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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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alternative uses
43     from imp import reload
44
45 Training model for 8
46 /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
alternative uses
59     from imp import reload
60
61 Training model for 14
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
   alternative uses
75   from imp import reload
76
77 Training model for 20
78 /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
91     from imp import reload
92
93 Training model for 26
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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      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 32
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 38
126 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
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        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 8 number of topics
154 [(0,
155     '0.014*"gas" + 0.009*"country" + 0.009*"russia" + 0.009*"energy" + '
156     '0.008*"year" + 0.008*"price" + 0.007*"oil" + 0.006*"government" + '
157     '0.006*"germany" + 0.006*"russian"),
158 (1,
159     '0.012*"people" + 0.010*"ukrainian" + 0.009*"russian" + 0.008*"war" + '
160     '0.008*"ukraine" + 0.006*"day" + 0.006*"city" + 0.005*"family" + '
161     '0.005*"leave" + 0.005*"home"),
162 (2,
163     '0.023*"ukraine" + 0.021*"russian" + 0.013*"russia" + 0.013*"ukrainian" + '
164     '0.012*"force" + 0.012*"war" + 0.009*"city" + 0.008*"military" + '
165     '0.008*"kyiv" + 0.007*"putin"),
166 (3,
167     '0.020*"russian" + 0.016*"russia" + 0.013*"putin" + 0.011*"sanction" + '
168     '0.010*"ukraine" + 0.007*"uk" + 0.006*"war" + 0.006*"government" + '
169     '0.005*"include" + 0.005*"company"),
170 (4,
171     '0.030*"ukraine" + 0.024*"russian" + 0.022*"russia" + 0.016*"ukrainian" + '
172     '0.010*"force" + 0.007*"city" + 0.007*"military" + 0.007*"war" + '
173     '0.006*"attack" + 0.006*"zelenskiy"),
174 (5,
175     '0.015*"macron" + 0.010*"le" + 0.009*"pen" + 0.009*"france" + 0.008*"right" +
176     '+ 0.008*"french" + 0.008*"vote" + 0.007*"election" + 0.007*"party" + '
177     '0.006*"year"),
178 (6,
179     '0.010*"nato" + 0.010*"putin" + 0.008*"russia" + 0.008*"country" + '
180     '0.007*"war" + 0.006*"finland" + 0.006*"year" + 0.005*"nuclear" + '
181     '0.005*"sweden" + 0.005*"ukraine"),
182 (7,
183     '0.010*"china" + 0.007*"russia" + 0.006*"ukraine" + 0.005*"minister" + '
184     '0.005*"eu" + 0.005*"war" + 0.005*"country" + 0.005*"johnson" + '
185     '0.004*"government" + 0.004*"support")]
186
187 Topics for a model trained for 14 number of topics
188 [(0,
189     '0.019*"gas" + 0.012*"energy" + 0.011*"russia" + 0.010*"country" + '
190     '0.010*"germany" + 0.010*"oil" + 0.009*"price" + 0.008*"year" + '

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191   '0.007*"russian" + 0.007*"supply"' ),
192 (1,
193   '0.012*"people" + 0.009*"russian" + 0.009*"ukrainian" + 0.007*"day" + '
194   '0.007*"war" + 0.007*"city" + 0.007*"ukraine" + 0.006*"leave" + '
195   '0.006*"child" + 0.005*"family"' ),
196 (2,
197   '0.029*"russian" + 0.023*"ukraine" + 0.019*"ukrainian" + 0.016*"russia" + '
198   '0.016*"city" + 0.015*"force" + 0.009*"war" + 0.008*"military" + '
199   '0.008*"kyiv" + 0.007*"civilian"' ),
200 (3,
201   '0.020*"russian" + 0.018*"sanction" + 0.013*"russia" + 0.011*"putin" + '
202   '0.009*"uk" + 0.009*"ukraine" + 0.008*"eu" + 0.007*"include" + '
203   '0.005*"government" + 0.005*"crime"' ),
204 (4,
205   '0.029*"ukraine" + 0.022*"russian" + 0.020*"russia" + 0.014*"ukrainian" + '
206   '0.010*"plant" + 0.009*"nuclear" + 0.008*"grain" + 0.007*"sea" + '
207   '0.007*"port" + 0.006*"attack"' ),
208 (5,
209   '0.021*"eu" + 0.016*"ukraine" + 0.010*"european" + 0.009*"war" + '
210   '0.007*"ukrainian" + 0.007*"gorbachev" + 0.006*"uk" + 0.006*"country" + '
211   '0.006*"british" + 0.005*"year"' ),
212 (6,
213   '0.008*"year" + 0.006*"nuclear" + 0.006*"protest" + 0.004*"government" + '
214   '0.004*"world" + 0.004*"people" + 0.003*"police" + 0.003*"trump" + '
215   '0.003*"time" + 0.003*"power"' ),
216 (7,
217   '0.033*"china" + 0.011*"chinese" + 0.010*"taiwan" + 0.008*"beijing" + '
218   '0.007*"japan" + 0.007*"korea" + 0.007*"north" + 0.005*"india" + '
219   '0.004*"russia" + 0.004*"military"' ),
220 (8,
221   '0.013*"nato" + 0.012*"country" + 0.010*"finland" + 0.008*"sweden" + '
222   '0.007*"minister" + 0.007*"new" + 0.006*"ukraine" + 0.006*"turkey" + '
223   '0.005*"people" + 0.005*"government"' ),
224 (9,
225   '0.029*"macron" + 0.021*"le" + 0.021*"vote" + 0.019*"pen" + 0.018*"party" + '
226   '0.018*"election" + 0.018*"france" + 0.015*"right" + 0.015*"french" + '
227   '0.010*"far"' ),
228 (10,
229   '0.014*"russian" + 0.014*"russia" + 0.010*"company" + 0.005*"group" + '
230   '0.005*"country" + 0.005*"government" + 0.005*"sanction" + 0.005*"state" + '
231   '0.004*"wagner" + 0.004*"ukraine"' ),
232 (11,
233   '0.030*"ukraine" + 0.021*"russia" + 0.012*"russian" + 0.010*"weapon" + '
234   '0.009*"war" + 0.008*"force" + 0.008*"nato" + 0.008*"military" + '
235   '0.008*"country" + 0.008*"ukrainian"' ),
236 (12,
237   '0.012*"year" + 0.008*"guardian" + 0.007*"story" + 0.006*"time" + '
238   '0.006*"good" + 0.006*"cost" + 0.006*"like" + 0.005*"big" + 0.005*"today" + '
239   '0.005*"woman"' ),
240 (13,
241   '0.015*"ukraine" + 0.014*"russia" + 0.013*"russian" + 0.013*"war" + '
242   '0.011*"putin" + 0.008*"ukrainian" + 0.006*"country" + 0.006*"people" + '
243   '0.005*"government" + 0.005*"invasion"' ])
244
245 Topics for a model trained for 20 number of topics
246 [(0,
247   '0.032*"gas" + 0.018*"energy" + 0.014*"oil" + 0.010*"supply" + '

