

Karthik B 19BAI1076

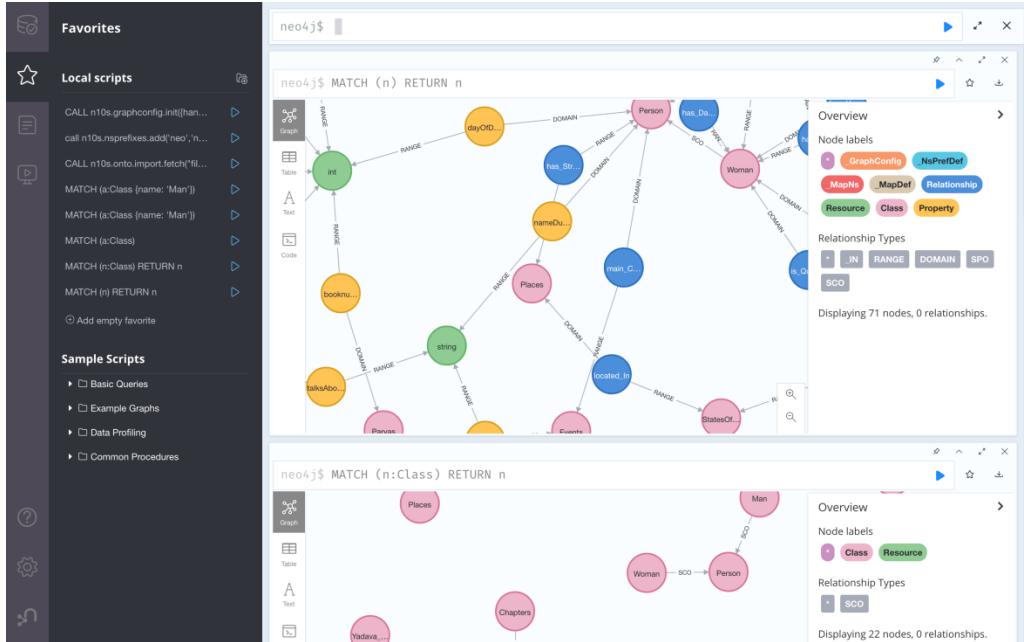
Bharathwaj Murali 19BAI1137

A Simple and Efficient Framework for Identifying Relation-gaps in Ontologies

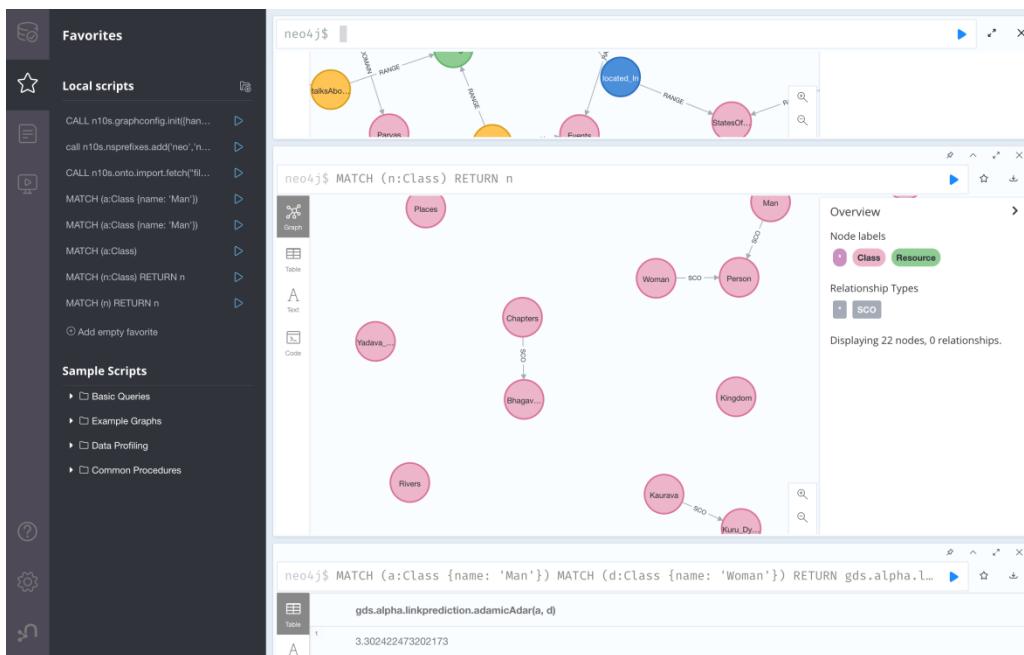
Abstract:

The goal of this project is to find potential pairs of classes that could be connected by an object property but have not yet been connected. Such pairs of classes are called relation-gaps. Relation-Gaps are termed as a link prediction task that is used in graph-based data models, to predict edges that will appear in near future. We propose a simple machine learning framework which exhibits low time complexity and yet gives promising results with respect to both precision as well as number of class-pairs retrieved. This includes a methodology to predict potential pairs of classes which could be connected by object properties but are not yet connected. We take the evidence obtained from external textual resources and their Word2Vec representations can be made use of, for this purpose. Our approach gives results that are complementary to those given by the traditional techniques found in the literature. Hence our method can be used in combination with the traditional techniques for maximum benefits.

Mahabharata Ontology



Classes



Measure of Proximity or Similarity between two nodes

Common Neighbors:

As the name suggests, this measure computes the number of common neighbors that a pair of nodes share.



The screenshot shows the Neo4j Browser interface. On the left, there's a sidebar with 'Favorites' and 'Local scripts'. The 'Local scripts' section contains several items, with the last one, 'MATCH (a:Class {name: 'Man'}) MATCH (d:Class {name: 'Woman'}) RETURN gds.alpha.l...', highlighted. The main window shows the results of running this script. It has a 'Table' view which displays a single row with a value of 3.0. Below the table, it says 'Started streaming 1 records after 23 ms and completed after 5096 ms.'

Adamic Adar:

It computes the sum of the inverse log of the degree of each of the neighbors. The degree of a node is the number of neighbors it has, and the intuition behind this algorithm is that when it comes to closing triangles, nodes of low degree are likely to be more influential.



The screenshot shows the Neo4j Browser interface. The 'Local scripts' sidebar is visible, with the same script as before: 'MATCH (a:Class {name: 'Man'}) MATCH (d:Class {name: 'Woman'}) RETURN gds.alpha.l...'. The results window shows a 'Table' with a single row containing the value 3.302422473202173. It also includes the message 'Started streaming 1 records after 26 ms and completed after 38 ms.'

Measure of Proximity for all classes

The screenshot shows the Neo4j browser interface. On the left, there's a sidebar with 'Favorites' and sections for 'Local scripts' and 'Sample Scripts'. The 'Local scripts' section contains several Cypher queries related to graph configuration and class matching. The main area is a table showing the results of a query:

```

neo4j$ MATCH (a:Class) MATCH (d:Class) RETURN a.name,d.name,gds.alpha.linkprediction.commonNeighbors(a, d), gds.alpha.linkprediction.adamicAdar(a, d)
  
```

	a.name	d.name	gds.alpha.linkprediction.commonNeighbors(a, d)	gds.alpha.linkprediction.adamicAdar(a, d)
1	"Parvas"	"Parvas"	0.0	0.0
2	"Parvas"	"Kingdom"	0.0	0.0
3	"Parvas"	"Deities"	0.0	0.0
4	"Parvas"	"Kaurava"	0.0	0.0
5	"Parvas"	"Shape"	0.0	0.0
6	"Parvas"	"Asura"	0.0	0.0

