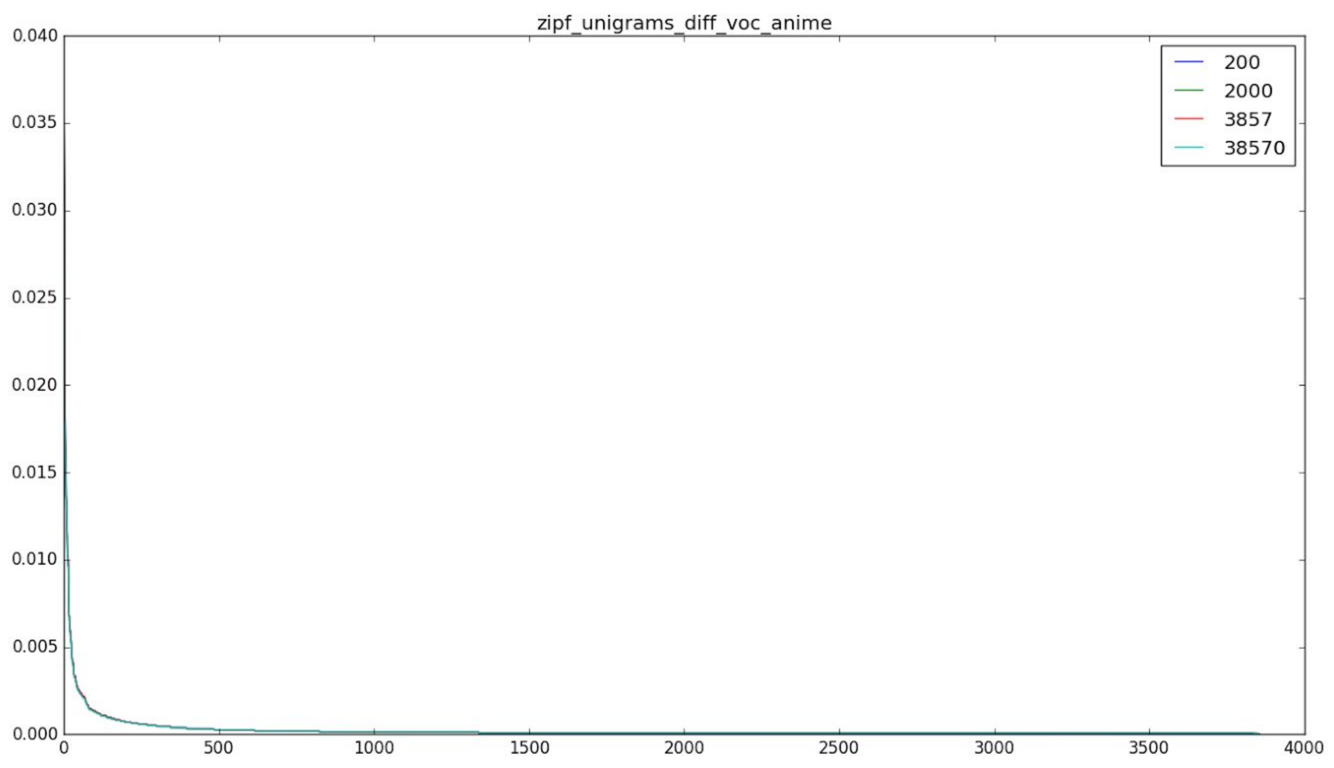
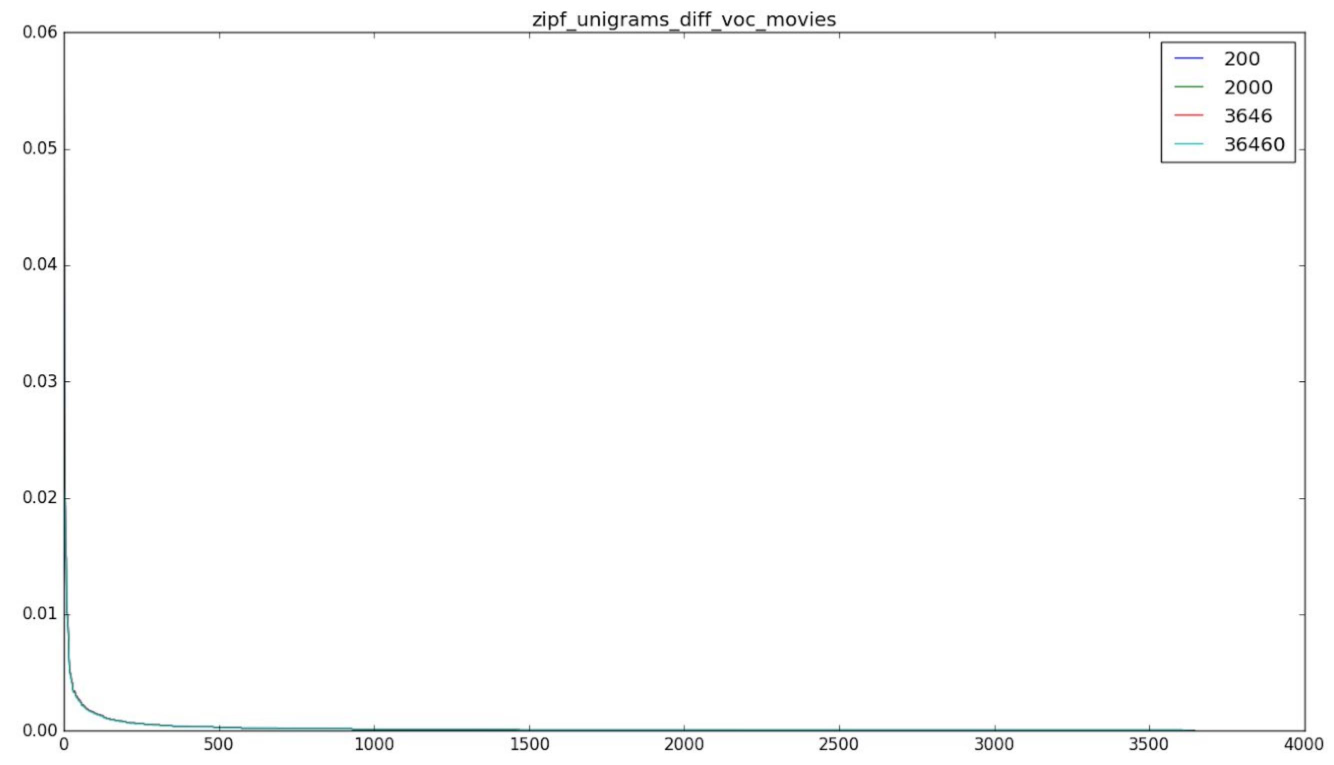
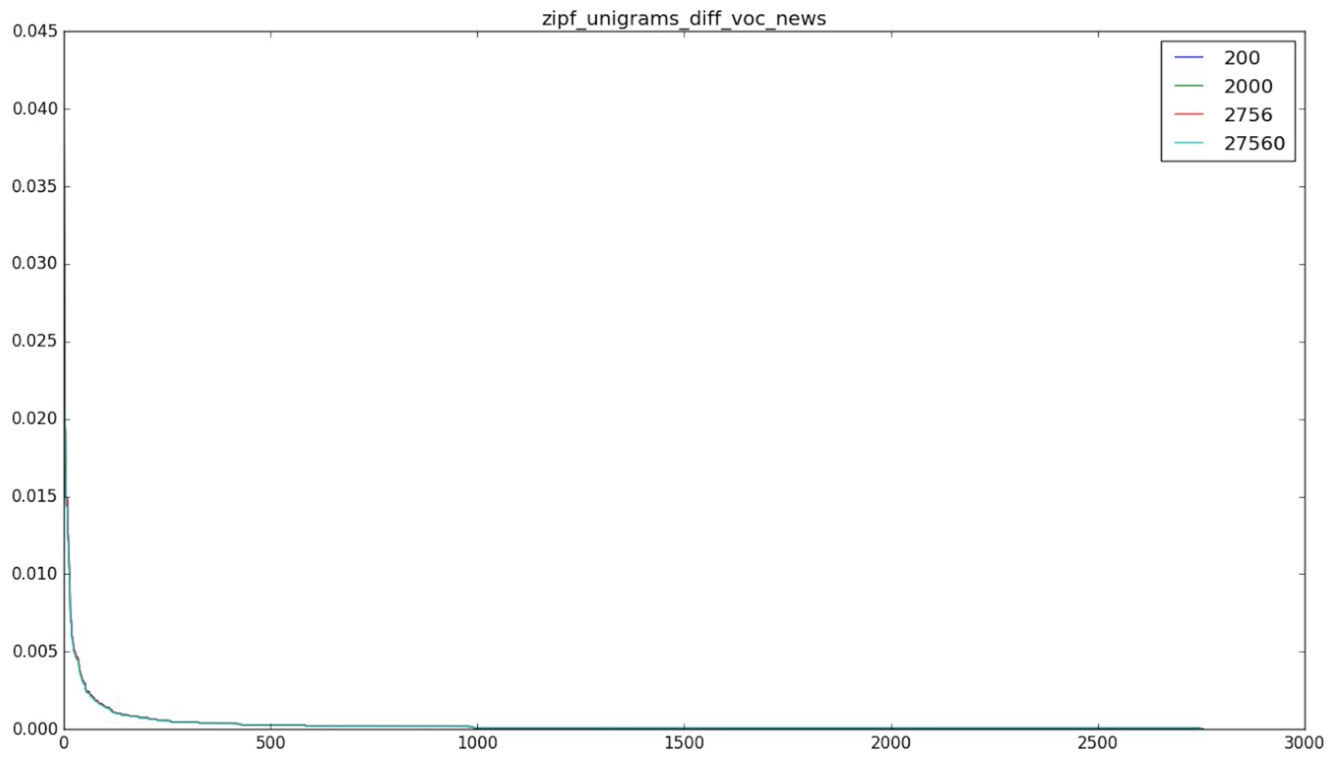