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248   '0.009*"russia" + 0.009*"year" + 0.009*"price" + 0.008*"import" + '
249   '0.008*"germany" + 0.007*"country"' ),
250 (1,
251   '0.012*"people" + 0.011*"russian" + 0.010*"city" + 0.008*"day" + '
252   '0.007*"ukrainian" + 0.007*"leave" + 0.007*"war" + 0.005*"ukraine" + '
253   '0.005*"child" + 0.005*"kyiv"' ),
254 (2,
255   '0.019*"russian" + 0.014*"ukraine" + 0.014*"force" + 0.010*"ukrainian" + '
256   '0.010*"war" + 0.008*"city" + 0.007*"russia" + 0.006*"military" + '
257   '0.006*"syria" + 0.005*"week"' ),
258 (3,
259   '0.021*"sanction" + 0.016*"russian" + 0.012*"uk" + 0.011*"putin" + '
260   '0.011*"company" + 0.009*"russia" + 0.008*"abramovich" + 0.008*"include" + '
261   '0.007*"government" + 0.007*"asset"' ),
262 (4,
263   '0.021*"ukraine" + 0.017*"plant" + 0.016*"nuclear" + 0.014*"grain" + '
264   '0.013*"sea" + 0.013*"ship" + 0.012*"port" + 0.012*"ukrainian" + '
265   '0.012*"russian" + 0.010*"russia"' ),
266 (5,
267   '0.035*"eu" + 0.014*"european" + 0.014*"ukraine" + 0.009*"war" + '
268   '0.007*"country" + 0.006*"commission" + 0.006*"year" + 0.006*"aslin" + '
269   '0.005*"von" + 0.005*"europe"' ),
270 (6,
271   '0.022*"germany" + 0.019*"german" + 0.008*"scholz" + 0.007*"year" + '
272   '0.006*"government" + 0.006*"berlin" + 0.005*"green" + 0.005*"protest" + '
273   '0.004*"energy" + 0.004*"chancellor"' ),
274 (7,
275   '0.040*"china" + 0.012*"chinese" + 0.012*"taiwan" + 0.010*"beijing" + '
276   '0.009*"japan" + 0.008*"north" + 0.008*"korea" + 0.006*"nuclear" + '
277   '0.006*"security" + 0.005*"military"' ),
278 (8,
279   '0.017*"country" + 0.011*"nato" + 0.009*"finland" + 0.008*"world" + '
280   '0.008*"food" + 0.008*"sweden" + 0.007*"new" + 0.007*"year" + '
281   '0.006*"ukraine" + 0.006*"minister"' ),
282 (9,
283   '0.032*"macron" + 0.023*"le" + 0.021*"pen" + 0.020*"france" + 0.020*"vote" + '
284   '0.017*"french" + 0.017*"election" + 0.017*"right" + 0.015*"party" + '
285   '0.011*"far"' ),
286 (10,
287   '0.011*"russian" + 0.011*"russia" + 0.007*"medium" + 0.006*"wagner" + '
288   '0.006*"government" + 0.006*"company" + 0.006*"group" + 0.006*"country" + '
289   '0.006*"ukraine" + 0.005*"state"' ),
290 (11,
291   '0.029*"ukraine" + 0.014*"weapon" + 0.012*"russia" + 0.010*"force" + '
292   '0.010*"russian" + 0.009*"military" + 0.008*"supply" + 0.007*"ukrainian" + '
293   '0.007*"war" + 0.007*"artillery"' ),
294 (12,
295   '0.014*"price" + 0.013*"year" + 0.008*"cost" + 0.007*"rise" + 0.006*"high" + '
296   '0.005*"time" + 0.005*"farmer" + 0.005*"power" + 0.005*"increase" + '
297   '0.004*"energy"' ),
298 (13,
299   '0.017*"russia" + 0.015*"putin" + 0.015*"war" + 0.015*"ukraine" + '
300   '0.015*"russian" + 0.007*"country" + 0.005*"invasion" + 0.005*"ukrainian" + '
301   '0.005*"people" + 0.005*"year"' ),
302 (14,
303   '0.006*"year" + 0.006*"people" + 0.006*"johnson" + 0.005*"time" + '
304   '0.004*"guardian" + 0.004*"good" + 0.004*"like" + 0.004*"new" + 0.004*"day" '