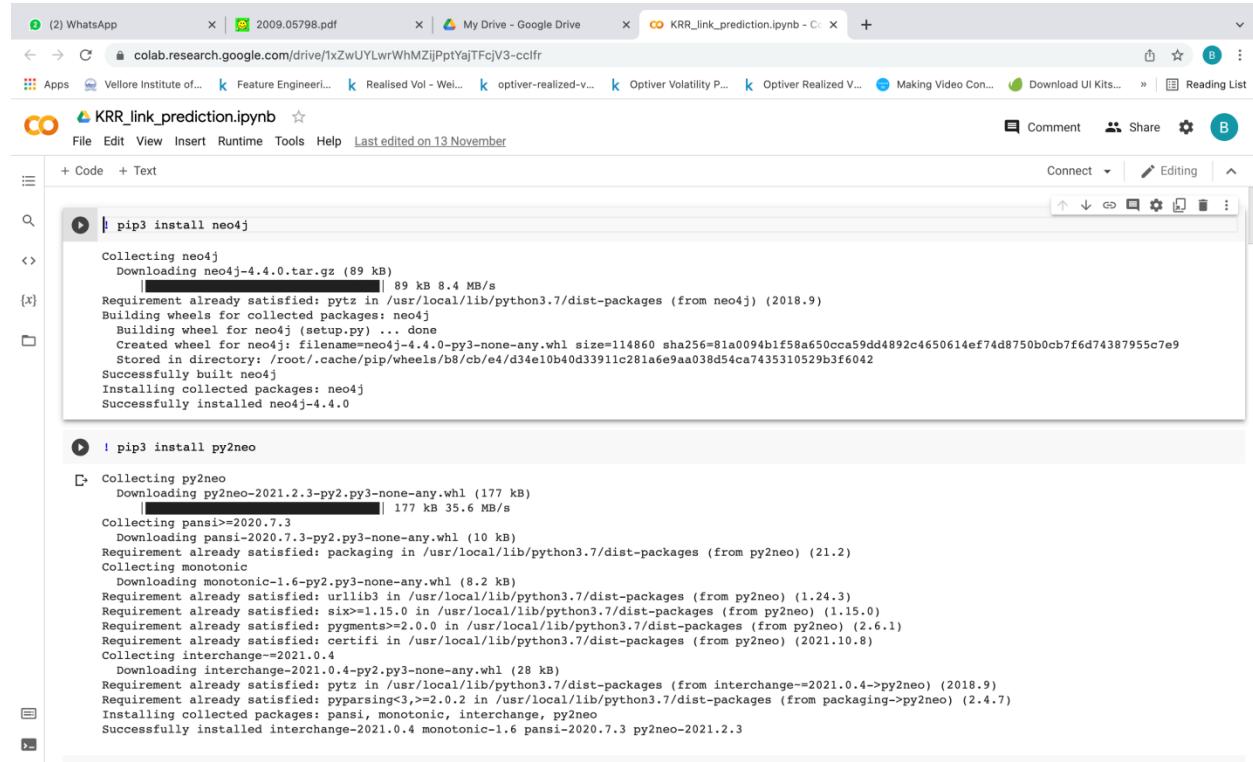
Below the table, a message says: "Started streaming 484 records after 23 ms and completed after 178 ms."

Export as CSV

The screenshot shows a Google Sheets document titled 'Sheet 1'. The table has columns labeled A through H. The first few rows show the schema and some initial data points. The table continues with many more rows of data, representing the proximity measures for various entities.

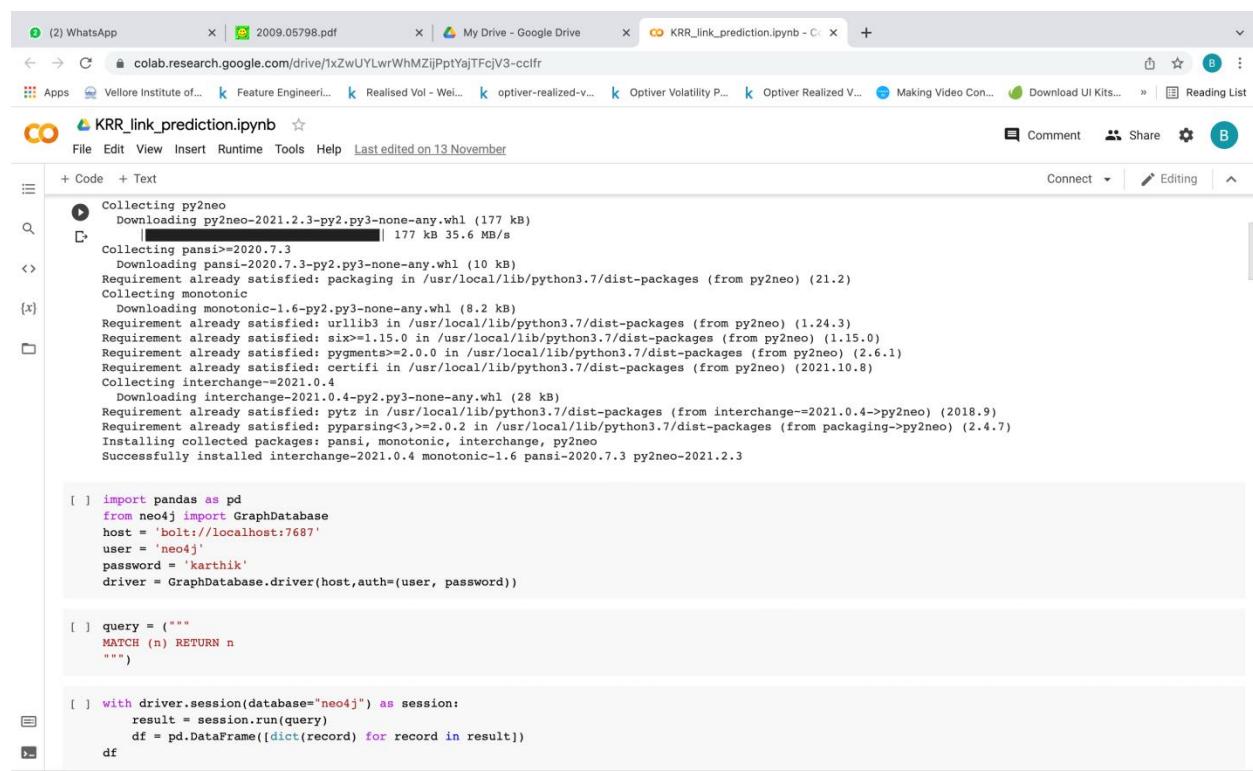
	a.name	d.name	gds.alpha.linkprediction.commonNeighbors(a,d)	gds.alpha.linkprediction.adamicAdar(a,d)	gds.alpha.linkprediction.totalNeighbors(a,d)	gds.alpha.linkprediction.sameCommunity(a,d)	gds.alpha.linkprediction.preferentialAttachment(a,d)	gds.alpha.linkprediction.resourceAllocation(a,d)
1	Parvas	Parvas	0.0	0.0	2.0	0.0	4.0	0.0
2	Parvas	Kingdom	0.0	0.0	8.0	0.0	12.0	0.0
3	Parvas	Deities	0.0	0.0	5.0	0.0	6.0	0.0
4	Parvas	Kaurava	0.0	0.0	3.0	0.0	2.0	0.0
5	Parvas	Shape	0.0	0.0	3.0	0.0	2.0	0.0
6	Parvas	Asura	0.0	0.0	3.0	0.0	2.0	0.0
7	Parvas	Rishi	0.0	0.0	2.0	0.0	0.0	0.0
8	Parvas	Woman	0.0	0.0	10.0	0.0	16.0	0.0
9	Parvas	Person	0.0	0.0	13.0	0.0	22.0	0.0
10	Parvas	Deva	0.0	0.0	3.0	0.0	2.0	0.0
11	Parvas	Pandava	0.0	0.0	3.0	0.0	2.0	0.0
12	Parvas	Bhagavad_Gita	0.0	0.0	3.0	0.0	2.0	0.0
13	Parvas	StatesOfIndia	0.0	0.0	4.0	0.0	4.0	0.0
14	Parvas	Events	1.0	1.442695040888900	4.0	0.0	6.0	0.5
15	Parvas	Places	0.0	0.0	4.0	0.0	4.0	0.0
16	Parvas	Vyaha	0.0	0.0	3.0	0.0	2.0	0.0
17	Parvas	Yadava_Dynasty	0.0	0.0	2.0	0.0	0.0	0.0
18	Parvas	Rivers	0.0	0.0	3.0	0.0	2.0	0.0
19	Parvas	Man	0.0	0.0	10.0	0.0	16.0	0.0
20	Parvas	Chapters	0.0	0.0	5.0	0.0	6.0	0.0
21	Parvas	Traits	0.0	0.0	3.0	0.0	2.0	0.0
22	Parvas	Kuru_Dynasty	0.0	0.0	6.0	0.0	8.0	0.0
23	Kingdom	Parvas	0.0	0.0	8.0	0.0	12.0	0.0
24	Kingdom	Kingdom	0.0	0.0	6.0	0.0	36.0	0.0
25	Kingdom	Deities	0.0	0.0	9.0	0.0	18.0	0.0
26	Kingdom	Kaurava	0.0	0.0	7.0	0.0	6.0	0.0
27	Kingdom	Shape	0.0	0.0	7.0	0.0	6.0	0.0
28	Kingdom	Asura	0.0	0.0	7.0	0.0	6.0	0.0
29	Kingdom	Rishi	0.0	0.0	6.0	0.0	0.0	0.0
30	Kingdom	Woman	2.0	2.885390081777900	12.0	0.0	48.0	1.0
31	Kingdom	Person	0.0	0.0	17.0	0.0	66.0	0.0
32	Kingdom	Deva	0.0	0.0	7.0	0.0	6.0	0.0
33	Kingdom	Pandava	0.0	0.0	7.0	0.0	6.0	0.0
34	Kingdom	Bhagavad_Gita	0.0	0.0	7.0	0.0	6.0	0.0
35	Kingdom	StatesOfIndia	1.0	1.442695040888900	7.0	0.0	12.0	0.5
36	Kingdom	Events	0.0	0.0	8.0	0.0	18.0	0.0
37	Kingdom	Places	0.0	0.0	8.0	0.0	12.0	0.0
38	Kingdom	Vyaha	0.0	0.0	7.0	0.0	6.0	0.0
39	Kingdom	Yadava_Dynasty	0.0	0.0	6.0	0.0	0.0	0.0
40	Kingdom	Rivers	1.0	1.442695040888900	6.0	0.0	6.0	0.5
41	Kingdom	Man	2.0	2.885390081777900	12.0	0.0	48.0	1.0
42	Kingdom	Chapters	0.0	0.0	9.0	0.0	18.0	0.0
43	Kingdom	Traits	0.0	0.0	7.0	0.0	6.0	0.0
44	Kingdom	Kun_Dynasty	0.0	0.0	10.0	0.0	24.0	0.0
45	Deities	Parvas	0.0	0.0	5.0	0.0	6.0	0.0
46	Deities	Kingdom	0.0	0.0	9.0	0.0	18.0	0.0
47	Deities	Deities	0.0	0.0	3.0	0.0	9.0	0.0
48	Deities	Kaurava	0.0	0.0	4.0	0.0	3.0	0.0
49	Deities	Shape	0.0	0.0	4.0	0.0	3.0	0.0
50	Deities	0.0	0.0	0.0	0.0

