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1 /Users/nelsonquintanilla/.conda/envs/dissertation/bin/python /Users/nelsonquintanilla/  
Documents/repos/nfq160/dissertation/main.py  
2 Console output is saving to: /Users/nelsonquintanilla/Documents/repos/nfq160/  
dissertation/console_logs  
3 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/  
builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of  
importlib and slated for removal in Python 3.12; see the module's documentation for  
alternative uses  
4     from imp import reload  
5  
6 Data before pre-processing  
7 Number of articles: 2275  
8 Average word count per article: 864 words  
9  
10 Normalisation and tokenization  
11  
12 Stop Words Removal 1  
13 total of words, stop words removal 1: 1004995  
14  
15 Lemmatisation  
16 total of words, lemmatisation: 1005022  
17  
18 Stop Words Removal 2  
19 total of words, stop words removal 2: 965512  
20  
21 Transform the documents to a vectorized form  
22  
23 Number of tokens and documents to train  
24 Number of unique tokens: 31493  
25 Number of documents: 2275  
26  
27 Building the Topic Model  
28  
29 Training model for 2  
30 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/  
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38 alternative uses
39     from imp import reload
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importlib and slated for removal in Python 3.12; see the module's documentation for
alternative uses
43     from imp import reload
44
45 Training model for 4
46 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
importlib and slated for removal in Python 3.12; see the module's documentation for
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importlib and slated for removal in Python 3.12; see the module's documentation for
alternative uses
59     from imp import reload
60
61 Training model for 6
62 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
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importlib and slated for removal in Python 3.12; see the module's documentation for
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   importlib and slated for removal in Python 3.12; see the module's documentation for
   alternative uses
75   from imp import reload
76
77 Training model for 8
78 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
   builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
   importlib and slated for removal in Python 3.12; see the module's documentation for
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     importlib and slated for removal in Python 3.12; see the module's documentation for
     alternative uses
91     from imp import reload
92
93 Training model for 10
94 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
     builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
     importlib and slated for removal in Python 3.12; see the module's documentation for
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      builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
      importlib and slated for removal in Python 3.12; see the module's documentation for
      alternative uses
107     from imp import reload
108
109 Training model for 12
110 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
      builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
      importlib and slated for removal in Python 3.12; see the module's documentation for
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importlib and slated for removal in Python 3.12; see the module's documentation for
alternative uses
123 from imp import reload
124
125 Training model for 14
126 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
importlib and slated for removal in Python 3.12; see the module's documentation for