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305   '+ 0.004*"story"'),
306   (15,
307     '0.006*"government" + 0.005*"yandex" + 0.005*"uk" + 0.005*"year" + '
308     '0.005*"usmanov" + 0.004*"museum" + 0.004*"taliban" + 0.004*"swiss" + '
309     '0.004*"heritage" + 0.004*"cultural"'),
310   (16,
311     '0.029*"ukraine" + 0.027*"russia" + 0.024*"russian" + 0.011*"ukrainian" + '
312     '0.009*"country" + 0.008*"force" + 0.008*"president" + 0.007*"war" + '
313     '0.007*"military" + 0.007*"zelenskiy"'),
314   (17,
315     '0.017*"ukrainian" + 0.016*"refugee" + 0.015*"uk" + 0.014*"ukraine" + '
316     '0.013*"family" + 0.013*"people" + 0.012*"home" + 0.011*"visa" + '
317     '0.009*"government" + 0.007*"help"'),
318   (18,
319     '0.026*"russian" + 0.020*"ukraine" + 0.019*"ukrainian" + 0.014*"city" + '
320     '0.013*"russia" + 0.011*"force" + 0.011*"war" + 0.010*"civilian" + '
321     '0.008*"kyiv" + 0.008*"mariupol"'),
322   (19,
323     '0.012*"gorbachev" + 0.009*"orban" + 0.008*"party" + 0.008*"russia" + '
324     '0.007*"hungary" + 0.007*"russian" + 0.007*"hungarian" + 0.006*"war" + '
325     '0.006*"state" + 0.006*"nuclear"')
326
327 Topics for a model trained for 26 number of topics
328 [(0,
329   '0.006*"year" + 0.006*"chemical" + 0.004*"chicken" + 0.004*"country" + '
330   '0.004*"war" + 0.004*"grow" + 0.004*"oil" + 0.004*"russia" + 0.004*"crisis" '
331   '+ 0.003*"world"'),
332   (1,
333     '0.013*"people" + 0.009*"russian" + 0.009*"day" + 0.008*"city" + '
334     '0.008*"leave" + 0.007*"war" + 0.007*"ukrainian" + 0.006*"child" + '
335     '0.005*"come" + 0.005*"family"'),
336   (2,
337     '0.013*"ukraine" + 0.011*"syria" + 0.009*"war" + 0.008*"country" + '
338     '0.008*"syrian" + 0.007*"russian" + 0.006*"poland" + 0.006*"ukrainian" + '
339     '0.005*"year" + 0.005*"russia"'),
340   (3,
341     '0.022*"sanction" + 0.017*"russian" + 0.012*"uk" + 0.012*"putin" + '
342     '0.011*"company" + 0.010*"russia" + 0.009*"abramovich" + 0.008*"include" + '
343     '0.008*"asset" + 0.007*"government"'),
344   (4,
345     '0.025*"ukraine" + 0.018*"plant" + 0.017*"grain" + 0.014*"port" + '
346     '0.014*"nuclear" + 0.014*"ship" + 0.013*"ukrainian" + 0.013*"russia" + '
347     '0.013*"sea" + 0.011*"russian"'),
348   (5,
349     '0.020*"eu" + 0.013*"ukraine" + 0.009*"european" + 0.008*"war" + '
350     '0.007*"aslin" + 0.007*"british" + 0.007*"year" + 0.005*"foreign" + '
351     '0.005*"sentence" + 0.005*"ukrainian"'),
352   (6,
353     '0.012*"protest" + 0.008*"police" + 0.007*"year" + 0.005*"government" + '
354     '0.005*"people" + 0.004*"novaya" + 0.004*"trump" + 0.004*"protester" + '
355     '0.004*"gazeta" + 0.004*"image"'),
356   (7,
357     '0.044*"china" + 0.014*"chinese" + 0.014*"taiwan" + 0.011*"beijing" + '
358     '0.008*"north" + 0.008*"korea" + 0.006*"biden" + 0.006*"security" + '
359     '0.006*"military" + 0.005*"india"'),
360   (8,
361     '0.018*"country" + 0.013*"nato" + 0.011*"finland" + 0.009*"sweden" + '