Linking Neo4j with Google Colab



```
pip3 install neo4j
Collecting neo4j
  Downloading neo4j-4.4.0.tar.gz (89 kB)
    |████████| 89 kB 8.4 MB/s
Requirement already satisfied: pytz in /usr/local/lib/python3.7/dist-packages (from neo4j) (2018.9)
Building wheels for collected packages: neo4j
  Building wheel for neo4j (setup.py) ... done
    Created wheel for neo4j: filename=neo4j-4.4.0-py3-none-any.whl size=114860 sha256=81a0094b1f58a650cca59dd4892c4650614ef74d8750b0cb7f6d74387955c7e9
    Stored in directory: /root/.cache/pip/wheels/b8/cb/e4/d34e10b40d3391lc281a6e9aa038d54ca7435310529b3f6042
Successfully built neo4j
Installing collected packages: neo4j
Successfully installed neo4j-4.0

pip3 install py2neo
Collecting py2neo
  Downloading py2neo-2021.2.3-py2.py3-none-any.whl (177 kB)
    |████████| 177 kB 35.6 MB/s
Collecting pansi>=2020.7.3
  Downloading pansi-2020.7.3-py2.py3-none-any.whl (10 kB)
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages (from py2neo) (21.2)
Collecting monotonic
  Downloading monotonic-1.6-py2.py3-none-any.whl (8.2 kB)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from py2neo) (1.24.3)
Requirement already satisfied: six!=1.15.0 in /usr/local/lib/python3.7/dist-packages (from py2neo) (1.15.0)
Requirement already satisfied: pygments>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from py2neo) (2.6.1)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from py2neo) (2021.10.8)
Collecting interchange->2021.0.4
  Downloading interchange-2021.0.4-py2.py3-none-any.whl (28 kB)
Requirement already satisfied: pytz in /usr/local/lib/python3.7/dist-packages (from interchange->2021.0.4->py2neo) (2018.9)
Requirement already satisfied: pyarsing<3,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packaging->py2neo) (2.4.7)
Installing collected packages: pansi, monotonic, interchange, py2neo
Successfully installed interchange-2021.0.4 monotonic-1.6 pansi-2020.7.3 py2neo-2021.2.3
```



```
[ ] import pandas as pd
from neo4j import GraphDatabase
host = 'bolt://localhost:7687'
user = 'neo4j'
password = 'karthik'
driver = GraphDatabase.driver(host, auth=(user, password))

[ ] query = """
MATCH (n) RETURN n
"""

[ ] with driver.session(database="neo4j") as session:
    result = session.run(query)
    df = pd.DataFrame([dict(record) for record in result])
df
```

GloVe Embedding

```
[ ] import os
import urllib.request
import matplotlib.pyplot as plt
from scipy import spatial
from sklearn.manifold import TSNE
import numpy as np

[ ] urllib.request.urlretrieve('https://nlp.stanford.edu/data/glove.6B.zip', 'glove.6B.zip')

[ ] from google.colab import drive
drive.mount('/content/drive')

Mounted at /content/drive

[ ] !unzip "/content/glove.6B.zip" -d "/content/"

Archive: /content/glove.6B.zip
inflating: /content/glove.6B.50d.txt
inflating: /content/glove.6B.100d.txt
inflating: /content/glove.6B.200d.txt
inflating: /content/glove.6B.300d.txt

[ ] emmbed_dict = {}
with open('/content/glove.6B.200d.txt','r') as f:
    for line in f:
        values = line.split()
        word = values[0]
        vector = np.asarray(values[1:], 'float32')
        emmbed_dict[word]=vector
```

```
[ ] word = values[0]
vector = np.asarray(values[1:], 'float32')
emmbed_dict[word]=vector

[ ] def find_similar_word(emmbedes):
    nearest = sorted(emmbded_dict.keys(), key=lambda word: spatial.distance.euclidean(emmbded_dict[word], emmbedes))
    return nearest

[ ] find_similar_word(emmbded_dict['river'])[0:10]

['river',
 'rivers',
 'tributary',
 'confluence',
 'creek',
 'along',
 'tributaries',
 'valley',
 'flows',
 'danube']

[ ] find_similar_word(emmbded_dict['parva'] + emmbded_dict['kaurava'])[0:10]

['parva',
 'kaurava',
 'bhishma',
 'pandava',
 'mahabbhara',
 'thornham',
 'karna',
 'kauravas',
 'duryodhana',
 'mahabharata']
```