4.*Implement Witten-Bell backoff.*

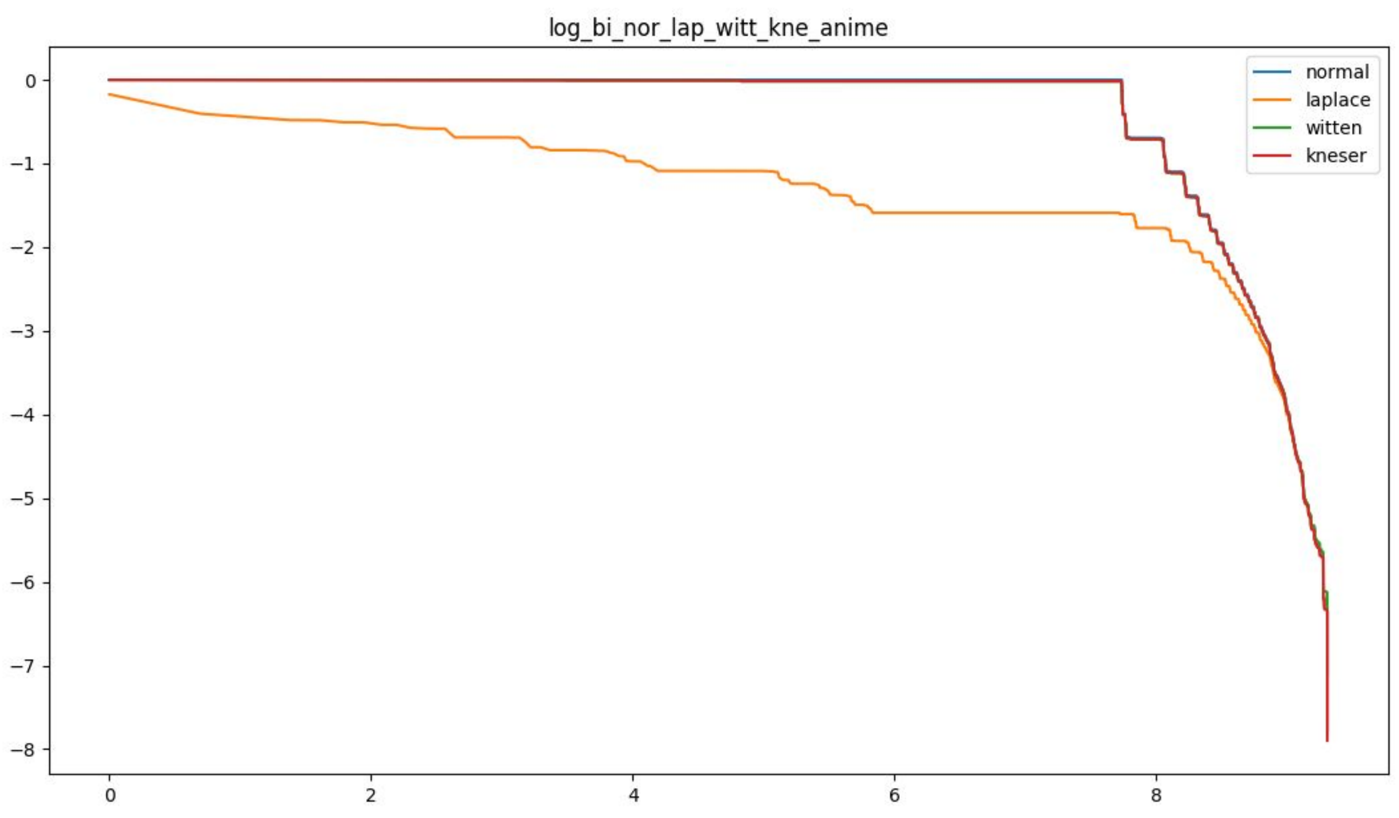
This functions could be called as shown below:

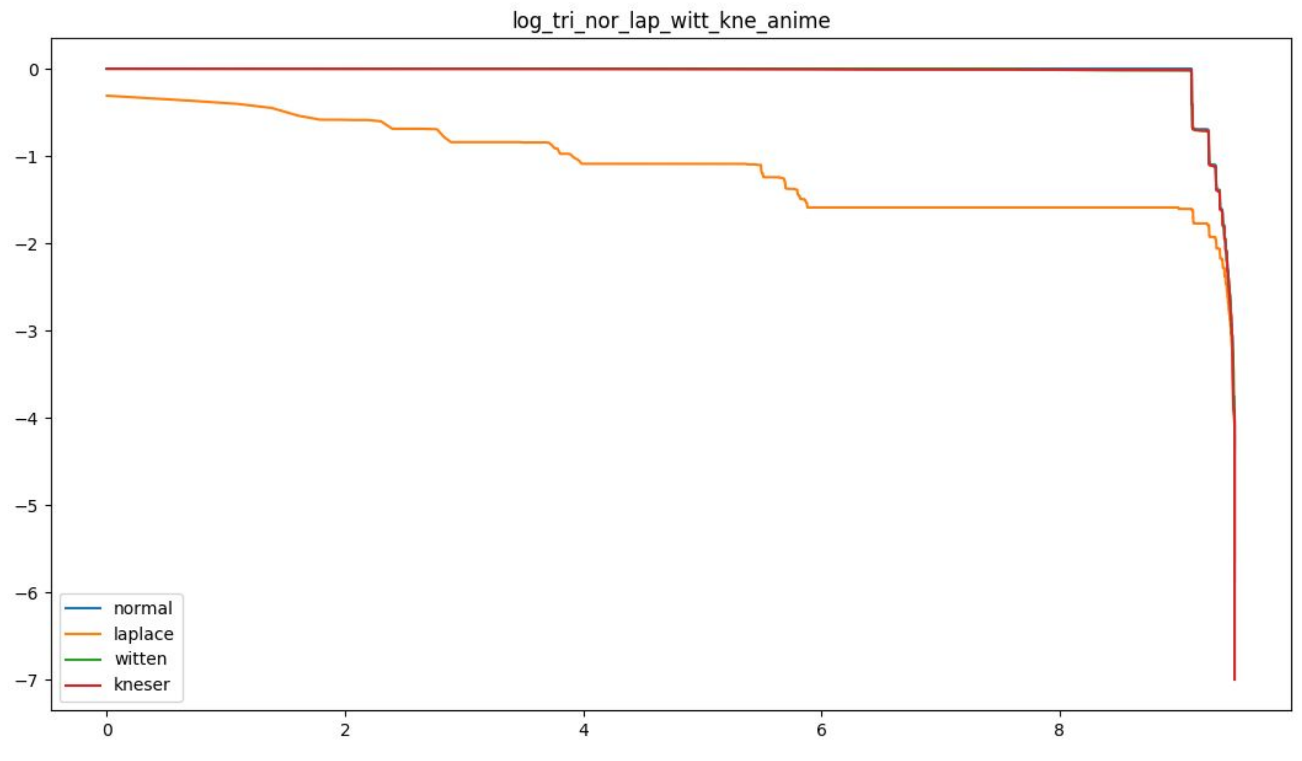
```
wittenbell_bigrams_prob = get_wittenbell_bigrams(unigrams,bigrams,unigrams_prob,wittenbell_unigrams_prob)
wittenbell_trigrams_prob = get_wittenbell_trigrams(unigrams,trigrams,trigrams_prob,wittenbell_bigrams_prob)
```

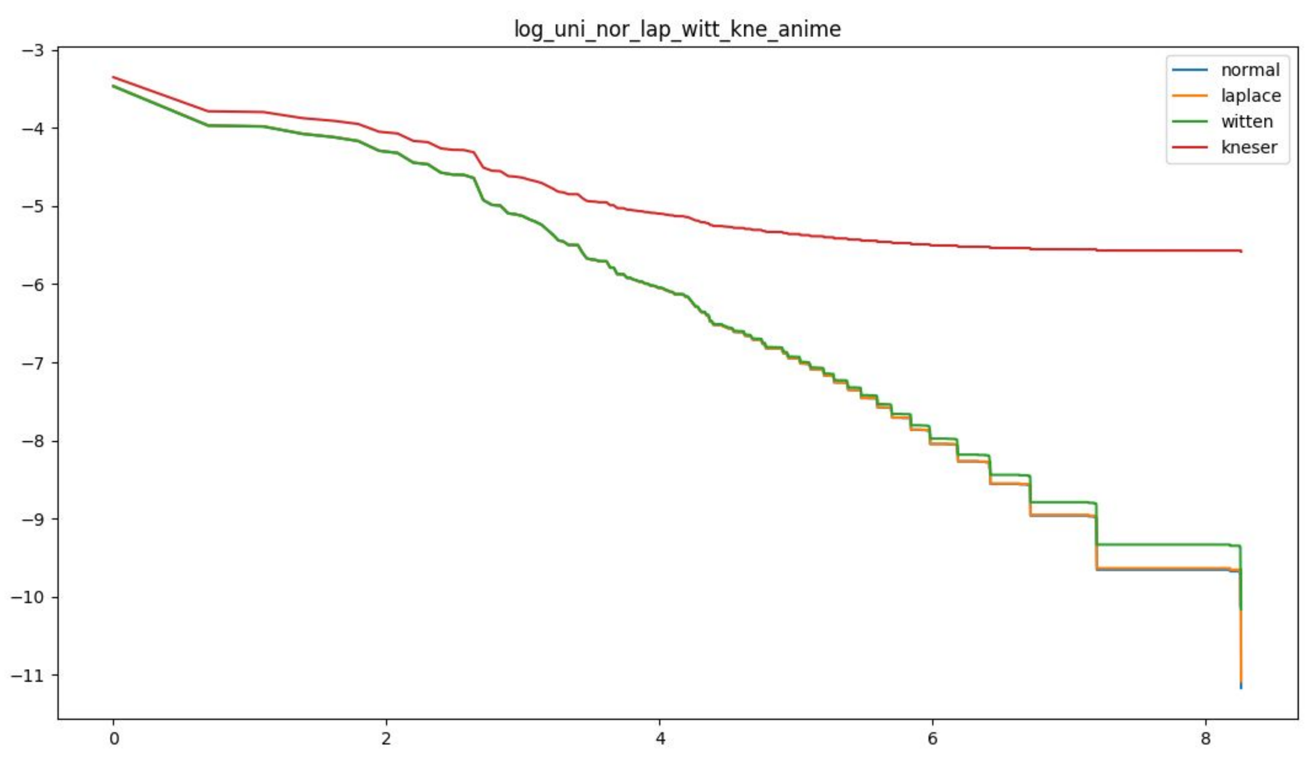
4.*Implement Kneser-Ney smoothing.*
Kneser-Ney smoothing is implemented which could be called using below functions

```
kn_unigrams_prob = get_kn_unigrams(unigrams,200)
kn_bigrams_prob =  get_kn_bigrams(unigrams,bigrams)
kn_trigrams_prob =  get_kn_trigrams(unigrams,bigrams,trigrams)
```