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362   '0.008*"food" + 0.008*"world" + 0.008*"new" + 0.007*"year" + 0.007*"price" + '
363   '0.006*"government"'),
364 (9,
365   '0.035*"macron" + 0.025*"le" + 0.022*"pen" + 0.022*"france" + 0.021*"vote" + '
366   '0.019*"french" + 0.018*"election" + 0.018*"right" + 0.017*"party" + '
367   '0.012*"far"'),
368 (10,
369   '0.013*"russian" + 0.010*"russia" + 0.009*"company" + 0.006*"medium" + '
370   '0.006*"government" + 0.005*"country" + 0.005*"facebook" + 0.005*"platform" '
371   '+ 0.005*"people" + 0.004*"account"'),
372 (11,
373   '0.027*"ukraine" + 0.013*"weapon" + 0.009*"russia" + 0.009*"supply" + '
374   '0.009*"military" + 0.008*"force" + 0.007*"war" + 0.007*"russian" + '
375   '0.006*"tank" + 0.006*"need"'),
376 (12,
377   '0.015*"price" + 0.015*"year" + 0.009*"cost" + 0.007*"rise" + 0.007*"high" + '
378   '0.006*"time" + 0.005*"temperature" + 0.005*"increase" + 0.004*"inflation" + '
379   '0.004*"month"'),
380 (13,
381   '0.018*"russia" + 0.016*"putin" + 0.016*"russian" + 0.015*"ukraine" + '
382   '0.015*"war" + 0.007*"country" + 0.005*"invasion" + 0.005*"ukrainian" + '
383   '0.005*"people" + 0.004*"year"'),
384 (14,
385   '0.008*"johnson" + 0.006*"people" + 0.005*"year" + 0.005*"time" + '
386   '0.005*"like" + 0.004*"day" + 0.004*"Labour" + 0.004*"come" + 0.004*"party" '
387   '+ 0.004*"ukraine"'),
388 (15,
389   '0.010*"government" + 0.007*"ukraine" + 0.006*"yandex" + 0.006*"visa" + '
390   '0.006*"ukrainian" + 0.005*"uk" + 0.005*"year" + 0.004*"khudainatov" + '
391   '0.004*"case" + 0.004*"month"'),
392 (16,
393   '0.029*"russia" + 0.028*"ukraine" + 0.021*"russian" + 0.010*"country" + '
394   '0.009*"president" + 0.008*"ukrainian" + 0.008*"minister" + 0.008*"war" + '
395   '0.008*"putin" + 0.007*"sanction"'),
396 (17,
397   '0.017*"ukraine" + 0.012*"ukrainian" + 0.009*"people" + 0.009*"war" + '
398   '0.008*"family" + 0.006*"help" + 0.006*"day" + 0.006*"fight" + '
399   '0.005*"country" + 0.005*"volunteer"'),
400 (18,
401   '0.019*"ukraine" + 0.019*"russian" + 0.016*"war" + 0.013*"ukrainian" + '
402   '0.012*"crime" + 0.011*"russia" + 0.010*"soldier" + 0.009*"civilian" + '
403   '0.007*"kill" + 0.006*"international"'),
404 (19,
405   '0.014*"gorbachev" + 0.012*"orban" + 0.011*"hungary" + 0.008*"russia" + '
406   '0.008*"hungarian" + 0.008*"party" + 0.008*"russian" + 0.007*"soviet" + '
407   '0.007*"state" + 0.006*"putin"'),
408 (20,
409   '0.031*"gas" + 0.016*"energy" + 0.015*"germany" + 0.013*"nuclear" + '
410   '0.011*"oil" + 0.009*"german" + 0.009*"eu" + 0.008*"supply" + 0.007*"year" + '
411   '0.006*"import"'),
412 (21,
413   '0.031*"refugee" + 0.026*"uk" + 0.019*"visa" + 0.019*"home" + '
414   '0.018*"ukrainian" + 0.016*"people" + 0.014*"government" + 0.014*"family" + '
415   '0.013*"scheme" + 0.008*"flee"'),
416 (22,
417   '0.006*"train" + 0.006*"war" + 0.005*"space" + 0.005*"work" + 0.004*"whelan" '
418   '+ 0.004*"leave" + 0.004*"year" + 0.004*"woman" + 0.003*"station" + '