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mahtrain2.ipynb

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emmbed_dict['parva']

```
array([[ 0.052372, -0.073249,  0.54317,  0.77166,  0.26027,
       0.31328,  0.10696, -0.21406, -0.42988, -0.36084,
       0.08621,  0.041889,  0.11485, -0.56057,  0.081475,
      -0.55094, -0.0013465, -0.068466, -0.54215,  0.39124,
      -0.02743, -0.55813,  0.46773, -0.28278,  0.1125,
      -0.43499,  0.033575,  0.030307,  0.44102, -0.22467,
      -0.52963,  0.50628, -1.0513,  0.31944,  0.3795,
      0.44105,  0.36506,  0.10485, -0.13882, -0.36718,
      -0.44109, -0.49471, -0.66257, -0.19849,  0.71579,
      0.3712,  0.09054,  1.0606,  0.15619,  0.093396,
      0.49391,  0.42068,  1.2107,  0.5097, -0.081617,
      0.57774, -0.42948, -0.031579,  0.027088,  0.06845,
      0.094691,  0.049382,  0.2596, -0.28876, -0.65507,
      -0.43972, -0.54992, -0.28109, -0.42191,  0.02875,
      0.13087, -0.06301, -0.36436,  0.46947, -0.089693,
      0.01574,  0.05616, -0.16567, -0.01153, -0.29869,
      0.99177, -0.16273, -0.4931,  0.87034, -0.080702,
      0.29727,  0.07809,  1.0823, -1.1301,  1.064,
      0.44866, -0.15017,  0.76523, -0.47895,  0.76238,
      -0.046897, -0.1358, -0.7034,  0.069812,  0.17584,
      -0.18132,  0.91645,  0.59529,  0.23569, -0.47709,
      0.14285, -0.74953, -0.61911,  0.97506,  0.080631,
      0.63495,  0.84459, -0.13915, -0.10619, -0.20864,
      0.080774,  0.12864, -0.35843,  0.62044, -0.059513,
      0.53423, -0.46728, -0.87762, -0.78261, -0.96135,
      0.19782,  0.99603,  0.13789,  0.021371, -0.089737,
      -0.53195, -0.0026336, -0.65259,  0.14382,  0.24707,
      -0.47734, -0.32945,  0.33254, -0.65554,  0.21047,
      0.12207,  0.087162, -0.099307, -0.31054, -0.5406,
      0.045137, -0.18106, -0.035845,  0.095216,  0.4449,
      -0.44309, -0.13923, -0.75516, -0.13535,  0.75231,
      0.31005, -0.43234, -0.11228,  0.40591,  0.34363,
      -0.0031507, -0.21404,  0.3536, -0.092981,  0.55814,
      -0.018919,  0.1467,  0.17519,  0.42463, -0.12036,
      0.36107,  0.026772,  0.02404,  0.07085,  0.51244]]
```

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colab.research.google.com/drive/17SyxXprgFMSqbw_ZMyXVPtIIEpKPJPFQ#scrollTo=d4udSjs760T3

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mahtrain2.ipynb

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a = "yadava"

```
#orig = st.stem(a)
#dest = st.stem(d)
print(a)
print(d)

try:
    euc_dist = np.add(euc_dist, spatial.distance.euclidean(emmbed_dict[a], emmbed_dict[d]))
    #x = spatial.distance.euclidean(emmbed_dict[a], emmbed_dict[d])
    cosine = 1 - spatial.distance.cosine(emmbed_dict[a], emmbed_dict[d])
    cos[i] = cosine
    #euc_dist[i] = x
    #start[i] = emmbed_dict[a]
    #end[i] = emmbed_dict[d]
    #np.append(euc_dist, x, axis = None)
    print(cosine)
    #print(start[i])
    #print(end[i])
except:
    pass
```

parva
parva
1.0
parva
Kingdom
-0.12920942902565002
parva
deities
0.09014522284269333
parva
kaurava
0.1676744520664215
parva
shape
-0.185008700016174

The screenshot shows a Jupyter Notebook interface with the file 'mahtrain2.ipynb' open. The code cell contains a list of names and their corresponding cosine similarity scores:

```
+ Code + Text
[ ] gloveOut = pd.DataFrame(cos, columns=['gloveOut'])
[ ] gloveOut
```

	gloveOut
0	1.000000
1	-0.129209
2	0.090145
3	0.167674
4	-0.140580
...	...
479	0.034214
480	-0.076911
481	-0.029307
482	-0.029313
483	1.000000

484 rows × 1 columns

```
[ ] gloveOut.to_csv('/content/drive/MyDrive/KRR_Project/gloveOut1.csv')
[ ] mahtrain2 = pd.concat([train, gloveOut], axis=1)
```

The screenshot shows a Jupyter Notebook interface with the file 'mahtrain2.ipynb' open. The code cell contains a list of names and their corresponding cosine similarity scores, with the 'gloveOut' column added to the 'train' DataFrame:

```
+ Code + Text
[ ] gloveOut = pd.DataFrame(cos, columns=['gloveOut'])
[ ] gloveOut
```

	gloveOut
0	1.000000
1	-0.129209
2	0.090145
3	0.167674
4	-0.140580
...	...
479	0.034214
480	-0.076911
481	-0.029307
482	-0.029313
483	1.000000

484 rows × 1 columns

```
[ ] gloveOut.to_csv('/content/drive/MyDrive/KRR_Project/gloveOut1.csv')
[ ] mahtrain2 = pd.concat([train, gloveOut], axis=1)
```

SVM Model

The image shows two screenshots of a Google Colab notebook titled "RelationGap.ipynb".

Top Screenshot: This screenshot shows a table of data being processed. The columns are labeled "gds.alpha.linkprediction.commonNeighbors(a, d)", "gds.alpha.linkprediction.adamicAdar(a, d)", and "gloveOut". The rows are indexed from 0 to 316. The data includes numerical values such as 0.0, 1.0, and 2.0.

	gds.alpha.linkprediction.commonNeighbors(a, d)	gds.alpha.linkprediction.adamicAdar(a, d)	gloveOut
0	0.0	0.000000	1.000000
1	0.0	0.000000	-0.129209
2	0.0	0.000000	0.090145
3	0.0	0.000000	0.167674
4	0.0	0.000000	-0.140580
5	0.0	0.000000	0.210667
6	0.0	0.000000	0.168444
7	0.0	0.000000	-0.152072
8	2.0	0.975143	-0.155621
9	0.0	0.000000	0.188431
13	1.0	1.442695	-0.190751
34	1.0	1.442695	0.000000
155	3.0	3.275261	0.227884
172	4.0	3.633796	0.752009
183	2.0	1.300110	0.671338
189	2.0	2.000806	0.379231
194	2.0	1.300110	0.691708
316	1.0	1.442695	0.463611

Bottom Screenshot: This screenshot shows a code cell for an SVM model. It imports SVC from sklearn.svm, imports accuracy_score from sklearn.metrics, instantiates an SVC classifier, fits it to the training data, and then makes predictions on the test data. The output shows a DataFrame of predictions where all values are False.

```
[ ] from sklearn.svm import SVC
[ ] # import metrics to compute accuracy
[ ] from sklearn.metrics import accuracy_score
[ ] # instantiate classifier with default hyperparameters
[ ] svc=SVC()
[ ] 
[ ] # fit classifier to training set
[ ] svc.fit(X_train,y_train)
[ ] SVC()
[ ] 
[ ] y_pred=svc.predict(X_test)
[ ] /usr/local/lib/python3.7/dist-packages/sklearn/base.py:439: UserWarning: X has feature names, but SVC was fitted without feature names
[ ]   f'X has feature names, but {self._class_.__name__} was fitted without'
[ ] 
[ ] y1 = pd.DataFrame(y_pred)
[ ] 
[ ] y1
```