5. *Compare the three smoothing techniques:*



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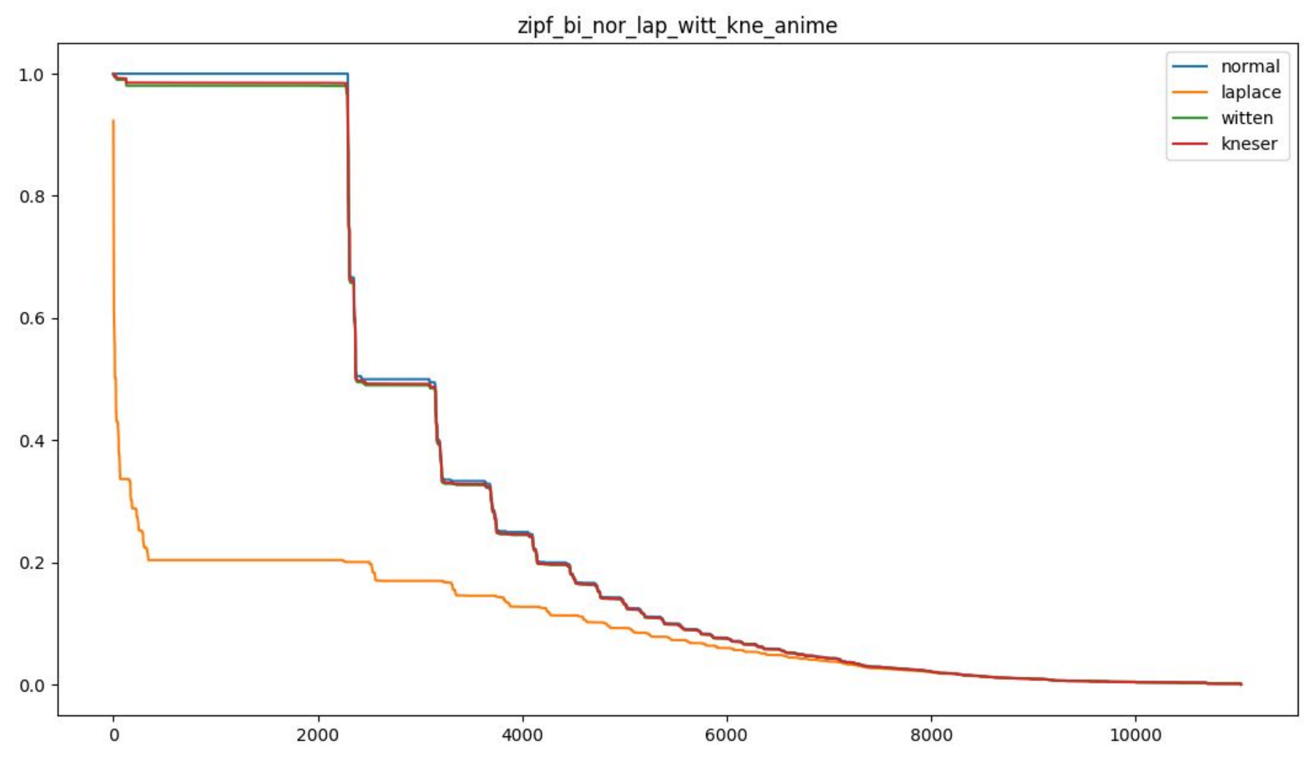
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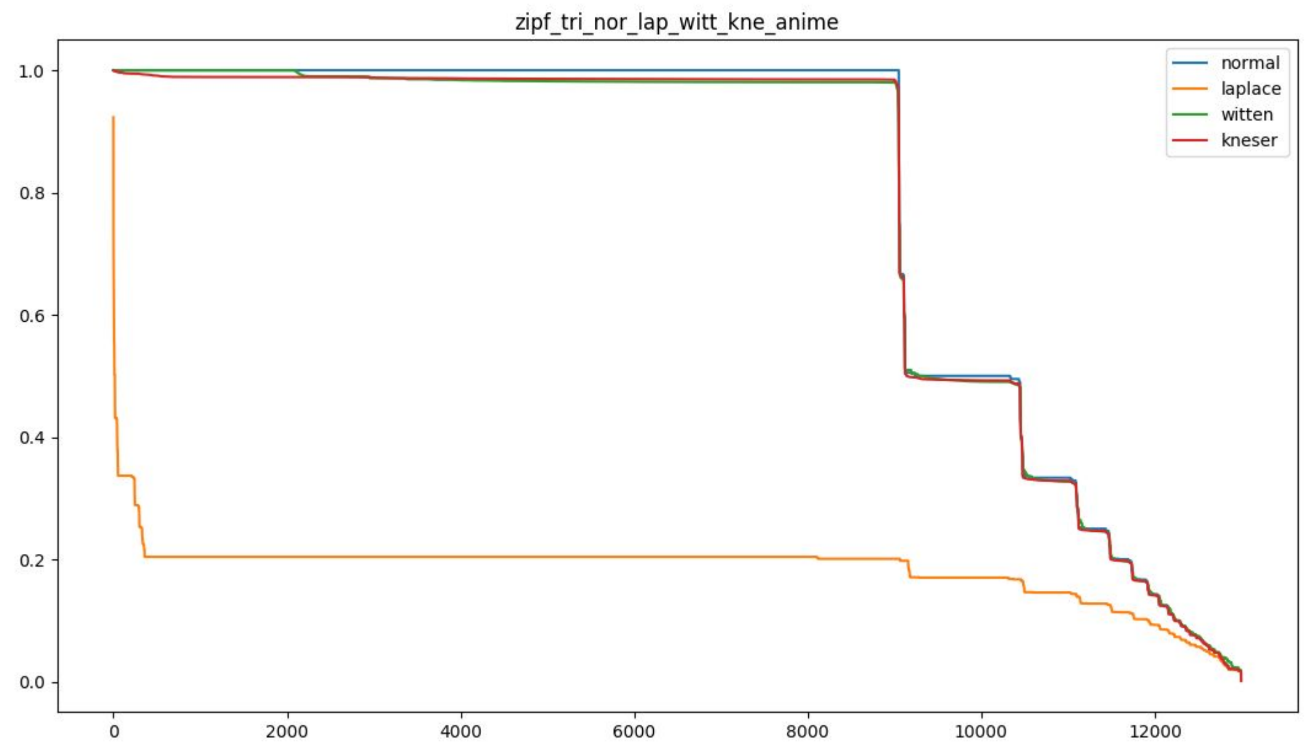