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        importlib and slated for removal in Python 3.12; see the module's documentation for
        alternative uses
139     from imp import reload
140
141 View the topics in LDA mode
142
143 Topics for a model trained for 2 number of topics
144 [(0,
145     '0.011*"russia" + 0.009*"ukraine" + 0.007*"russian" + 0.007*"country" +
146     '0.005*"putin" + 0.005*"sanction" + 0.005*"war" + 0.005*"year" + 0.005*"eu" +
147     '+ 0.005*"government"),
148 (1,
149     '0.018*"russian" + 0.018*"ukraine" + 0.013*"ukrainian" + 0.012*"russia" +
150     '0.009*"war" + 0.007*"city" + 0.007*"people" + 0.007*"force" + 0.005*"kyiv" +
151     '+ 0.005*"military")]
152
153 Topics for a model trained for 4 number of topics
154 [(0,
155     '0.007*"year" + 0.006*"country" + 0.006*"russia" + 0.006*"gas" +
156     '0.005*"government" + 0.005*"china" + 0.005*"ukraine" + 0.004*"energy" +
157     '0.004*"war" + 0.004*"germany"),
158 (1,
159     '0.010*"people" + 0.008*"ukrainian" + 0.008*"war" + 0.008*"russian" +
160     '0.007*"ukraine" + 0.006*"day" + 0.005*"year" + 0.005*"family" +
161     '0.005*"leave" + 0.005*"home"),
162 (2,
163     '0.026*"ukraine" + 0.023*"russian" + 0.018*"russia" + 0.015*"ukrainian" +
164     '0.011*"force" + 0.009*"city" + 0.008*"war" + 0.008*"military" +
165     '0.007*"kyiv" + 0.005*"country"),
166 (3,
167     '0.017*"russia" + 0.017*"russian" + 0.012*"ukraine" + 0.011*"putin" +
168     '0.009*"sanction" + 0.007*"war" + 0.007*"eu" + 0.006*"country" + 0.005*"uk" +
169     '+ 0.005*"state")]
170
171 Topics for a model trained for 6 number of topics
172 [(0,
173     '0.010*"gas" + 0.009*"russia" + 0.008*"country" + 0.008*"year" +
174     '0.007*"china" + 0.006*"energy" + 0.006*"government" + 0.005*"price" +
175     '0.005*"germany" + 0.005*"world"),
176 (1,
177     '0.011*"people" + 0.009*"ukrainian" + 0.008*"russian" + 0.008*"war" +
178     '0.007*"ukraine" + 0.006*"day" + 0.005*"city" + 0.005*"family" +
179     '0.005*"leave" + 0.005*"year"),
180 (2,
181     '0.022*"ukraine" + 0.021*"russian" + 0.014*"russia" + 0.013*"ukrainian" +
182     '0.012*"force" + 0.011*"war" + 0.010*"city" + 0.008*"military" +
183     '0.008*"kyiv" + 0.007*"putin"),
184 (3,
185     '0.017*"russian" + 0.016*"russia" + 0.013*"putin" + 0.010*"sanction" +
186     '0.009*"ukraine" + 0.006*"uk" + 0.006*"war" + 0.006*"government" +
187     '0.005*"country" + 0.005*"state"),
188 (4,
189     '0.028*"ukraine" + 0.023*"russian" + 0.021*"russia" + 0.015*"ukrainian" +
190     '0.009*"force" + 0.007*"military" + 0.007*"war" + 0.006*"city" +

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191   '0.006*"attack" + 0.006*"defence"' ),
192 (5,
193   '0.010*"eu" + 0.007*"macron" + 0.006*"party" + 0.006*"ukraine" + '
194   '0.006*"country" + 0.006*"right" + 0.006*"minister" + 0.006*"european" + '
195   '0.005*"nato" + 0.005*"president"' )
196
197 Topics for a model trained for 8 number of topics
198 [(0,
199   '0.014*"gas" + 0.009*"country" + 0.009*"russia" + 0.009*"energy" + '
200   '0.008*"year" + 0.008*"price" + 0.007*"oil" + 0.006*"government" + '
201   '0.006*"germany" + 0.006*"russian"' ),
202 (1,
203   '0.012*"people" + 0.010*"ukrainian" + 0.009*"russian" + 0.008*"war" + '
204   '0.008*"ukraine" + 0.006*"day" + 0.006*"city" + 0.005*"family" + '
205   '0.005*"leave" + 0.005*"home"' ),
206 (2,
207   '0.023*"ukraine" + 0.021*"russian" + 0.013*"russia" + 0.013*"ukrainian" + '
208   '0.012*"force" + 0.012*"war" + 0.009*"city" + 0.008*"military" + '
209   '0.008*"kyiv" + 0.007*"putin"' ),
210 (3,
211   '0.020*"russian" + 0.016*"russia" + 0.013*"putin" + 0.011*"sanction" + '
212   '0.010*"ukraine" + 0.007*"uk" + 0.006*"war" + 0.006*"government" + '
213   '0.005*"include" + 0.005*"company"' ),