0	1	2	3
False	False	False	False

Results

The output we should get

Objective: To find the relation-gaps in Mahabharata Ontology						
Class-pairs generated by the proposed approach		Manual Evaluations				
Class1	Class2	Evaluator 1	Evaluator 2	Evaluator 3	Consolidated	
mhb:Traits	mhb:Man	✓	✓	✓	✓	
mhb:Events	mhb:Man	✓	✓	✓	✓	
mhb:Deva	mhb:Deva	✓	✓	✓	✓	
mhb:Pandava	mhb:Pandava	✓	✓	✓	✓	
mhb:StatesOfIndia	mhb:StatesOfIndia	✓	✓	✓	✓	
mhb:Woman	mhb:Woman	✓	✓	✓	✓	
mhb:Pandava	mhb:Kaurava	✓	✓	✓	✓	
mhb:Rivers	mhb:Woman	✗	✓	✓	✓	
mhb:Traits	mhb:Events	✗	✗	✓	✗	
mhb:Rivers	mhb:Man	✗	✓	✓	✓	
mhb:Events	mhb:Places	✓	✓	✓	✓	
mhb:Chapters	mhb:Chapters	✓	✓	✓	✓	
mhb:Places	mhb:Shape	✓	✓	✓	✓	
mhb:Shape	mhb:Person	✓	✓	✓	✓	
mhb:Person	mhb:Kingdom	✓	✓	✓	✓	
mhb:Kingdom	mhb:Kingdom	✓	✓	✓	✓	
mhb:Deities	mhb:Deities	✓	✓	✓	✓	
mhb:Events	mhb:Woman	✓	✓	✓	✓	
mhb:Kaurava	mhb:Kaurava	✓	✓	✓	✓	
mhb:Places	mhb:Places	✓	✓	✓	✓	
mhb:Yadava_Dynasty	mhb:Yadava_Dynasty	✓	✓	✓	✓	

Our Output

a.name	d.name	gds.alpha.linkprediction.commonNeighbors(d, d)	label	Unnamec.0	gloveOut	j
8	Panas	Chapters	1.0	0.417032391424140	FALSE	19
12	Panas	Kuru_Dynasty	1.0	0.417032391424140	FALSE	21
20	Kingdom	Woman	3.0	3.279615272029210	FALSE	29
21	Kingdom	Person	2.0	0.79142402005500	FALSE	30
24	Kingdom	Places	1.0	0.72134750444400	FALSE	36
27	Kingdom	Rivers	1.0	1.42695040889600	FALSE	39
30	Kingdom	Man	3.0	3.279615272029210	FALSE	40
64	Kaurava	Pandava	1.0	0.58811060551410	FALSE	76
93	Shape	Vyaya	1.0	1.42695040889600	FALSE	103
109	Asura	Deva	1.0	0.910299209009370	FALSE	119
151	Woman	Person	2.0	1.300110471871200	FALSE	162
155	Woman	StatesOfIndia	1.0	0.402429604381840	FALSE	166
156	Woman	Events	1.0	0.34597620261940	FALSE	167
157	Woman	Places	1.0	0.34597620261940	FALSE	168
160	Woman	Rivers	1.0	0.402429604381840	FALSE	171
162	Woman	Traits	1.0	0.34597620261940	FALSE	174
164	Woman	Parvas	2.0	0.97514301797490	FALSE	176
165	Person	Kingdom	2.0	0.79742402005600	FALSE	177
175	Person	StatesOfIndia	1.0	0.72134750444800	FALSE	188
176	Person	Places	1.0	1.42695040889600	FALSE	190
180	Person	Chapters	2.0	0.97514301797490	FALSE	195
181	Person	Traits	1.0	1.42695040889600	FALSE	196
182	Person	Kuru_Dynasty	1.0	0.417032391424140	FALSE	197
188	Deva	Asura	1.0	0.910299209009370	FALSE	203
208	Pandava	Kaurava	1.0	0.58811060551410	FALSE	223
250	StatesOfIndia	Kingdom	1.0	1.42695040889600	FALSE	265
258	StatesOfIndia	Woman	1.0	0.402429604381840	FALSE	271
257	StatesOfIndia	Person	1.0	0.72134750444800	FALSE	272
263	StatesOfIndia	Places	1.0	1.42695040889600	FALSE	278
266	StatesOfIndia	Rivers	1.0	0.402429604381840	FALSE	281
267	StatesOfIndia	Man	1.0	0.402429604381840	FALSE	282

Totally they predicted 20 classes that could be connected in the given paper. We got all 20 of those outputs. In extra to that, we also got these nodes that could be connected in the following pictures.

Shape - Vyuh

	a.name	d.name	gds.alpha.linkprediction.commonNeighbors(a, d)	gds.alpha.linkprediction.adamicAdar(a, d)	label	Unnamed: 0	gloveOut	0	
10	8 Parvas	Chapters	1.0	0.4170323914242460	FALSE	19	0.16173787415027600	TRUE	0
12	10 Parvas	Kuru, Dynasty	1.0	0.4170323914242460	FALSE	21	0.275474686974380	TRUE	0
20	18 Kingdom	Woman	3.0	3.27592132702910	FALSE	29	0.2278842478905060	TRUE	0
21	19 Kingdom	Person	2.0	0.7797425005250560	FALSE	30	0.241272378757400	TRUE	1
24	24 Kingdom	Places	1.0	0.721347520444820	FALSE	36	0.377657051199669	TRUE	1
29	27 Kingdom	Rivers	1.0	1.442695040888960	FALSE	39	0.18306365341003100	TRUE	0
38	28 Kingdom	Man	3.0	3.27592132702910	FALSE	40	0.25029987196214	TRUE	0
66	64 Kaurava	Pandava	1.0	0.5581102655512470	FALSE	76	0.5821722149848940	TRUE	1
93	91 Shape	Vyuh	1.0	1.442695040888960	FALSE	103	0.0	TRUE	0
109	107 Asura	Deva	1.0	0.910283262698370	FALSE	119	0.348520697116850	TRUE	0
151	141 Woman	Person	2.0	1.30010417871200	FALSE	162	0.6713380813598630	TRUE	1
155	153 Woman	StatesOfIndia	1.0	0.4024290403818450	FALSE	166	0.0	TRUE	1
156	154 Woman	Events	1.0	0.3497925262611940	FALSE	167	0.2289743721485140	TRUE	1
157	155 Woman	Places	1.0	0.3497925262611940	FALSE	168	0.334688747406010	TRUE	1
160	156 Woman	Rivers	1.0	0.4024290403818450	FALSE	171	0.13192442059516900	TRUE	1
162	158 Woman	Traits	1.0	0.3497925262611940	FALSE	174	0.1691269269240700	TRUE	1
164	162 Person	Parvas	2.0	0.975140319754940	FALSE	176	-0.15560261965465500	TRUE	1
165	162 Person	Kingdom	2.0	0.7797424905025600	FALSE	177	0.2411272378757400	TRUE	1
175	172 Person	StatesOfIndia	1.0	0.721347520444820	FALSE	188	0.0	TRUE	1
176	174 Person	Places	1.0	1.442695040888960	FALSE	190	0.4636110365397080	TRUE	0
180	173 Person	Chapters	2.0	0.971451017954940	FALSE	195	0.1871104904058700	TRUE	0
181	175 Person	Traits	1.0	1.442695040888960	FALSE	196	0.3180263042449950	TRUE	0
182	180 Person	Kuru, Dynasty	1.0	0.4170323914242460	FALSE	197	-0.01085731981848	TRUE	0
188	186 Deva	Asura	1.0	0.910283262698370	FALSE	203	0.348520697116850	TRUE	0
208	206 Pandava	Kaurava	1.0	0.5581102655512470	FALSE	223	0.5821722149848940	TRUE	1
250	248 StatesOfIndia	Kingdom	1.0	1.442695040888960	FALSE	265	0.0	TRUE	1
256	254 StatesOfIndia	Woman	1.0	0.4024290403818450	FALSE	271	0.0	TRUE	1
257	255 StatesOfIndia	Person	1.0	0.721347520444820	FALSE	272	0.0	TRUE	1
263	261 StatesOfIndia	Places	1.0	1.442695040888960	FALSE	278	0.0	TRUE	0