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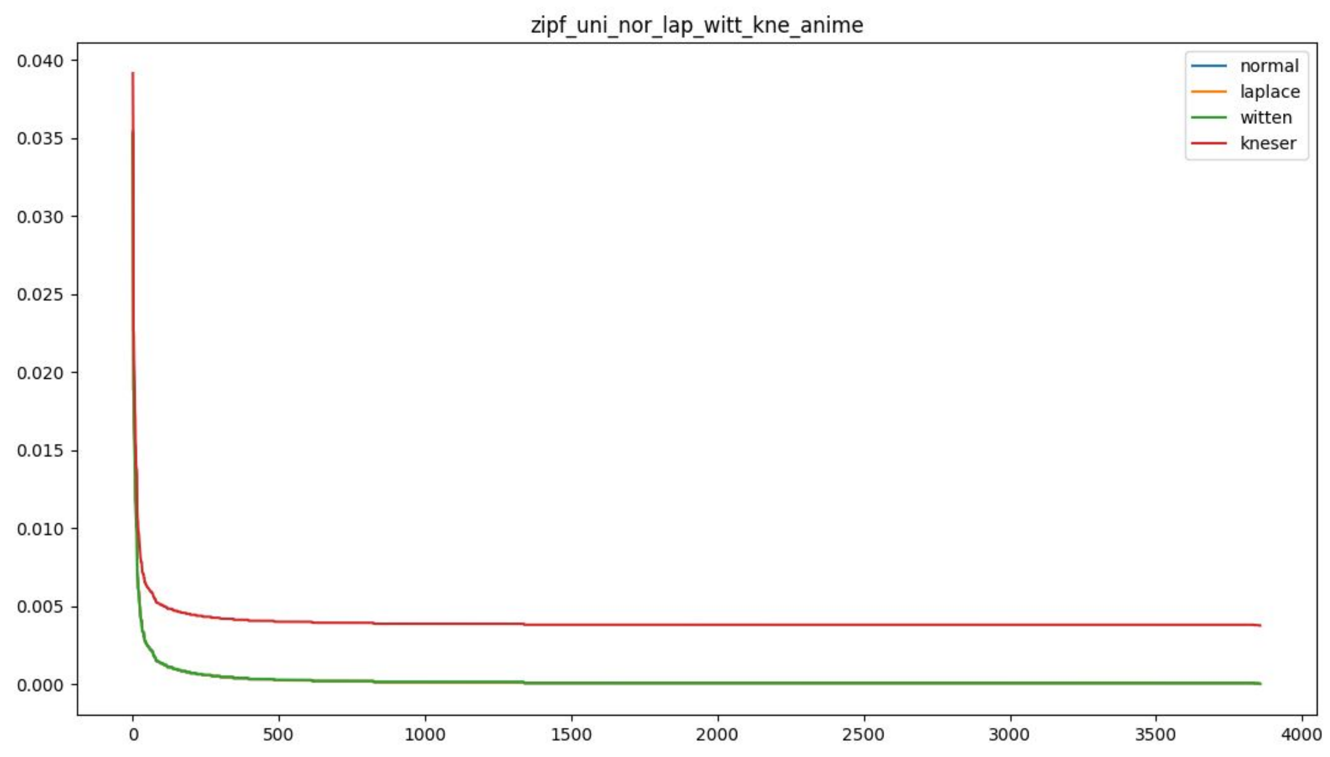
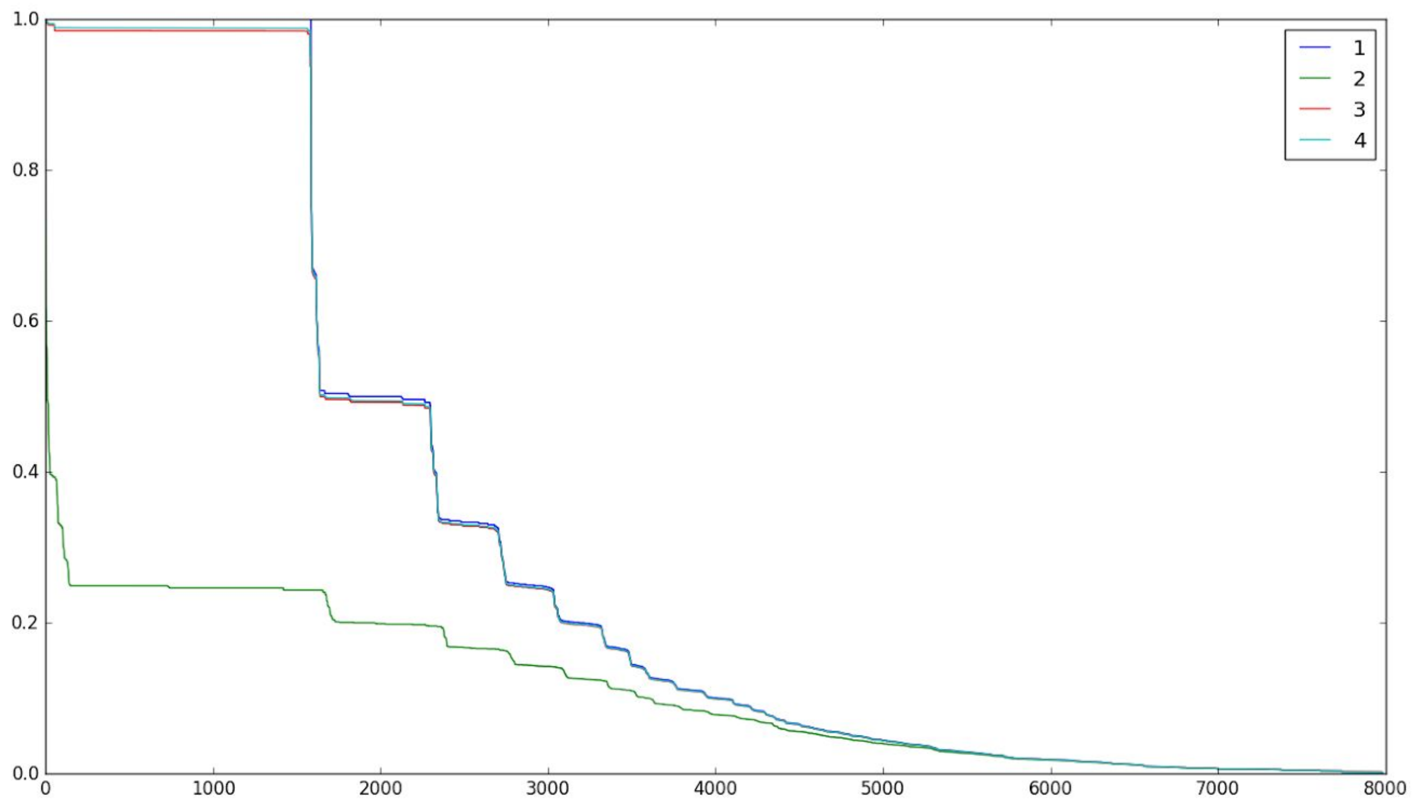
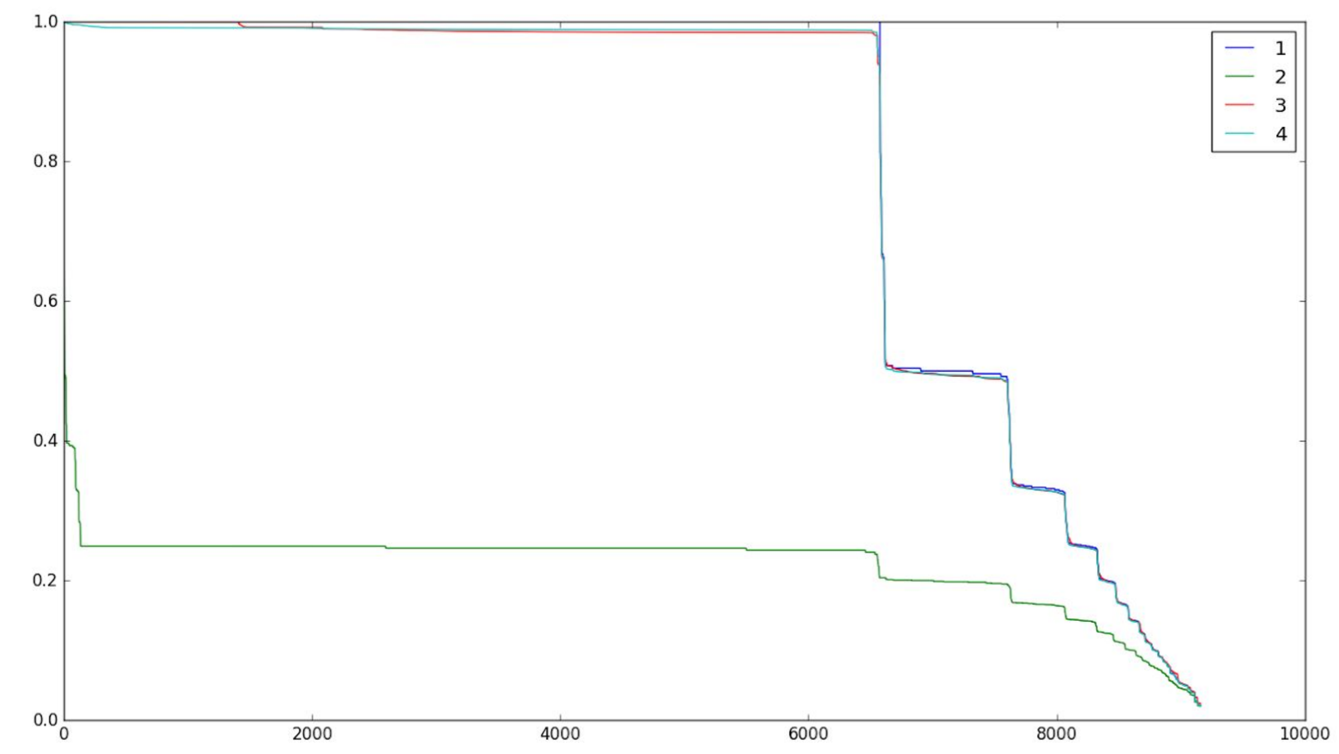