214 (4,
215   '0.030*"ukraine" + 0.024*"russian" + 0.022*"russia" + 0.016*"ukrainian" + '
216   '0.010*"force" + 0.007*"city" + 0.007*"military" + 0.007*"war" + '
217   '0.006*"attack" + 0.006*"zelenskiy"' ),
218 (5,
219   '0.015*"macron" + 0.010*"le" + 0.009*"pen" + 0.009*"france" + 0.008*"right" +
220   '0.008*"french" + 0.008*"vote" + 0.007*"election" + 0.007*"party" + '
221   '0.006*"year"' ),
222 (6,
223   '0.010*"nato" + 0.010*"putin" + 0.008*"russia" + 0.008*"country" + '
224   '0.007*"war" + 0.006*"finland" + 0.006*"year" + 0.005*"nuclear" + '
225   '0.005*"sweden" + 0.005*"ukraine"' ),
226 (7,
227   '0.010*"china" + 0.007*"russia" + 0.006*"ukraine" + 0.005*"minister" + '
228   '0.005*"eu" + 0.005*"war" + 0.005*"country" + 0.005*"johnson" + '
229   '0.004*"government" + 0.004*"support"' )
230
231 Topics for a model trained for 10 number of topics
232 [(0,
233   '0.015*"gas" + 0.010*"russia" + 0.010*"energy" + 0.009*"country" + '
234   '0.008*"year" + 0.008*"price" + 0.007*"oil" + 0.007*"germany" + '
235   '0.006*"russian" + 0.006*"government"' ),
236 (1,
237   '0.012*"people" + 0.010*"russian" + 0.009*"ukrainian" + 0.008*"war" + '
238   '0.007*"city" + 0.007*"ukraine" + 0.007*"day" + 0.006*"leave" + '
239   '0.005*"child" + 0.004*"year"' ),
240 (2,
241   '0.022*"ukraine" + 0.022*"russian" + 0.014*"ukrainian" + 0.013*"russia" + '
242   '0.012*"force" + 0.012*"war" + 0.010*"city" + 0.009*"military" + '
243   '0.008*"kyiv" + 0.007*"putin"' ),
244 (3,
245   '0.020*"russian" + 0.017*"russia" + 0.013*"putin" + 0.012*"sanction" + '
246   '0.009*"ukraine" + 0.007*"uk" + 0.006*"war" + 0.006*"include" + '
247   '0.006*"company" + 0.005*"government"' ),

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248 (4,
249   '0.030*"ukraine" + 0.025*"russian" + 0.022*"russia" + 0.016*"ukrainian" + '
250   '0.010*"force" + 0.008*"city" + 0.007*"military" + 0.007*"war" + '
251   '0.006*"zelenskiy" + 0.006*"attack"' ),
252 (5,
253   '0.016*"uk" + 0.014*"ukraine" + 0.013*"refugee" + 0.013*"ukrainian" + '
254   '0.010*"visa" + 0.010*"government" + 0.010*"family" + 0.008*"eu" + '
255   '0.008*"home" + 0.008*"people"' ),
256 (6,
257   '0.010*"putin" + 0.008*"year" + 0.008*"war" + 0.005*"russia" + '
258   '0.005*"protest" + 0.005*"nuclear" + 0.004*"world" + 0.004*"country" + '
259   '0.004*"leader" + 0.004*"state"' ),
260 (7,
261   '0.012*"china" + 0.007*"eu" + 0.007*"russia" + 0.006*"minister" + '
262   '0.006*"ukraine" + 0.005*"leader" + 0.005*"war" + 0.004*"taiwan" + '
263   '0.004*"johnson" + 0.004*"government"' ),
264 (8,
265   '0.012*"nato" + 0.011*"ukraine" + 0.010*"russia" + 0.010*"country" + '
266   '0.007*"war" + 0.005*"new" + 0.005*"finland" + 0.005*"people" + '
267   '0.004*"putin" + 0.004*"minister"' ),
268 (9,
269   '0.026*"macron" + 0.019*"le" + 0.017*"pen" + 0.016*"vote" + 0.016*"france" + '
270   '0.014*"election" + 0.014*"right" + 0.013*"french" + 0.012*"party" + '
271   '0.009*"far"' ])
272
273 Topics for a model trained for 12 number of topics
274 [(0,
275   '0.017*"gas" + 0.011*"energy" + 0.010*"country" + 0.009*"russia" + '
276   '0.009*"price" + 0.009*"oil" + 0.009*"year" + 0.007*"government" + '
277   '0.006*"germany" + 0.006*"supply"' ),
278 (1,
279   '0.012*"people" + 0.010*"ukrainian" + 0.009*"russian" + 0.008*"war" + '
280   '0.008*"ukraine" + 0.007*"day" + 0.007*"city" + 0.006*"leave" + '
281   '0.006*"child" + 0.005*"home"' ),
282 (2,
283   '0.027*"russian" + 0.021*"ukraine" + 0.017*"ukrainian" + 0.016*"city" + '
284   '0.014*"force" + 0.014*"russia" + 0.010*"war" + 0.008*"military" + '
285   '0.008*"kyiv" + 0.006*"region"' ),
286 (3,
287   '0.018*"russian" + 0.014*"sanction" + 0.013*"putin" + 0.012*"russia" + '
288   '0.008*"uk" + 0.008*"ukraine" + 0.006*"include" + 0.006*"eu" + 0.005*"crime" '
289   '+ 0.005*"government"' ),