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419   '0.003*"human"' ),
420   (23,
421     '0.007*"year" + 0.007*"cultural" + 0.007*"war" + 0.006*"artist" + '
422     '0.006*"ukraine" + 0.006*"museum" + 0.006*"art" + 0.005*"people" + '
423     '0.005*"work" + 0.005*"russian"' ),
424   (24,
425     '0.028*"russian" + 0.020*"ukraine" + 0.019*"ukrainian" + 0.017*"city" + '
426     '0.015*"russia" + 0.014*"force" + 0.008*"military" + 0.008*"kyiv" + '
427     '0.007*"war" + 0.007*"people"' ),
428   (25,
429     '0.007*"year" + 0.007*"government" + 0.005*"tax" + 0.005*"new" + '
430     '0.005*"guardian" + 0.005*"cost" + 0.004*"abortion" + 0.004*"energy" + '
431     '0.004*"crisis" + 0.004*"people"' )
432
433 Topics for a model trained for 32 number of topics
434 [(0,
435   '0.014*"chemical" + 0.010*"biological" + 0.008*"weapon" + 0.007*"chicken" + '
436   '0.005*"grow" + 0.005*"greenland" + 0.005*"world" + 0.004*"include" + '
437   '0.004*"uk" + 0.004*"fast"' ),
438   (1,
439     '0.013*"people" + 0.011*"russian" + 0.009*"day" + 0.008*"city" + '
440     '0.008*"leave" + 0.007*"ukrainian" + 0.006*"war" + 0.006*"child" + '
441     '0.005*"soldier" + 0.005*"come"' ),
442   (2,
443     '0.014*"ukraine" + 0.012*"syria" + 0.009*"russian" + 0.008*"syrian" + '
444     '0.008*"country" + 0.007*"ukrainian" + 0.007*"war" + 0.006*"company" + '
445     '0.005*"russia" + 0.004*"assad"' ),
446   (3,
447     '0.024*"sanction" + 0.018*"russian" + 0.015*"uk" + 0.015*"putin" + '
448     '0.009*"abramovich" + 0.009*"russia" + 0.009*"asset" + 0.008*"government" + '
449     '0.008*"include" + 0.008*"company"' ),
450   (4,
451     '0.033*"plant" + 0.025*"nuclear" + 0.018*"ukraine" + 0.016*"power" + '
452     '0.010*"russian" + 0.010*"russia" + 0.010*"ship" + 0.009*"sea" + '
453     '0.008*"ukrainian" + 0.008*"zaporizhzhia"' ),
454   (5,
455     '0.016*"ukraine" + 0.014*"russian" + 0.012*"prisoner" + 0.011*"ukrainian" + '
456     '0.011*"war" + 0.011*"aslin" + 0.010*"british" + 0.010*"capture" + '
457     '0.008*"sentence" + 0.008*"fight"' ),
458   (6,
459     '0.012*"protest" + 0.008*"police" + 0.007*"year" + 0.006*"novaya" + '
460     '0.005*"gazeta" + 0.005*"trump" + 0.005*"journalist" + 0.005*"world" + '
461     '0.005*"image" + 0.004*"government"' ),
462   (7,
463     '0.039*"china" + 0.021*"taiwan" + 0.012*"chinese" + 0.011*"india" + '
464     '0.011*"north" + 0.010*"beijing" + 0.010*"korea" + 0.009*"biden" + '
465     '0.008*"south" + 0.007*"military"' ),
466   (8,
467     '0.017*"country" + 0.017*"new" + 0.015*"covid" + 0.013*"zealand" + '
468     '0.010*"china" + 0.010*"pacific" + 0.009*"australia" + 0.009*"minister" + '
469     '0.007*"pandemic" + 0.007*"health"' ),
470   (9,
471     '0.036*"macron" + 0.025*"le" + 0.023*"pen" + 0.022*"france" + 0.021*"vote" + '
472     '0.019*"election" + 0.019*"french" + 0.018*"right" + 0.016*"party" + '
473     '0.012*"far"' ),
474   (10,
475     '0.017*"russian" + 0.017*"company" + 0.011*"russia" + 0.007*"sanction" + '