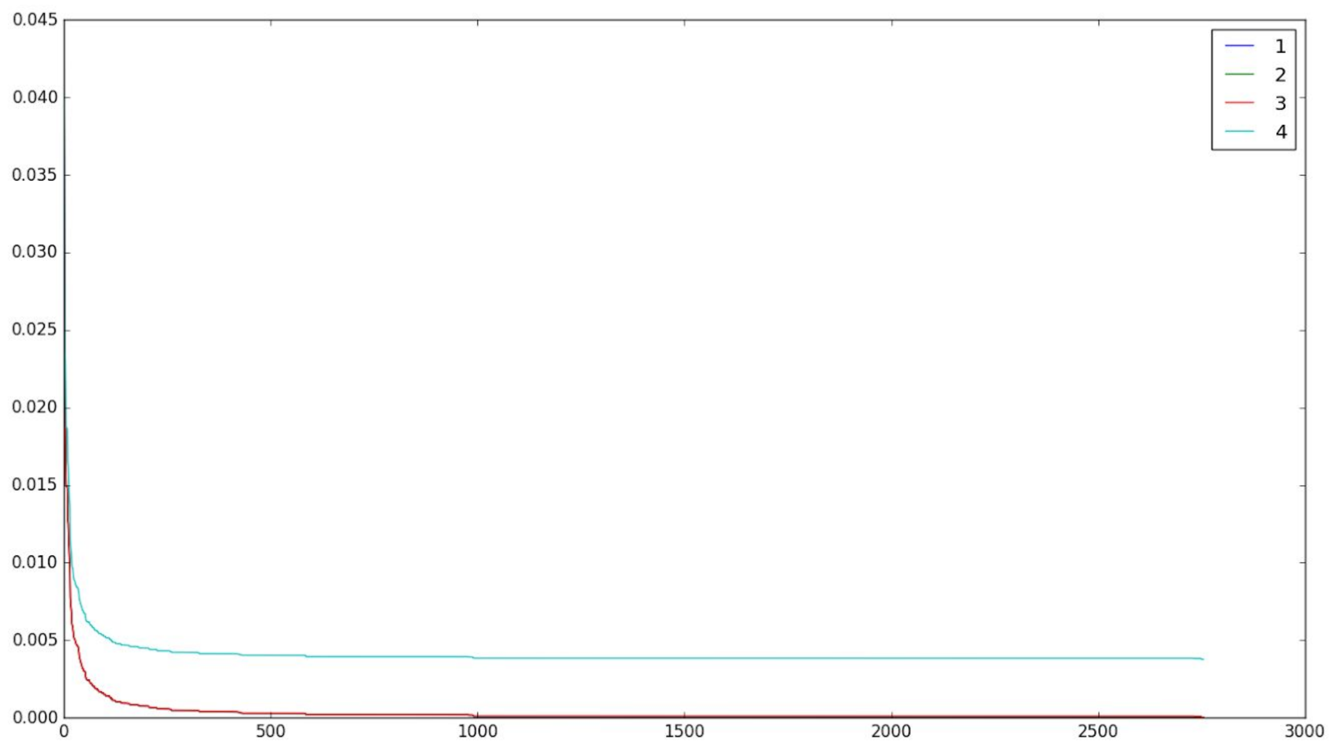
Zipf Bigram News



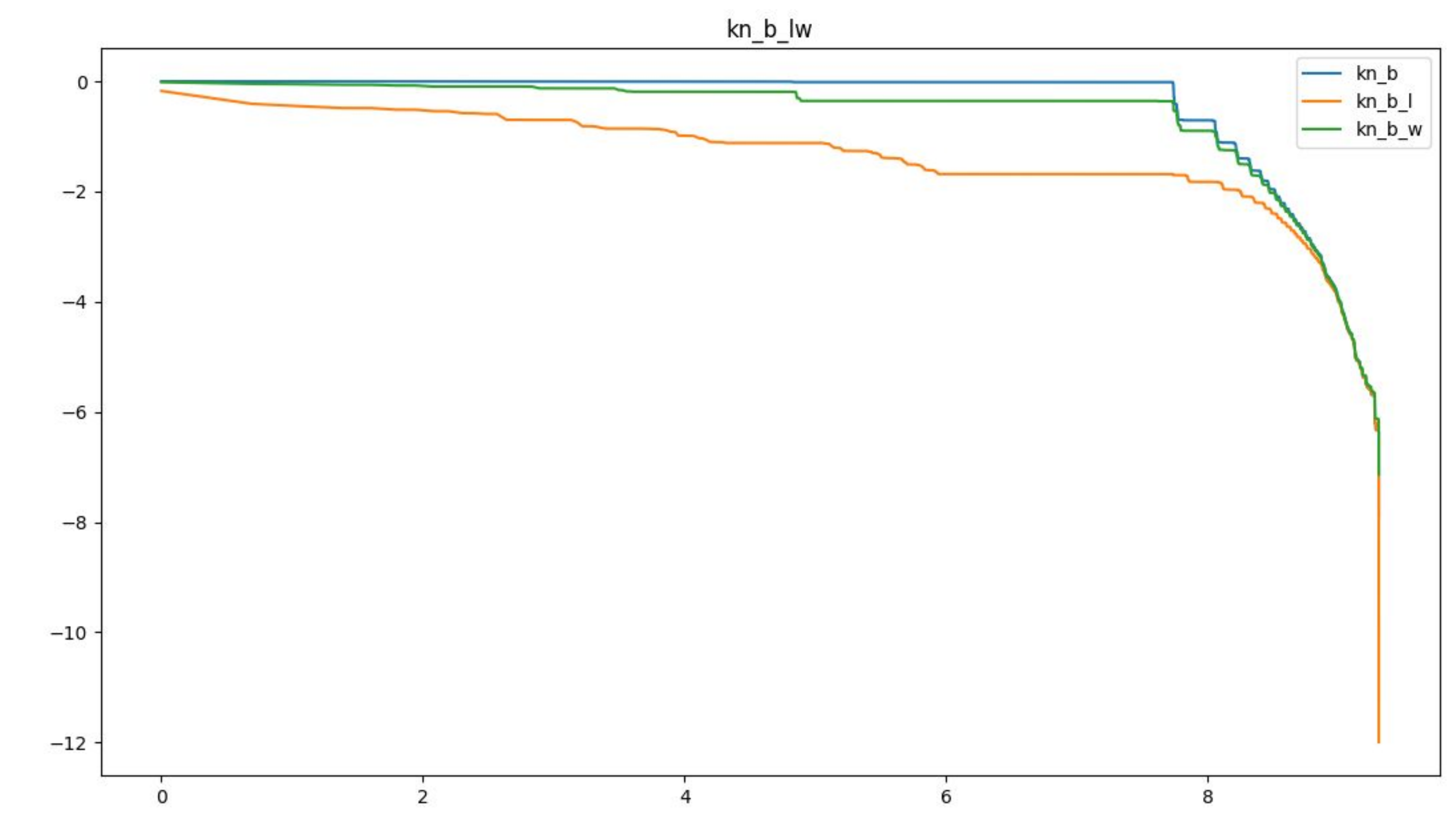
Zipf trigram News



Zipf Unigram News



7. In Kneser-Ney, what happens if we use the estimates from laplace and wittenbell in the absolute discounting step ?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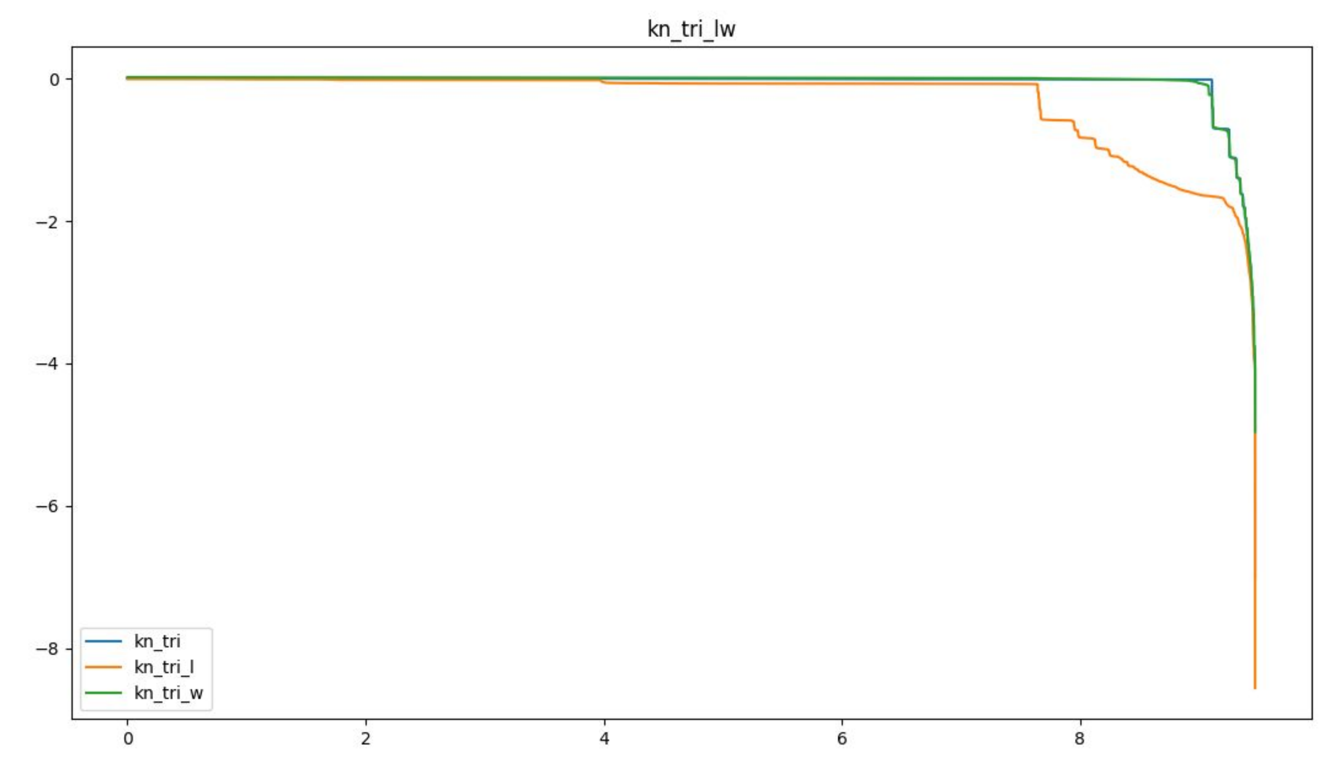