Asura – Deva

	a.name	d.name	gds.alpha.linkprediction.commonNeighbors(a, d)	gds.alpha.linkprediction.adamicAdar(a, d)	label	Unnamed: 0	gloveOut	0	
10	8 Parvas	Chapters	1.0	0.4170323914242460	FALSE	19	0.16173787415027600	TRUE	0
12	10 Parvas	Kuru, Dynasty	1.0	0.4170323914242460	FALSE	21	0.275474686974380	TRUE	0
20	18 Kingdom	Woman	3.0	3.27592132702910	FALSE	29	0.2278842478905060	TRUE	0
21	19 Kingdom	Person	2.0	0.7797425005250560	FALSE	30	0.241272378757400	TRUE	1
24	24 Kingdom	Places	1.0	0.721347520444820	FALSE	36	0.377657051199669	TRUE	1
29	27 Kingdom	Rivers	1.0	1.442695040888960	FALSE	39	0.18306365341003100	TRUE	0
38	28 Kingdom	Man	3.0	3.27592132702910	FALSE	40	0.25029987196214	TRUE	1
66	64 Kaurava	Pandava	1.0	0.5581102655512470	FALSE	76	0.5821722149848940	TRUE	1
93	91 Shape	Vyuh	1.0	1.442695040888960	FALSE	103	0.0	TRUE	0
109	107 Asura	Deva	1.0	0.910283262698370	FALSE	119	0.348520697116850	TRUE	0
151	141 Woman	Person	2.0	1.30010417871200	FALSE	162	0.6713380813598630	TRUE	1
155	153 Woman	StatesOfIndia	1.0	0.4024290403818450	FALSE	166	0.0	TRUE	1
156	154 Woman	Events	1.0	0.3497925262611940	FALSE	167	0.2289743721485140	TRUE	1
157	156 Woman	Places	1.0	0.3497925262611940	FALSE	168	0.334688747406010	TRUE	1
160	158 Woman	Rivers	1.0	0.4024290403818450	FALSE	171	0.1319242059519500	TRUE	1
162	160 Woman	Traits	1.0	0.3497925262611940	FALSE	174	0.1691269269240700	TRUE	1
164	162 Person	Parvas	2.0	0.975140319754940	FALSE	175	-0.15560261965465500	TRUE	1
165	162 Person	Kingdom	2.0	0.7797424905025600	FALSE	177	0.2411272378757400	TRUE	1
175	172 Person	StatesOfIndia	1.0	0.721347520444820	FALSE	188	0.0	TRUE	1
176	174 Person	Places	1.0	1.442695040888960	FALSE	190	0.4636110365397080	TRUE	0
180	173 Person	Chapters	2.0	0.971451017954940	FALSE	195	0.1871104904058700	TRUE	0
181	175 Person	Traits	1.0	1.442695040888960	FALSE	196	0.3180263042449950	TRUE	0
182	180 Person	Kuru, Dynasty	1.0	0.4170323914242460	FALSE	197	-0.01085731981848	TRUE	0
188	186 Deva	Asura	1.0	0.910283262698370	FALSE	203	0.348520697116850	TRUE	0
208	206 Pandava	Kaurava	1.0	0.5581102655512470	FALSE	223	0.5821722149848940	TRUE	1
250	248 StatesOfIndia	Kingdom	1.0	1.442695040888960	FALSE	265	0.0	TRUE	1
256	254 StatesOfIndia	Woman	1.0	0.4024290403818450	FALSE	271	0.0	TRUE	1
257	255 StatesOfIndia	Person	1.0	0.721347520444820	FALSE	272	0.0	TRUE	1
263	261 StatesOfIndia	Places	1.0	1.442695040888960	FALSE	278	0.0	TRUE	0

Proof of relationship between Asura and Deva:

Google search results for "how are asuras and devas related in mahabharata":

About 4,42,000 results (0.46 seconds)

During this battle between good and evil, creation and destruction, some powerful **Asuras** side with the good and are called Devas, other powerful Asuras side with the evil and thereafter called Asuras.

<https://en.wikipedia.org/w/index.php?title=Asura&oldid=9581958>

People also ask :

- How are devas and asuras related?
- Are asuras and devas brothers?
- Who is the father of devas and asuras?
- Are rakshasas and asuras same?

https://en.wikipedia.org/w/index.php?title=List_of_Asuras&oldid=9581958

List of Asuras - Wikipedia

Asuras (Sanskrit: असुर) are a class of beings or power-seeking clans related to the more benevolent Devas (also known as Suras) in Hinduism. ... Alāmbāsa - A powerful asura in...

StatesOfIndia- Places

The screenshot shows a Numbers spreadsheet titled "out7" with 461 rows of data. The columns are labeled A through J. The data includes various numerical values and some descriptive text. A sidebar on the right provides options for styling the table, including table styles, table options, headers & footer, rows, columns, and gridlines.

A	B	C	D	E	F	G	H	I	J
1.0	0.349792562611940	FALSE	167	0.2289743721485140	TRUE	1			
1.0	0.349792562611940	FALSE	168	0.334688747406010	TRUE	1			
1.0	0.402429040818450		171	0.13192442059516900	TRUE	1			
1.0	0.349792562611940	FALSE	174	0.1692652982940700	TRUE	1			
2.0	0.97514017954940	FALSE	176	-0.156206196546500	TRUE	1			
2.0	0.7797423902505000	FALSE	177	0.24112723787757400	TRUE	1			
1.0	0.73134730444820	FALSE	188	0.0	TRUE	1			
1.0	1.442895040886900	FALSE	190	0.463011036390780	TRUE	0			
2.0	0.97514017954940	FALSE	195	0.1711040914059700	TRUE	0			
1.0	1.442895040886900	FALSE	196	0.18628304244950	TRUE	0			
1.0	0.41703291434400	FALSE	197	-0.09108571981848	TRUE	0			
1.0	0.91023926260370	FALSE	203	0.348502099116650	TRUE	0			
1.0	0.5591103695511470	FALSE	223	0.062172249848940	TRUE	1			
1.0	1.442895040886900	FALSE	265	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	271	0.0	TRUE	1			
1.0	0.72134730444820	FALSE	272	0.0	TRUE	1			
1.0	1.442895040886900	FALSE	278	0.0	TRUE	0			
1.0	0.402429040818450	FALSE	281	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	282	0.0	TRUE	1			
1.0	1.442895040886900	FALSE	286	-0.19075087523272700	TRUE	0			
1.0	0.349792562611940	FALSE	293	0.2289743721485140	TRUE	1			
2.0	2.000805671402100	FALSE	294	0.3792311874209800	TRUE	0			
1.0	0.349792562611940	FALSE	300	0.457011980472240	TRUE	1			
1.0	0.349792562611940	FALSE	304	0.230756283355710	TRUE	1			
1.0	0.5591103695511470	FALSE	305	0.332125763271330	TRUE	0			
1.0	0.349792562611940	FALSE	306	0.140890323543550	TRUE	1			
1.0	0.72134730444820	FALSE	309	0.377457011099680	TRUE	1			
1.0	0.349792562611940	FALSE	315	0.334688747406010	TRUE	1			
1.0	0.349792562611940	FALSE	321	0.457011980472240	TRUE	1			
1.0	0.349792562611940	FALSE	326	0.355402529296550	TRUE	1			
1.0	0.349792562611940	FALSE	328	0.165978568121110	TRUE	1			
1.0	0.402429040818450	FALSE	381	0.13192442059516900	TRUE	1			
1.0	0.402429040818450	FALSE	382	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	383	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	384	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	385	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	386	0.0	TRUE	1			
1.0	0.402429040818450	FALSE	387	0.0	TRUE	1			

Events -Chapters

This screenshot shows a Numbers spreadsheet titled "out7 - Edited". The table has columns A through J. Row 175 contains the header: "175 174 Person StatesOfIndia", "1.0", "0.721347520444820", "FALSE", "188", "0.0", "TRUE", "1". Rows 176 through 299 contain data for various entities like Person, Places, Rivers, etc., with their respective traits and values. The last row (299) is highlighted in green. The sidebar on the right shows "Table Styles" and "Table Options" (Title checked). The status bar at the bottom shows "SUM 594.890235803" and "AVERAGE 99.14837265".