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476   '0.006*"account" + 0.006*"include" + 0.006*"link" + 0.006*"bank" + '
477   '0.005*"business" + 0.005*"uk"' ),
478 (11,
479   '0.030*"ukraine" + 0.014*"weapon" + 0.010*"force" + 0.010*"supply" + '
480   '0.010*"russia" + 0.009*"military" + 0.008*"artillery" + 0.007*"western" + '
481   '0.007*"war" + 0.007*"russian"' ),
482 (12,
483   '0.033*"price" + 0.020*"cost" + 0.018*"year" + 0.015*"rise" + 0.012*"energy" +
484   '+ 0.011*"high" + 0.011*"inflation" + 0.011*"increase" + 0.009*"month" +
485   '0.009*"oil"' ),
486 (13,
487   '0.018*"russia" + 0.017*"putin" + 0.016*"russian" + 0.016*"war" + '
488   '0.015*"ukraine" + 0.007*"country" + 0.005*"invasion" + 0.005*"ukrainian" + '
489   '0.005*"people" + 0.005*"year"' ),
490 (14,
491   '0.009*"johnson" + 0.006*"people" + 0.005*"time" + 0.005*"labour" + '
492   '0.005*"year" + 0.004*"come" + 0.004*"minister" + 0.004*"day" +
493   '0.004*"party" + 0.004*"like"' ),
494 (15,
495   '0.010*"svitlana" + 0.008*"khudainatov" + 0.007*"yandex" + '
496   '0.006*"harrington" + 0.005*"amadea" + 0.005*"ukraine" + 0.005*"vitaly" + '
497   '0.005*"company" + 0.004*"russia" + 0.004*"al"' ),
498 (16,
499   '0.034*"ukraine" + 0.027*"russia" + 0.024*"russian" + 0.014*"ukrainian" + '
500   '0.009*"force" + 0.008*"country" + 0.008*"president" + 0.008*"zelenskiy" + '
501   '0.007*"war" + 0.007*"minister"' ),
502 (17,
503   '0.023*"uk" + 0.023*"ukrainian" + 0.018*"visa" + 0.016*"ukraine" + '
504   '0.015*"family" + 0.013*"home" + 0.012*"people" + 0.011*"refugee" + '
505   '0.011*"government" + 0.007*"help"' ),
506 (18,
507   '0.018*"russian" + 0.018*"ukraine" + 0.016*"war" + 0.014*"crime" + '
508   '0.012*"ukrainian" + 0.011*"civilian" + 0.010*"soldier" + 0.010*"russia" + '
509   '0.008*"kill" + 0.007*"international"' ),
510 (19,
511   '0.021*"gorbachev" + 0.012*"russian" + 0.009*"russia" + 0.009*"soviet" + '
512   '0.008*"party" + 0.007*"company" + 0.007*"diamond" + 0.007*"state" + '
513   '0.006*"belarus" + 0.005*"union"' ),
514 (20,
515   '0.033*"nuclear" + 0.015*"japan" + 0.010*"weapon" + 0.009*"war" + '
516   '0.008*"missile" + 0.006*"world" + 0.006*"test" + 0.005*"year" +
517   '0.005*"north" + 0.005*"korea"' ),
518 (21,
519   '0.040*"refugee" + 0.016*"scheme" + 0.016*"people" + 0.013*"host" + '
520   '0.012*"home" + 0.010*"government" + 0.010*"sponsor" + 0.009*"support" + '
521   '0.008*"child" + 0.008*"uk"' ),
522 (22,
523   '0.005*"leave" + 0.004*"racism" + 0.004*"country" + 0.004*"produce" + '
524   '0.004*"franco" + 0.004*"yerevan" + 0.003*"bucher" + 0.003*"pandora" + '
525   '0.003*"tech" + 0.003*"child"' ),
526 (23,
527   '0.009*"cultural" + 0.009*"war" + 0.008*"museum" + 0.008*"ukraine" + '
528   '0.008*"artist" + 0.008*"russian" + 0.007*"art" + 0.007*"work" + '
529   '0.006*"year" + 0.006*"world"' ),
530 (24,
531   '0.028*"russian" + 0.018*"city" + 0.018*"ukrainian" + 0.018*"ukraine" + '
532   '0.014*"force" + 0.014*"russia" + 0.008*"military" + 0.008*"kyiv" + '

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533   '0.008*"war" + 0.007*"mariupol"' ),
534   (25,
535     '0.007*"year" + 0.007*"guardian" + 0.005*"abortion" + 0.005*"government" + '
536     '0.005*"new" + 0.005*"story" + 0.005*"uk" + 0.005*"people" + 0.005*"big" + '
537     '0.005*"ireland"' ),
538   (26,
539     '0.011*"people" + 0.007*"day" + 0.007*"war" + 0.007*"ukraine" + '
540     '0.007*"leave" + 0.007*"work" + 0.007*"year" + 0.006*"like" + 0.006*"child" + '
541     '+ 0.006*"help"' ),
542   (27,
543     '0.008*"year" + 0.006*"taliban" + 0.005*"party" + 0.004*"people" + '
544     '0.004*"time" + 0.004*"government" + 0.003*"woman" + 0.003*"right" + '
545     '0.003*"come" + 0.003*"work"' ),
546   (28,
547     '0.019*"grain" + 0.018*"food" + 0.017*"ukraine" + 0.016*"port" + '
548     '0.014*"world" + 0.010*"country" + 0.010*"export" + 0.009*"russia" + '
549     '0.008*"global" + 0.007*"crisis"' ),
550   (29,
551     '0.016*"eu" + 0.013*"gas" + 0.013*"russia" + 0.011*"russian" + '
552     '0.011*"ukraine" + 0.009*"germany" + 0.009*"country" + 0.008*"european" + '
553     '0.007*"energy" + 0.007*"war"' ),
554   (30,
555     '0.019*"russia" + 0.019*"china" + 0.010*"russian" + 0.010*"ukraine" + '
556     '0.008*"chinese" + 0.006*"invasion" + 0.005*"beijing" + 0.005*"year" + '
557     '0.005*"war" + 0.004*"government"' ),
558   (31,
559     '0.039*"nato" + 0.021*"finland" + 0.017*"sweden" + 0.016*"russia" + '
560     '0.013*"country" + 0.011*"membership" + 0.011*"turkey" + 0.011*"alliance" + '
561     '0.010*"security" + 0.010*"join"' )
562
563 Topics for a model trained for 38 number of topics
564 [(0,
565   '0.016*"chemical" + 0.010*"biological" + 0.007*"chicken" + 0.007*"weapon" + '
566   '0.005*"greenland" + 0.005*"grow" + 0.005*"include" + 0.004*"cuba" + '
567   '0.004*"flag" + 0.004*"world"' ),
568   (1,
569     '0.013*"people" + 0.011*"russian" + 0.009*"day" + 0.008*"city" + '
570     '0.008*"leave" + 0.007*"ukrainian" + 0.007*"war" + 0.006*"child" + '
571     '0.006*"come" + 0.005*"family"' ),
572   (2,
573     '0.016*"syria" + 0.015*"ukraine" + 0.011*"syrian" + 0.010*"russian" + '
574     '0.007*"country" + 0.007*"ukrainian" + 0.007*"war" + 0.006*"russia" + '
575     '0.006*"company" + 0.006*"assad"' ),
576   (3,
577     '0.008*"government" + 0.008*"russian" + 0.007*"uk" + 0.007*"court" + '
578     '0.007*"putin" + 0.007*"ukraine" + 0.007*"genocide" + 0.006*"people" + '
579     '0.006*"russia" + 0.005*"international"' ),
580   (4,
581     '0.043*"plant" + 0.039*"nuclear" + 0.022*"power" + 0.017*"ukraine" + '
582     '0.011*"zaporizhzhia" + 0.011*"reactor" + 0.010*"russia" + 0.009*"russian" + '
583     '0.008*"site" + 0.007*"ukrainian"' ),
584   (5,
585     '0.017*"ukraine" + 0.014*"russian" + 0.013*"prisoner" + 0.012*"war" + '
586     '0.012*"ukrainian" + 0.011*"aslin" + 0.010*"capture" + 0.010*"british" + '
587     '0.009*"foreign" + 0.009*"family"' ),
588   (6,
589     '0.009*"protest" + 0.006*"trump" + 0.006*"year" + 0.006*"police" + '