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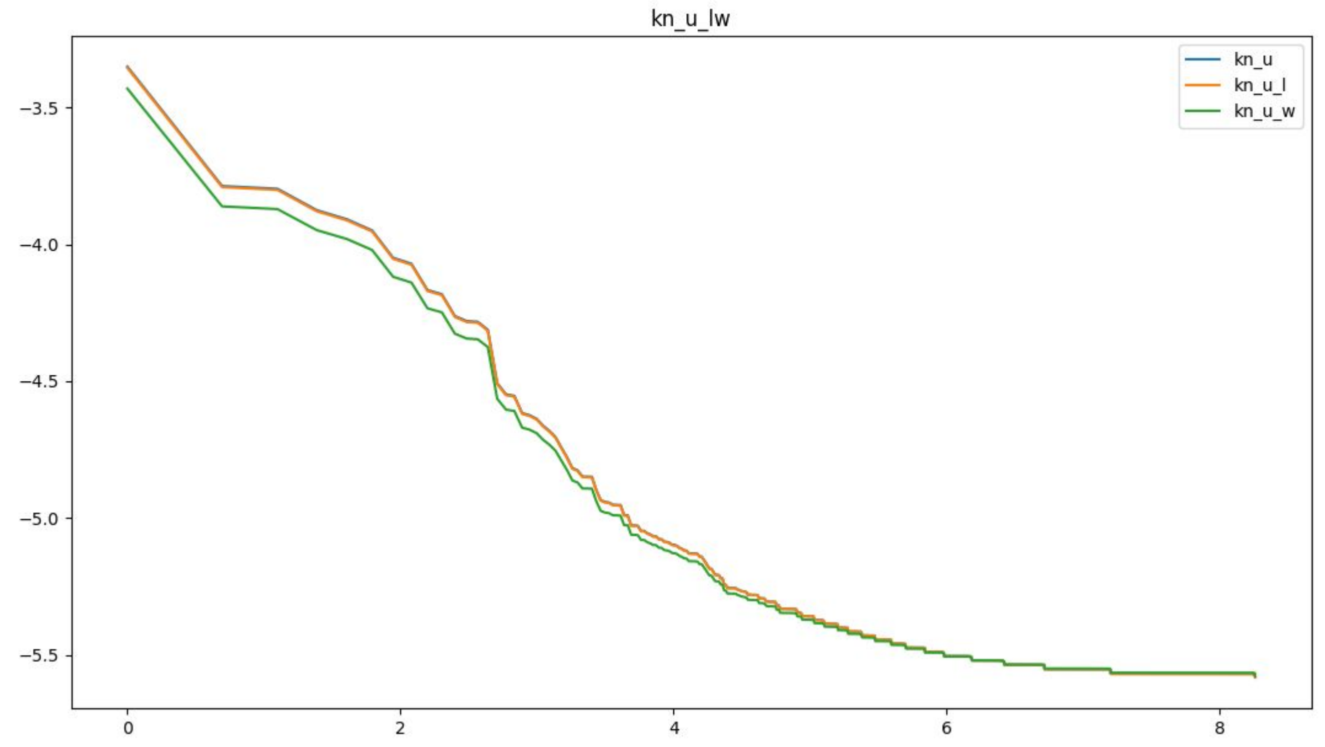
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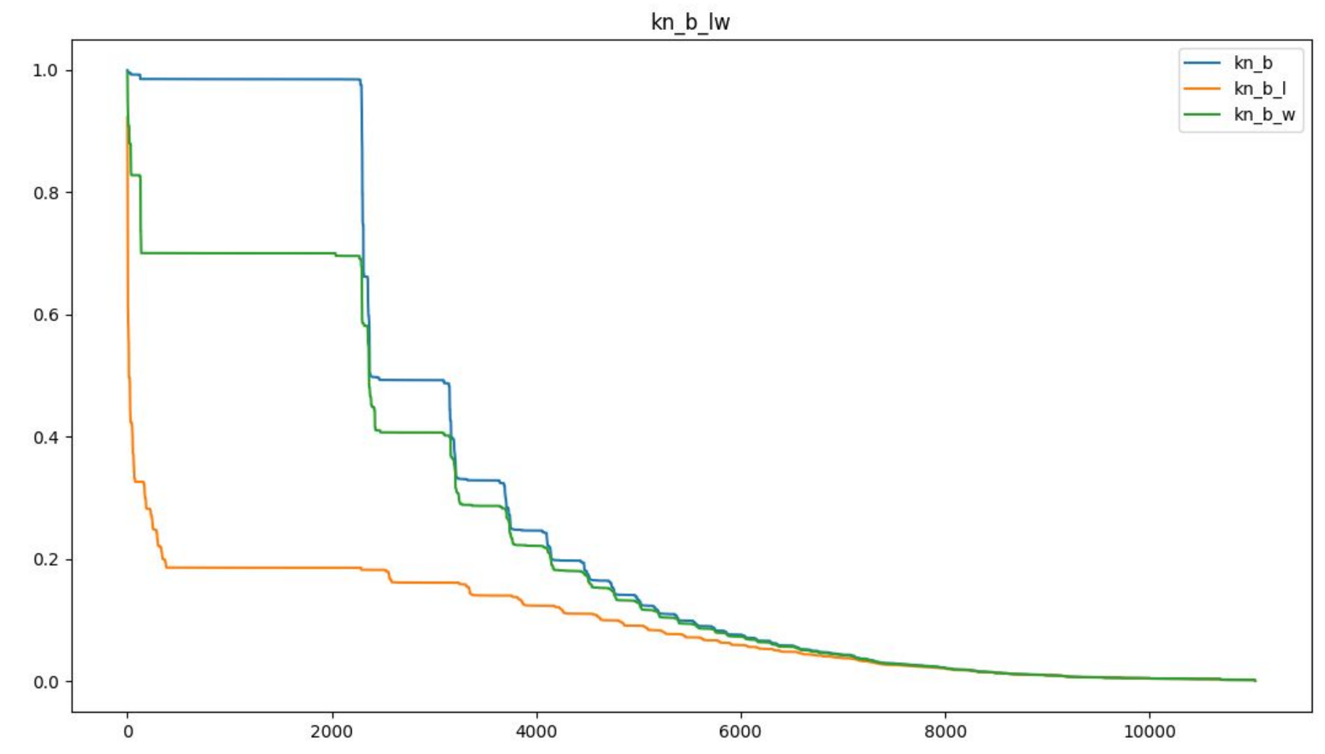
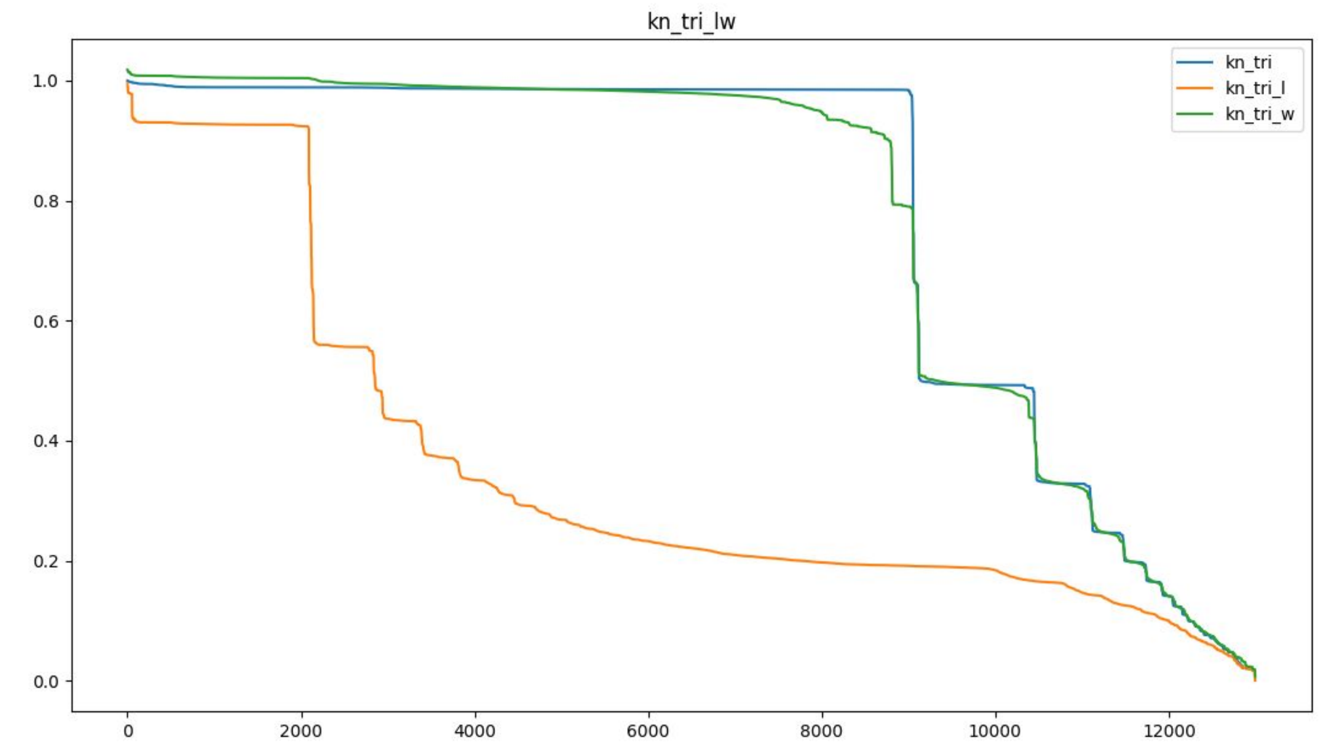
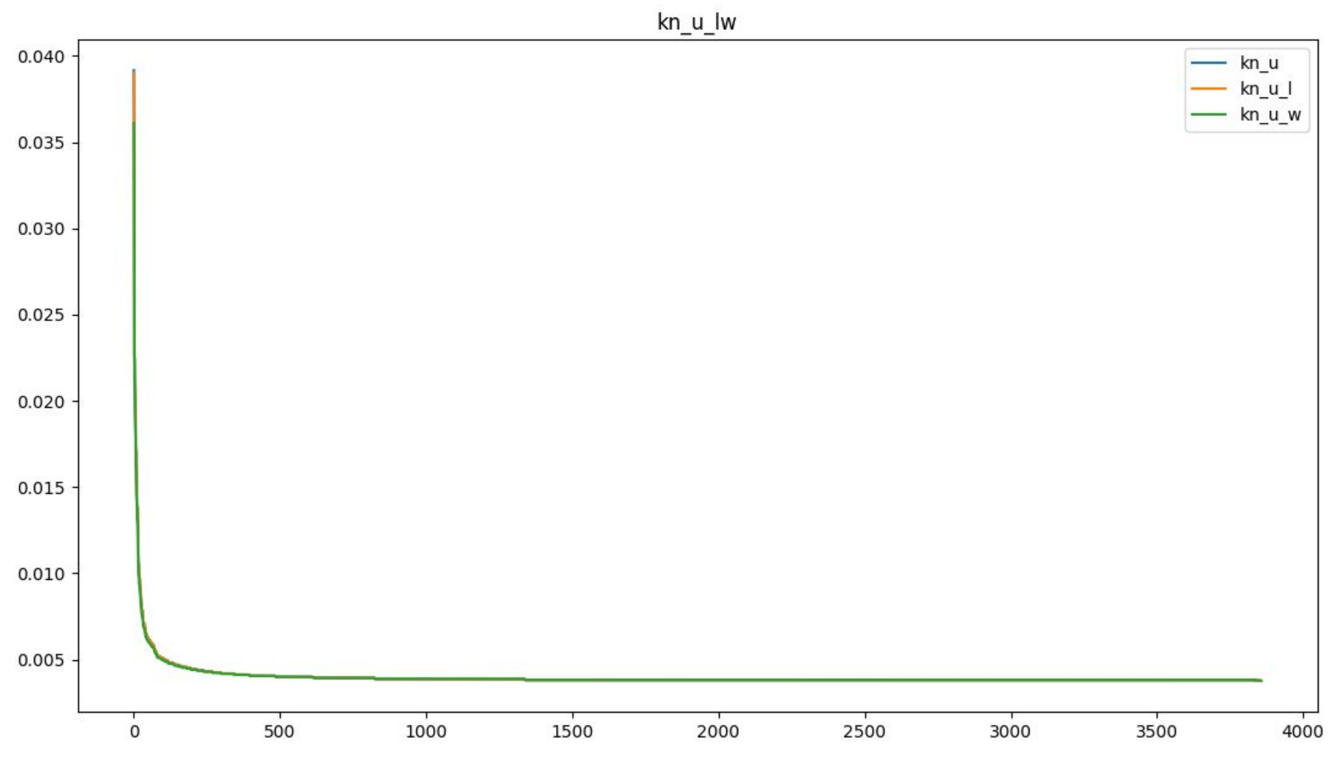






