Report of Locality Sensitivity Hashing

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Task 0:

The following graph depicts the similarity of two input strings using Jaccard Similiarity and MinHash functions. There is about 0.035 difference.

```
Testing minHash generators with two input strings...
Jaccard Similarity is: 0.415041782729805
Minhash estimated similarity is: 0.45
```

Task 1:

The following graph shows the query time, quality of all candidates in terms of Jaccard Similarity and quality of top-10 candidates in terms of Jaccard Similarity. The mean Jaccard Similarity of all URL retrieved is 0.2986. The mean Jaccard Similarity of all top-10 URLs in each candidate set is 0.652058. The query time for this process is 266 seconds. The quality of overall candidates is relatively low. However, by selecting the top-10 candidates, we are able to get a relatively good candidate that's similar to the sample url.

```
Query time = 266.01653027534485
Quality of all candidate urls:
0.29861981741716614
Quality of top 10 candidate urls:
0.6520580854391126
```

Task 2:

The following graph shows the time if we use brute-force way to calculate 200 urls' Jaccard Similarity with other urls in the list. It will take roughly 757 seconds to compute. It is significantly than the query time in task 1.

```
Time of brute-force way of calculating: 757.2964329719543
```

Task 3:

In summary, when the K increases, the quality of all candidate urls increases and the query time decreases significantly. When L increases, the query time increases as well, and the mean of Jaccard similarity decreases.

K is 2, L is 20

Query time = 191.69583082199097 seconds

Quality of all candidate urls: 0.3572813877669406

K is 2, L is 50

Query time = 209.32425022125244 seconds

Quality of all candidate urls: 0.3574632893650256

K is 2, L is 100

Query time = 193.26170682907104 seconds

Quality of all candidate urls: 0.3574632893650256

K is 3, L is 20

Query time = 17.580888986587524 seconds

Quality of all candidate urls: 0.4696390480316102

K is 3, L is 50

Query time = 17.695492029190063 seconds

Quality of all candidate urls: 0.4578114348090657

K is 3, L is 100

Query time = 17.590622901916504 seconds

Quality of all candidate urls: 0.45359489361401195

K is 4, L is 20

Query time = 2.3601620197296143 seconds

Quality of all candidate urls: 0.6114669902295689

K is 4, L is 50

Query time = 2.538541078567505 seconds

Quality of all candidate urls: 0.617855243105583

K is 4, L is 100

Query time = 2.2908742427825928 seconds

Quality of all candidate urls:

0.6166179192125812

K is 5, L is 20

Query time = 0.12875795364379883 seconds

Quality of all candidate urls: 0.7192508691941653

K is 5, L is 50

Query time = 0.13515520095825195 seconds

Quality of all candidate urls: 0.7149573519331667

K is 5, L is 100

Query time = 0.13062214851379395 seconds

Quality of all candidate urls: 0.7108147897310647

K is 6, L is 20

Query time = 0.06156802177429199 seconds

Quality of all candidate urls: 0.796732462596608

K is 6, L is 50

Query time = 0.06453990936279297 seconds

Quality of all candidate urls: 0.7652171829084561

K is 6, L is 100

Query time = 0.06892704963684082 seconds

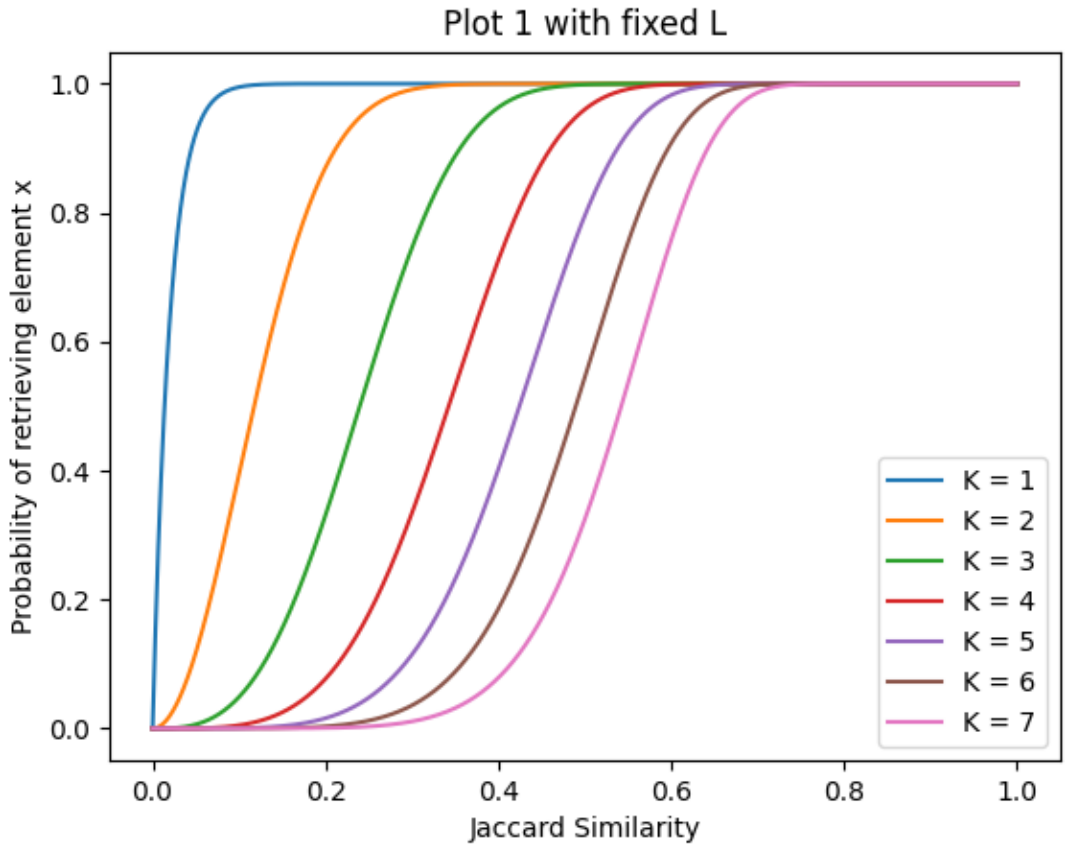
Quality of all candidate urls: 0.7689937785484657