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590   '0.005*"image" + 0.005*"world" + 0.004*"prince" + 0.004*"leader" + '
591   '0.004*"right" + 0.004*"government"'),  

592 (7,  

593   '0.018*"taiwan" + 0.017*"china" + 0.017*"north" + 0.016*"korea" + '  

594   '0.011*"india" + 0.011*"south" + 0.010*"biden" + 0.007*"visit" + '  

595   '0.007*"korean" + 0.006*"washington"'),  

596 (8,  

597   '0.017*"country" + 0.016*"new" + 0.014*"covid" + 0.011*"zealand" + '  

598   '0.009*"minister" + 0.009*"government" + 0.008*"pandemic" + 0.007*"pacific" + '  

599   '+ 0.007*"people" + 0.007*"health"'),  

600 (9,  

601   '0.044*"macron" + 0.031*"le" + 0.028*"pen" + 0.027*"france" + 0.023*"french" + '  

602   '+ 0.019*"vote" + 0.018*"election" + 0.017*"right" + 0.013*"far" + '  

603   '0.012*"round"'),  

604 (10,  

605   '0.014*"russian" + 0.011*"yacht" + 0.009*"russia" + 0.008*"uk" + '  

606   '0.007*"flight" + 0.006*"jet" + 0.006*"superyacht" + 0.006*"sanction" + '  

607   '0.006*"link" + 0.006*"ukraine"'),  

608 (11,  

609   '0.034*"ukraine" + 0.016*"weapon" + 0.015*"force" + 0.013*"military" + '  

610   '0.012*"russia" + 0.011*"russian" + 0.011*"supply" + 0.010*"ukrainian" + '  

611   '0.008*"western" + 0.008*"defence"'),  

612 (12,  

613   '0.031*"price" + 0.019*"cost" + 0.019*"energy" + 0.017*"year" + 0.014*"rise" + '  

614   '+ 0.011*"high" + 0.010*"increase" + 0.010*"month" + 0.009*"oil" + '  

615   '0.009*"inflation"'),  

616 (13,  

617   '0.018*"putin" + 0.017*"russia" + 0.016*"russian" + 0.015*"ukraine" + '  

618   '0.013*"war" + 0.007*"country" + 0.006*"ukrainian" + 0.005*"people" + '  

619   '0.005*"year" + 0.005*"invasion"'),  

620 (14,  

621   '0.008*"johnson" + 0.007*"year" + 0.006*"people" + 0.005*"time" + '  

622   '0.005*"guardian" + 0.005*"story" + 0.005*"like" + 0.004*"good" + '  

623   '0.004*"day" + 0.004*"today"'),  

624 (15,  

625   '0.038*"visa" + 0.021*"uk" + 0.015*"application" + 0.010*"ukrainian" + '  

626   '0.010*"home" + 0.010*"patel" + 0.009*"family" + 0.008*"ukraine" + '  

627   '0.008*"government" + 0.007*"office"'),  

628 (16,  

629   '0.033*"ukraine" + 0.029*"russian" + 0.028*"russia" + 0.015*"ukrainian" + '  

630   '0.009*"force" + 0.007*"region" + 0.007*"military" + 0.007*"moscow" + '  

631   '0.007*"country" + 0.006*"defence"'),  

632 (17,  

633   '0.027*"ukrainian" + 0.021*"uk" + 0.018*"ukraine" + 0.015*"family" + '  

634   '0.015*"people" + 0.012*"refugee" + 0.011*"visa" + 0.011*"home" + '  

635   '0.010*"government" + 0.009*"help"'),  

636 (18,  

637   '0.020*"russian" + 0.018*"ukraine" + 0.015*"war" + 0.014*"soldier" + '  

638   '0.013*"ukrainian" + 0.013*"crime" + 0.010*"russia" + 0.010*"kill" + '  

639   '0.009*"civilian" + 0.007*"body"'),  

640 (19,  

641   '0.013*"gorbachev" + 0.012*"russian" + 0.010*"diamond" + 0.009*"party" + '  

642   '0.008*"russia" + 0.008*"soviet" + 0.007*"state" + 0.007*"belarus" + '  