8. U*sing KN-estimates from the three sources, generate text with unigram, bigram and trigram probabilities.*

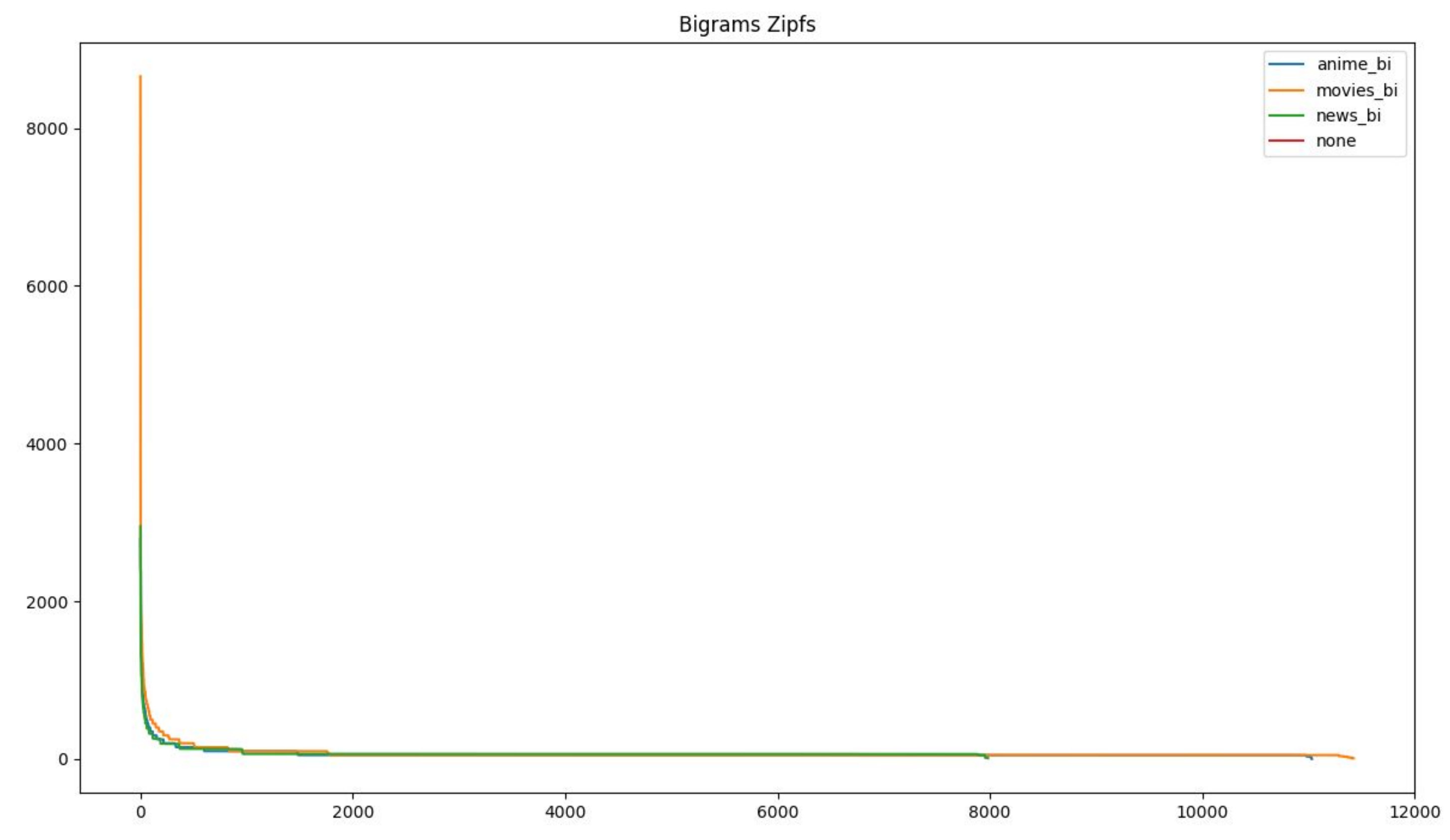
Generated Texts:

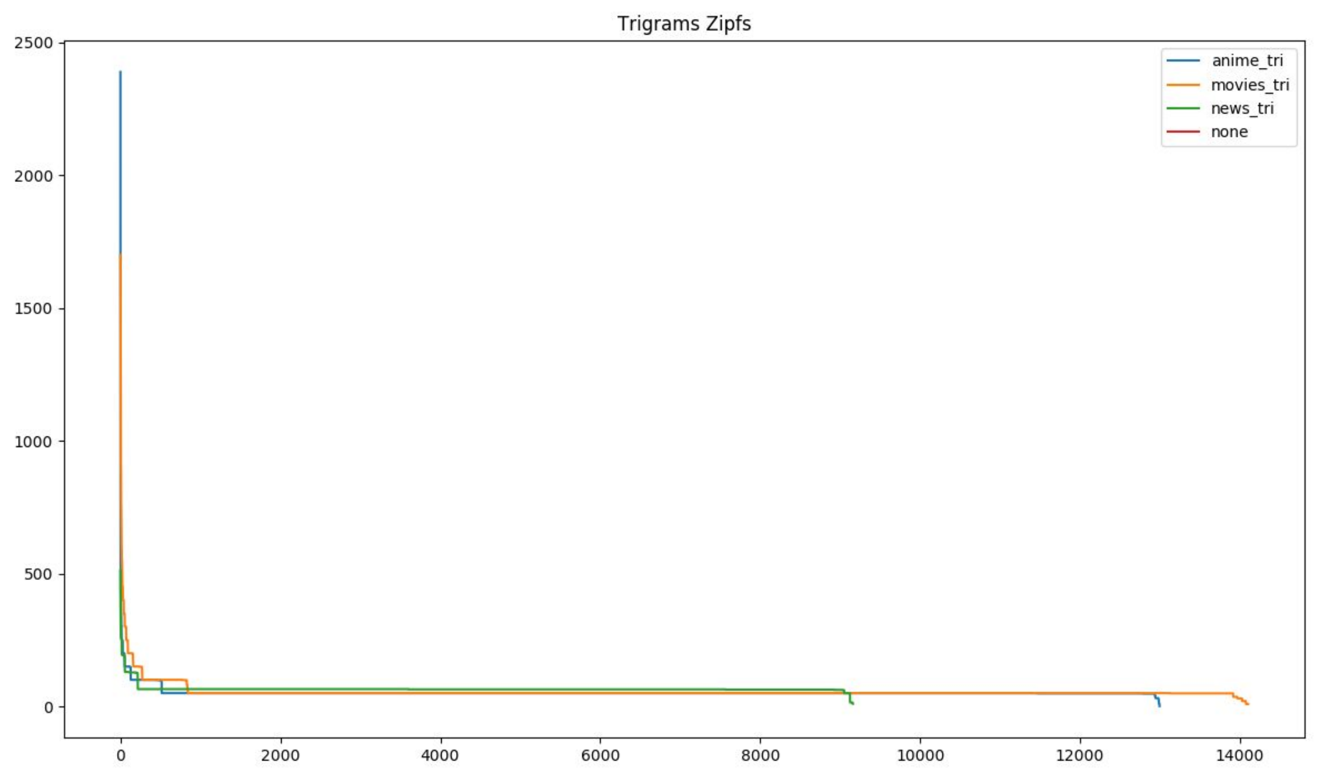
For trigram:
['team', 'is', 'back', 'it', 'was', 'a', 'little', 'too', 'much', 'and']
['man', 'am', 'i', 'the', 'only', 'one', 'of', 'my', 'favorite', 'anime']

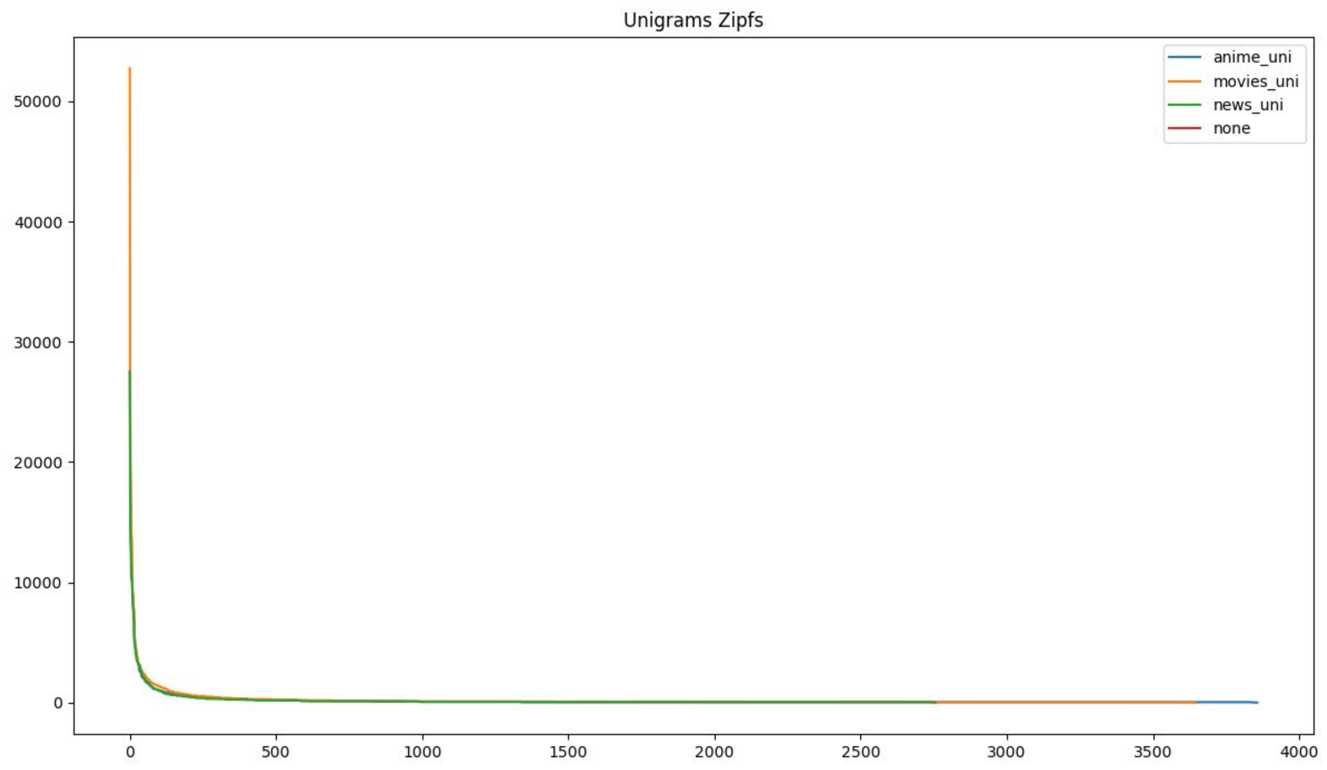
For Bigrams:
['planet', 'but', 'i', 'm', 'not']
['im', 'thoroughly', 'enjoying', 'seeing', 'misaki', 's', 'real', 'personality', 'as', 'well']