See Task 4 on next page.

Task 4:

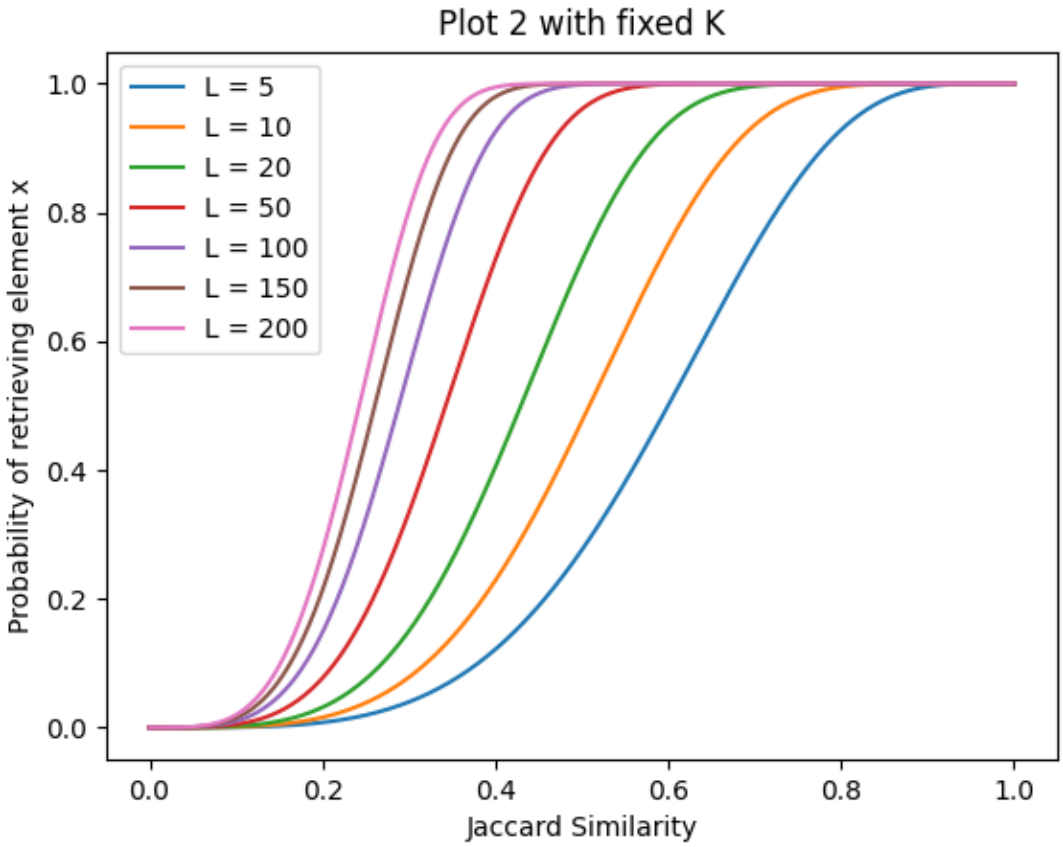
Plot 1:

When K increases, the quality of candidate sets increase as well (less likely to retrieve element with low jaccard similarity).



Plot 2:

When L increases, the quality of candidate sets decrease. However, it is more likely to find the exact match (since we are retrieving from a larger candidate set).


Plot 2 with fixed K
L = 5
L = 10
L = 20
L = 50
L = 100
L = 150
L = 200
Probability of retrieving element x
Jaccard Similarity
0.0
0.2
0.4
0.6
0.8
1.0