A	B	C	D	E	F	G	H	I	J	
175	174	Person	StatesOfIndia	1.0	0.721347520444820	FALSE	188	0.0	TRUE	1
176	174	Person	Places	1.0	1.442695040888960	FALSE	190	0.463611036939078	TRUE	0
180	174	Person	Chapters	2.0	0.975143017975490	FALSE	195	0.187110409140570	TRUE	0
181	174	Person	Traits	1.0	1.442695040888960	FALSE	196	0.318026304244995	TRUE	0
182	184	Person	Kuru_Dynasty	1.0	0.4170323914242460	FALSE	197	-0.091085731831848	TRUE	0
188	184	Deva	Asura	1.0	0.91023929269268370	FALSE	203	0.348502067111865	TRUE	0
208	204	Pandava	Kaurava	1.0	0.5581106205512470	FALSE	223	0.582172214848940	TRUE	1
250	244	StatesOf	Kingdom	1.0	1.442695040888960	FALSE	205	0.0	TRUE	1
256	224	StatesOf	Woman	1.0	0.424249043818450	FALSE	271	0.0	TRUE	1
257	224	StatesOf	Person	1.0	0.721347520444820	FALSE	272	0.0	TRUE	1
263	261	StatesOf	Places	1.0	1.442695040888960	FALSE	278	0.0	TRUE	0
266	264	StatesOf	Rivers	1.0	0.402429043818450	FALSE	281	0.0	TRUE	1
267	264	StatesOf	Man	1.0	0.402429043818450	FALSE	282	0.0	TRUE	1
271	274	Events	Parvas	1.0	1.442695040888960	FALSE	286	-0.19070508752372700	TRUE	0
278	274	Events	Woman	1.0	0.3459762562611940	FALSE	293	0.228947371481140	TRUE	1
279	274	Events	Person	2.0	2.0000805671442010	FALSE	294	0.37923118472099300	TRUE	0
285	284	Events	Places	1.0	0.3459762562611940	FALSE	300	0.4570115804672240	TRUE	1
289	284	Events	Man	1.0	0.3459762562611940	FALSE	304	0.2303752823595710	TRUE	1
290	284	Events	Chapters	1.0	0.5581106205512470	FALSE	305	0.331252763271330	TRUE	0
291	288	Events	Traits	1.0	0.3459762562611940	FALSE	308	0.1409990325343500	TRUE	1
294	264	Places	Kingdom	1.0	0.721347520444820	FALSE	309	0.3778457011699680	TRUE	1
300	264	Places	Woman	1.0	0.3459762562611940	FALSE	315	0.334688747400010	TRUE	1
304	304	Places	Events	1.0	0.3459762562611940	FALSE	321	0.4570115804672240	TRUE	1
309	307	Places	Man	1.0	0.3459762562611940	FALSE	326	0.3554025292396550	TRUE	1
311	304	Places	Traits	1.0	0.3459762562611940	FALSE	328	0.169975658121110	TRUE	1
312	304	Rivers	Woman	1.0	0.424249043818450	FALSE	381	0.13192442059516900	TRUE	1
367	366	Rivers	StatesOfIndia	1.0	0.424249043818450	FALSE	386	0.0	TRUE	1
373	371	Rivers	Man	1.0	0.424249043818450	FALSE	392	0.188972353935240	TRUE	1
383	381	Man	Person	2.0	1.3001104718781200	FALSE	404	0.891707968711853	TRUE	1
387	381	Man	StatesOfIndia	1.0	0.424249043818450	FALSE	408	0.0	TRUE	1
388	386	Man	Events	1.0	0.3459762562611940	FALSE	409	0.2303752823595710	TRUE	1
389	386	Man	Places	1.0	0.3459762562611940	FALSE	410	0.3554025292396550	TRUE	1
395	390	Man	Traits	1.0	0.3459762562611940	FALSE	416	0.165308778257371	TRUE	1
397	394	Chapters	Parvas	1.0	0.4170323914242460	FALSE	418	0.1617378741420700	TRUE	0
405	402	Chapters	Person	2.0	0.975143017975490	FALSE	426	0.187110409140570	TRUE	0
410	402	Chapters	Events	1.0	0.5581106205512470	FALSE	431	0.3321252763271330	TRUE	0
418	411	Chapters	Kuru_Dynasty	1.0	0.4170323914242460	FALSE	439	-0.02930689163160300	TRUE	0
426	424	Traits	Woman	1.0	0.3459762562611940	FALSE	447	0.1691266298594700	TRUE	1
431	421	Traits	Events	1.0	0.3459762562611940	FALSE	453	0.1408990323543500	TRUE	1
432	430	Traits	Places	1.0	0.3459762562611940	FALSE	454	0.1659785658121110	TRUE	1
436	434	Traits	Man	1.0	0.166978762562611940	FALSE	458	0.165308778257371	TRUE	1

Chapters - Parvas

This screenshot shows a Numbers spreadsheet titled "out7 - Edited". The table has columns A through J. Row 256 contains the header: "256 255 Person", "1.0", "0.721347520444820", "FALSE", "272", "0.0", "TRUE", "1". Rows 261 through 499 contain data for various entities like Person, Places, Rivers, etc., with their respective traits and values. The last row (499) is highlighted in green. The sidebar on the right shows "Table Styles" and "Table Options" (Title checked). The status bar at the bottom shows "SUM 814.578770266" and "AVERAGE 135.673128378".

A	B	C	D	E	F	G	H	I	J	
256	255	Person		1.0	0.721347520444820	FALSE	272	0.0	TRUE	1
261	261	StatesOf	Places	1.0	1.442695040888960	FALSE	278	0.0	TRUE	0
266	264	StatesOf	Rivers	1.0	0.402429043818450	FALSE	281	0.0	TRUE	1
267	265	StatesOf	Man	1.0	0.402429043818450	FALSE	282	0.0	TRUE	1
271	274	Events	Parvas	1.0	1.442695040888960	FALSE	286	-0.19070508752372700	TRUE	0
278	274	Events	Woman	1.0	0.3459762562611940	FALSE	293	0.228972353935240	TRUE	1
279	274	Events	Person	2.0	2.0000805671442010	FALSE	294	0.37923118472099300	TRUE	0
285	284	Events	Places	1.0	0.3459762562611940	FALSE	300	0.4570115804672240	TRUE	1
289	284	Events	Man	1.0	0.3459762562611940	FALSE	304	0.2303752823595710	TRUE	1
290	284	Events	Chapters	1.0	0.5581106205512470	FALSE	305	0.331252763271330	TRUE	0
291	288	Events	Traits	1.0	0.3459762562611940	FALSE	308	0.1409990323543500	TRUE	1
294	264	Places	Kingdom	1.0	0.721347520444820	FALSE	309	0.3778457011699680	TRUE	1
300	264	Places	Woman	1.0	0.3459762562611940	FALSE	315	0.334688747400010	TRUE	1
304	304	Places	Events	1.0	0.3459762562611940	FALSE	321	0.4570115804672240	TRUE	1
309	307	Places	Man	1.0	0.3459762562611940	FALSE	326	0.3554025292396550	TRUE	1
311	304	Places	Traits	1.0	0.3459762562611940	FALSE	328	0.169975658121110	TRUE	1
362	366	Rivers	Woman	1.0	0.424249043818450	FALSE	381	0.13192442059516900	TRUE	1
367	366	Rivers	StatesOfIndia	1.0	0.424249043818450	FALSE	386	0.0	TRUE	1
373	371	Rivers	Man	1.0	0.424249043818450	FALSE	392	0.188972353935240	TRUE	1
383	381	Man	Person	2.0	1.3001104718781200	FALSE	404	0.891707968711853	TRUE	1
387	381	Man	StatesOfIndia	1.0	0.424249043818450	FALSE	408	0.0	TRUE	1
388	386	Man	Events	1.0	0.3459762562611940	FALSE	409	0.2303752823595710	TRUE	1
389	386	Man	Places	1.0	0.3459762562611940	FALSE	410	0.3554025292396550	TRUE	1
392	390	Man	Rivers	1.0	0.402429043818450	FALSE	413	0.188972353935240	TRUE	1
395	390	Man	Traits	1.0	0.3459762562611940	FALSE	416	0.165308778257371	TRUE	1
397	394	Chapters	Parvas	1.0	0.4170323914242460	FALSE	418	0.1617378741420700	TRUE	0
405	402	Chapters	Person	2.0	0.975143017975490	FALSE	426	0.187110409140570	TRUE	0
410	402	Chapters	Events	1.0	0.5581106205512470	FALSE	431	0.3321252763271330	TRUE	0
418	411	Chapters	Kuru_Dynasty	1.0	0.4170323914242460	FALSE	439	-0.02930689163160300	TRUE	0
426	424	Traits	Woman	1.0	0.3459762562611940	FALSE	447	0.1691266298594700	TRUE	1
431	421	Traits	Events	1.0	0.3459762562611940	FALSE	453	0.1408990323543500	TRUE	1
432	430	Traits	Places	1.0	0.3459762562611940	FALSE	454	0.1659785658121110	TRUE	1
436	434	Traits	Man	1.0	0.166978762562611940	FALSE	458	0.165308778257371	TRUE	1