Naive Bayes

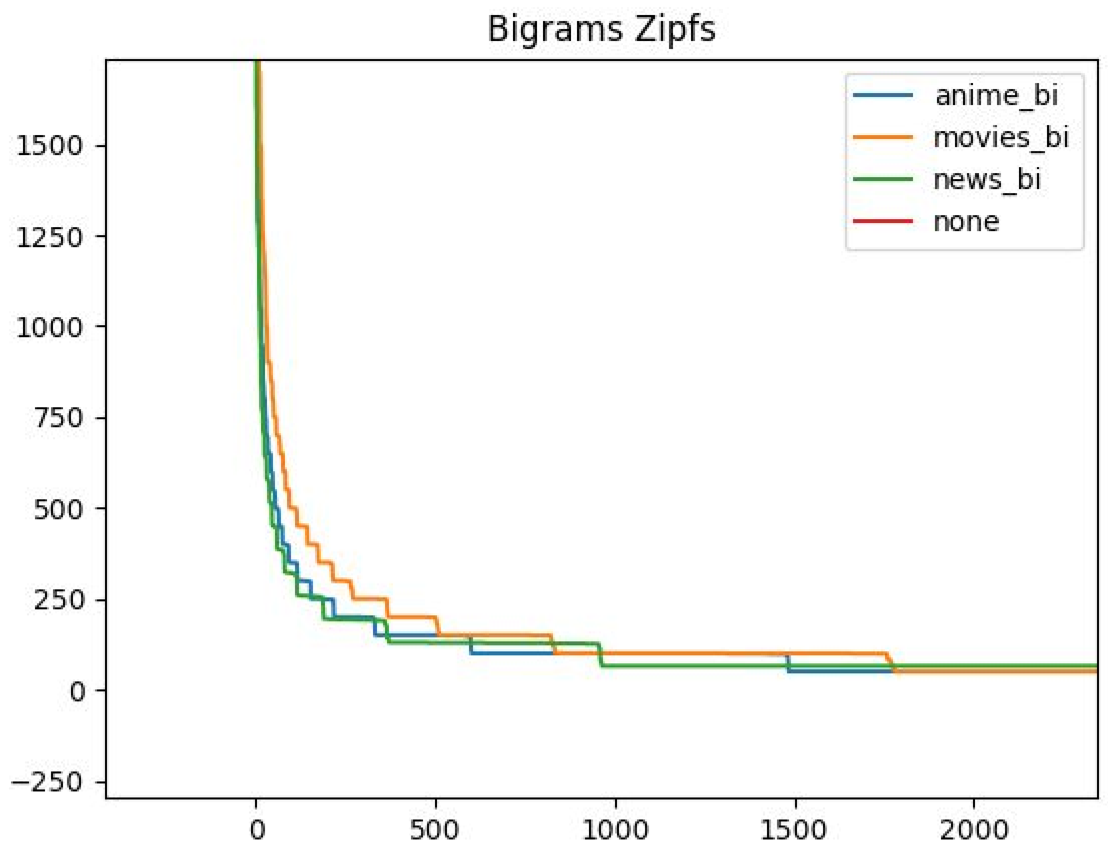
Plot the zipf's curves of all the three sources on one graph. Where do they match ? Where don't they match ?

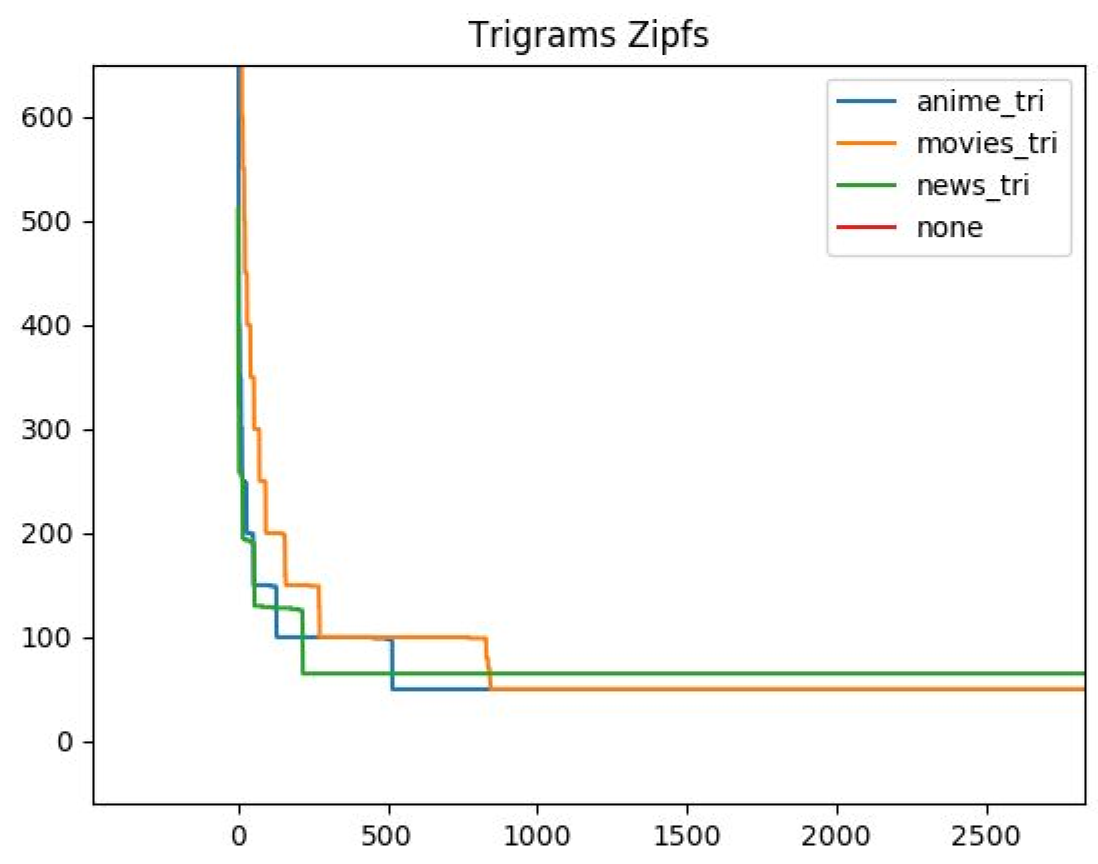


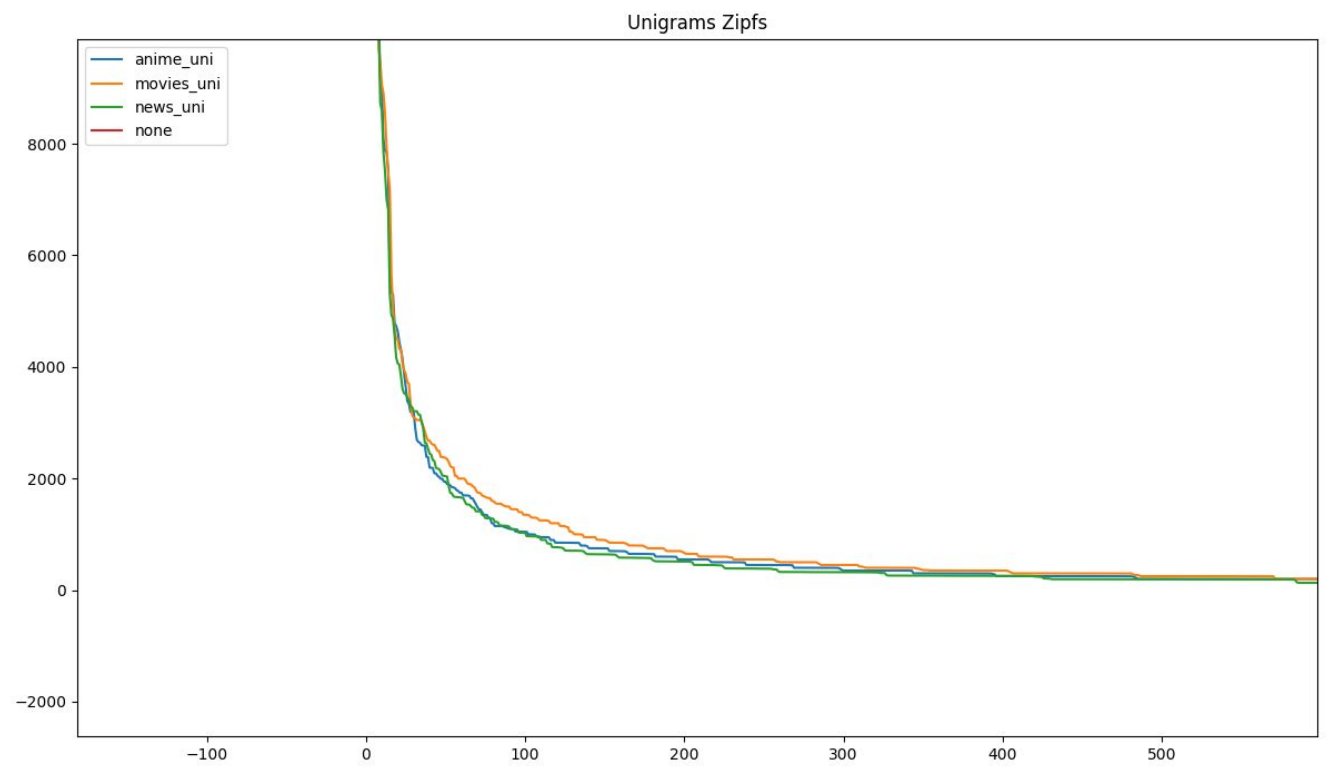




To Clearly view the meeting point I have Zoomed the pictures leading to pictures as below




Trigrams Zipfs
anime_tri
movies_tri
news_tri
none
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500


Unigrams Zipfs
anime_uni
movies_uni
news_uni
none
8000
6000
4000
2000
0
−2000
−100
0
100
200
300
400
500