290 (4,
291   '0.029*"ukraine" + 0.024*"russian" + 0.022*"russia" + 0.016*"ukrainian" + '
292   '0.008*"force" + 0.007*"plant" + 0.007*"military" + 0.006*"attack" + '
293   '0.006*"defence" + 0.006*"nuclear"' ),
294 (5,
295   '0.015*"uk" + 0.014*"ukraine" + 0.012*"eu" + 0.012*"ukrainian" + '
296   '0.011*"visa" + 0.010*"refugee" + 0.009*"government" + 0.008*"family" + '
297   '0.007*"british" + 0.007*"war"' ),
298 (6,
299   '0.008*"year" + 0.006*"putin" + 0.005*"protest" + 0.005*"war" + '
300   '0.005*"germany" + 0.004*"nuclear" + 0.004*"german" + 0.004*"world" + '
301   '0.004*"government" + 0.003*"power"' ),
302 (7,
303   '0.020*"china" + 0.007*"taiwan" + 0.006*"chinese" + 0.005*"eu" + '
304   '0.005*"beijing" + 0.005*"japan" + 0.005*"minister" + 0.005*"korea" + '

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305   '0.004*"north" + 0.004*"year"'),
306   (8,
307     '0.008*"nato" + 0.008*"country" + 0.006*"ukraine" + 0.006*"new" + '
308     '0.006*"russia" + 0.006*"finland" + 0.006*"people" + 0.005*"year" + '
309     '0.005*"world" + 0.005*"war"'),
310   (9,
311     '0.025*"macron" + 0.019*"vote" + 0.019*"le" + 0.017*"pen" + 0.016*"election" +
312     '+ 0.016*"party" + 0.016*"france" + 0.015*"right" + 0.013*"french" + '
313     '0.010*"far"'),
314   (10,
315     '0.019*"russian" + 0.019*"russia" + 0.010*"war" + 0.008*"ukraine" + '
316     '0.006*"country" + 0.006*"putin" + 0.006*"medium" + 0.006*"state" + '
317     '0.006*"moscow" + 0.005*"invasion"'),
318   (11,
319     '0.028*"ukraine" + 0.022*"russia" + 0.014*"russian" + 0.011*"putin" + '
320     '0.010*"war" + 0.008*"country" + 0.008*"ukrainian" + 0.008*"president" + '
321     '0.007*"nato" + 0.007*"weapon"]),
322
323 Topics for a model trained for 14 number of topics
324 [(0,
325   '0.019*"gas" + 0.012*"energy" + 0.011*"russia" + 0.010*"country" + '
326   '0.010*"germany" + 0.010*"oil" + 0.009*"price" + 0.008*"year" + '
327   '0.007*"russian" + 0.007*"supply"'),
328   (1,
329     '0.012*"people" + 0.009*"russian" + 0.009*"ukrainian" + 0.007*"day" + '
330     '0.007*"war" + 0.007*"city" + 0.007*"ukraine" + 0.006*"leave" + '
331     '0.006*"child" + 0.005*"family"'),
332   (2,
333     '0.029*"russian" + 0.023*"ukraine" + 0.019*"ukrainian" + 0.016*"russia" + '
334     '0.016*"city" + 0.015*"force" + 0.009*"war" + 0.008*"military" + '
335     '0.008*"kyiv" + 0.007*"civilian"'),
336   (3,
337     '0.020*"russian" + 0.018*"sanction" + 0.013*"russia" + 0.011*"putin" + '
338     '0.009*"uk" + 0.009*"ukraine" + 0.008*"eu" + 0.007*"include" + '
339     '0.005*"government" + 0.005*"crime"'),
340   (4,
341     '0.029*"ukraine" + 0.022*"russian" + 0.020*"russia" + 0.014*"ukrainian" + '
342     '0.010*"plant" + 0.009*"nuclear" + 0.008*"grain" + 0.007*"sea" + '
343     '0.007*"port" + 0.006*"attack"'),
344   (5,
345     '0.021*"eu" + 0.016*"ukraine" + 0.010*"european" + 0.009*"war" + '
346     '0.007*"ukrainian" + 0.007*"gorbachev" + 0.006*"uk" + 0.006*"country" + '
347     '0.006*"british" + 0.005*"year"'),
348   (6,
349     '0.008*"year" + 0.006*"nuclear" + 0.006*"protest" + 0.004*"government" + '
350     '0.004*"world" + 0.004*"people" + 0.003*"police" + 0.003*"trump" + '
351     '0.003*"time" + 0.003*"power"'),
352   (7,
353     '0.033*"china" + 0.011*"chinese" + 0.010*"taiwan" + 0.008*"beijing" + '
354     '0.007*"japan" + 0.007*"korea" + 0.007*"north" + 0.005*"india" + '
355     '0.004*"russia" + 0.004*"military"'),
356   (8,
357     '0.013*"nato" + 0.012*"country" + 0.010*"finland" + 0.008*"sweden" + '
358     '0.007*"minister" + 0.007*"new" + 0.006*"ukraine" + 0.006*"turkey" + '
359     '0.005*"people" + 0.005*"government"'),
360   (9,
361     '0.029*"macron" + 0.021*"le" + 0.021*"vote" + 0.019*"pen" + 0.018*"party" + '

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```