Proof of relationship between Chapters and Parvas:

Google search results for "chapters in mahabharata":

About 5,01,000 results (0.51 seconds)

The division into 18 Parvas

Book	Parva	Mention of clans in Chapters
7	Drona Parva (The Book of Drona)	VII.15, VII.61, VII.66, VII.67, VII.68, VII.165
8	Karna Parva (The Book of Karna)	VIII.4, VIII.17, VIII.30
9	Shalya Parvan (The Book of Shalya)	IX.43, IX.44
10	Sauptika Parva (The Book of the Sleeping Warriors)	
15 more rows		

<https://www.jatland.com/home/Mahabharata>

Mahabharata - Jatland Wiki

People also ask :

- How many chapters are there in Mahabharata?
- What are the 18 chapters of Mahabharata?

Chapters - Person

Apple Numbers spreadsheet showing the relationship between chapters and persons:

Row	Category	Value	Column	Value
255	StatesOrf Person	1.0	E	0.7213475204444820
261	StatesOrf Places	1.0	F	FALSE
266	StatesOrf Rivers	1.0	G	0.0 TRUE
267	StatesOrf Man	1.0	H	0.0 TRUE
271	Events Parvas	1.0	I	1
278	Events Woman	1.0	J	
279	Events Person	2.0		
285	Events Places	1.0		
289	Events Man	1.0		
290	Events Chapters	1.0		
291	Events Traits	1.0		
294	Places Kingdom	1.0		
300	Places Woman	1.0		
304	Places Events	1.0		
309	Places Man	1.0		
311	Places Traits	1.0		
362	Rivers Woman	1.0		
367	Rivers StatesOrfIndia	1.0		
373	Rivers Man	1.0		
383	Man Person	2.0		
387	Man StatesOrfIndia	1.0		
388	Man Events	1.0		
389	Man Places	1.0		
392	Man Rivers	1.0		
395	Man Traits	1.0		
397	Chapters Parvas	1.0		
405	Chapters Person	2.0		
410	Chapters Events	1.0		
418	Chapters Kuru_Dynasty	1.0		
426	Traits Woman	1.0		
431	Traits Events	1.0		
432	Traits Places	1.0		
436	Traits Man	1.0		

Chapters – Kuru_Dynasty

The screenshot shows a Numbers spreadsheet titled "out7" with the following data:

	A	B	C	D	E	F	G	H	I	J
261	Events	Parvas		1.0	1.4426950408899600	FALSE	286	-0.19075080752372700	TRUE	0
278	271	Events	Woman	1.0	0.3459762562611940	FALSE	293	0.2289743721485140	TRUE	1
279	271	Events	Person	2.0	2.000805674402100	FALSE	294	0.37923118472099300	TRUE	0
285	285	Events	Places	1.0	0.3459762562611940	FALSE	300	0.4570115804672240	TRUE	1
289	287	Events	Man	1.0	0.3459762562611940	FALSE	304	0.230375528355710	TRUE	1
290	288	Events	Chapters	1.0	0.5581106265512470	FALSE	305	0.3321252703271330	TRUE	0
291	288	Events	Traits	1.0	0.3459762562611940	FALSE	306	0.1408990323543500	TRUE	1
294	292	Places	Kingdom	1.0	0.7213473204444820	FALSE	309	0.3776457011699680	TRUE	1
300	294	Places	Woman	1.0	0.3459762562611940	FALSE	315	0.3346888747406010	TRUE	1
304	303	Places	Events	1.0	0.3459762562611940	FALSE	321	0.4570115804672240	TRUE	1
309	301	Places	Man	1.0	0.3459762562611940	FALSE	326	0.3554025292396550	TRUE	1
311	305	Places	Traits	1.0	0.3459762562611940	FALSE	328	0.1659785658121110	TRUE	1
362	366	Rivers	Woman	1.0	0.4024296043818450	FALSE	381	0.13192442059516900	TRUE	1
367	366	Rivers	StatesOfIndia	1.0	0.4024296043818450	FALSE	386	0.0	TRUE	1
373	371	Rivers	Man	1.0	0.4024296043818450	FALSE	392	0.188972353935240	TRUE	1
383	381	Man	Person	2.0	1.300104716781200	FALSE	404	0.69170968711853	TRUE	1
387	386	Man	StatesOfIndia	1.0	0.4024296043818450	FALSE	408	0.0	TRUE	1
388	386	Man	Events	1.0	0.3459762562611940	FALSE	409	0.230375528355710	TRUE	1
389	381	Man	Places	1.0	0.3459762562611940	FALSE	410	0.3554025292396550	TRUE	1
392	396	Man	Rivers	1.0	0.4024296043818450	FALSE	413	0.188972353935240	TRUE	1
395	393	Man	Traits	1.0	0.3459762562611940	FALSE	416	0.16530877825737	TRUE	1
397	396	Chapters	Parvas	1.0	0.4170323914242460	FALSE	418	0.16173787415027600	TRUE	0
405	403	Chapters	Person	2.0	0.975143017754940	FALSE	426	0.18711040914056700	TRUE	0
410	404	Chapters	Events	1.0	0.5581106265512470	FALSE	431	0.3321252703271330	TRUE	0
418	411	Chapters	Kuru_Dynasty	1.0	0.4170323914242460	FALSE	439	-0.029300989163160300	TRUE	0
426	424	Traits	Woman	1.0	0.3459762562611940	FALSE	447	0.16912662982940700	TRUE	1
431	421	Traits	Events	1.0	0.3459762562611940	FALSE	453	0.1408990323543500	TRUE	1
432	434	Traits	Places	1.0	0.3459762562611940	FALSE	454	0.1659785658121110	TRUE	1
436	434	Traits	Man	1.0	0.3459762562611940	FALSE	458	0.16530877825737	TRUE	1
440	434	Kuru_Dyn	Parvas	1.0	0.4170323914242460	FALSE	462	0.2754774688674380	TRUE	0
448	444	Kuru_Dyn	Person	1.0	0.4170323914242460	FALSE	470	-0.0910857319831848	TRUE	0
459	451	Kuru_Dyn	Chapters	1.0	0.4170323914242460	FALSE	481	-0.029300989163160300	TRUE	0

Total Relation Gaps predicted by our model: 36

Total Relation Gaps predicted by the model given in paper: 20

Extra relations we predicted: 16

Precision: $34/36 = 94.4\%$