362     '0.018*"election" + 0.018*"france" + 0.015*"right" + 0.015*"french" + '
363     '0.010*"far"'),
364 (10,
365     '0.014*"russian" + 0.014*"russia" + 0.010*"company" + 0.005*"group" + '
366     '0.005*"country" + 0.005*"government" + 0.005*"sanction" + 0.005*"state" + '
367     '0.004*"wagner" + 0.004*"ukraine"'),
368 (11,
369     '0.030*"ukraine" + 0.021*"russia" + 0.012*"russian" + 0.010*"weapon" + '
370     '0.009*"war" + 0.008*"force" + 0.008*"nato" + 0.008*"military" + '
371     '0.008*"country" + 0.008*"ukrainian"'),
372 (12,
373     '0.012*"year" + 0.008*"guardian" + 0.007*"story" + 0.006*"time" + '
374     '0.006*"good" + 0.006*"cost" + 0.006*"like" + 0.005*"big" + 0.005*"today" + '
375     '0.005*"woman"'),
376 (13,
377     '0.015*"ukraine" + 0.014*"russia" + 0.013*"russian" + 0.013*"war" + '
378     '0.011*"putin" + 0.008*"ukrainian" + 0.006*"country" + 0.006*"people" + '
379     '0.005*"government" + 0.005*"invasion")]
```

380

```
381 Compute Perplexity
```

382

```
383 Compute Topic Coherence Score
```

384 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of importlib and slated for removal in Python 3.12; see the module's documentation for alternative uses

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385     from imp import reload
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386 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of importlib and slated for removal in Python 3.12; see the module's documentation for alternative uses

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394 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of importlib and slated for removal in Python 3.12; see the module's documentation for alternative uses

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465 from imp import reload
466 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
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466 builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
       importlib and slated for removal in Python 3.12; see the module's documentation for
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       importlib and slated for removal in Python 3.12; see the module's documentation for
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       builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
       importlib and slated for removal in Python 3.12; see the module's documentation for
       alternative uses
481     from imp import reload
482 (list_index, number_topics, c_v_coherence, perplexity)
483 [(1, 2, 0.38712535076330623, -8.01397810823439),
484 (2, 4, 0.4077109674696836, -7.945252713811919),
485 (3, 6, 0.44368410714077705, -7.9422160507521795),
486 (4, 8, 0.46620449735318, -7.938327535921524),
487 (5, 10, 0.4583948835204902, -7.938225241656538),
488 (6, 12, 0.4477471910639792, -7.9400771256224765),
489 (7, 14, 0.46273933570804404, -7.937948890676798)]
490
491 Visualize the topics
492 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/pyLDAvis
      /_prepare.py:247: FutureWarning: In a future version of pandas all arguments of
       DataFrame.drop except for the argument 'labels' will be keyword-only.
493     by='saliency', ascending=False).head(R).drop('saliency', 1)
494 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
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alternative uses
507 from imp import reload
508 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
importlib and slated for removal in Python 3.12; see the module's documentation for
alternative uses
509 from imp import reload
510 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/pyLDAvis
/_prepare.py:247: FutureWarning: In a future version of pandas all arguments of
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