643   '0.007*"african" + 0.006*"company"'),  

644 (20,  

645   '0.028*"nuclear" + 0.012*"japan" + 0.009*"war" + 0.008*"weapon" + '  

646   '0.007*"year" + 0.006*"world" + 0.006*"missile" + 0.006*"test" + '

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647   '0.004*"bomb" + 0.004*"japanese"'),
648   (21,
649     '0.039*"refugee" + 0.020*"scheme" + 0.018*"home" + 0.013*"host" + '
650     '0.013*"people" + 0.012*"uk" + 0.012*"government" + 0.011*"sponsor" + '
651     '0.008*"child" + 0.007*"offer"'),
652   (22,
653     '0.005*"leave" + 0.005*"march" + 0.005*"war" + 0.004*"legal" + '
654     '0.004*"return" + 0.004*"church" + 0.004*"pandora" + 0.003*"guardian" + '
655     '0.003*"property" + 0.003*"relationship"'),
656   (23,
657     '0.011*"cultural" + 0.011*"artist" + 0.011*"museum" + 0.010*"art" + '
658     '0.009*"war" + 0.008*"ukraine" + 0.007*"work" + 0.007*"ukrainian" + '
659     '0.006*"russian" + 0.006*"people"'),
660   (24,
661     '0.029*"russian" + 0.020*"city" + 0.018*"ukrainian" + 0.016*"ukraine" + '
662     '0.014*"force" + 0.013*"russia" + 0.008*"mariupol" + 0.008*"military" + '
663     '0.008*"kyiv" + 0.007*"war"'),
664   (25,
665     '0.011*"abortion" + 0.006*"ship" + 0.006*"tax" + 0.005*"court" + '
666     '0.004*"government" + 0.004*"country" + 0.004*"people" + 0.004*"stowaway" + '
667     '0.004*"law" + 0.004*"crew"'),
668   (26,
669     '0.011*"people" + 0.007*"year" + 0.007*"day" + 0.007*"work" + 0.007*"child" '
670     '+ 0.006*"leave" + 0.006*"family" + 0.006*"war" + 0.006*"refugee" + '
671     '0.005*"help"'),
672   (27,
673     '0.008*"year" + 0.007*"taliban" + 0.006*"party" + 0.005*"people" + '
674     '0.004*"time" + 0.004*"woman" + 0.004*"marin" + 0.004*"work" + '
675     '0.003*"country" + 0.003*"gun"'),
676   (28,
677     '0.021*"grain" + 0.021*"ukraine" + 0.020*"food" + 0.017*"port" + '
678     '0.013*"world" + 0.013*"export" + 0.010*"country" + 0.009*"russia" + '
679     '0.009*"global" + 0.008*"sea"'),
680   (29,
681     '0.018*"eu" + 0.014*"russia" + 0.014*"gas" + 0.012*"russian" + '
682     '0.011*"ukraine" + 0.010*"country" + 0.008*"european" + 0.008*"germany" + '
683     '0.007*"sanction" + 0.007*"war"'),
684   (30,
685     '0.035*"china" + 0.017*"russia" + 0.012*"chinese" + 0.010*"ukraine" + '
686     '0.010*"beijing" + 0.008*"russian" + 0.007*"invasion" + 0.005*"war" + '
687     '0.005*"government" + 0.005*"medium"'),
688   (31,
689     '0.042*"nato" + 0.021*"finland" + 0.018*"russia" + 0.017*"sweden" + '
690     '0.013*"country" + 0.012*"membership" + 0.011*"alliance" + 0.011*"security" '
691     '+ 0.011*"turkey" + 0.010*"join"'),
692   (32,
693     '0.020*"russia" + 0.012*"german" + 0.012*"germany" + 0.010*"russian" + '
694     '0.007*"war" + 0.006*"year" + 0.006*"gorbachev" + 0.005*"iran" + '
695     '0.005*"soviet" + 0.004*"gas"'),
696   (33,
697     '0.024*"war" + 0.018*"news" + 0.017*"medium" + 0.016*"russian" + '
698     '0.015*"russia" + 0.014*"journalist" + 0.014*"channel" + 0.011*"protest" + '
699     '0.010*"state" + 0.009*"outlet"'),
700   (34,
701     '0.029*"ukraine" + 0.020*"russia" + 0.019*"russian" + 0.014*"ukrainian" + '
702     '0.012*"war" + 0.011*"zelenskiy" + 0.009*"president" + 0.009*"putin" + '
703     '0.008*"force" + 0.007*"country"'),

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704 (35,
705   '0.015*"party" + 0.011*"government" + 0.008*"minister" + 0.006*"vote" + '
706   '0.006*"election" + 0.006*"italy" + 0.006*"ukraine" + 0.006*"political" + '
707   '0.005*"new" + 0.005*"right"' ),
708 (36,
709   '0.030*"sanction" + 0.018*"russian" + 0.018*"company" + 0.015*"putin" + '
710   '0.014*"abramovich" + 0.014*"uk" + 0.012*"asset" + 0.010*"russia" + '
711   '0.009*"include" + 0.008*"list"' ),
712 (37,
713   '0.047*"israel" + 0.026*"israeli" + 0.021*"japan" + 0.016*"china" + '
714   '0.016*"taiwan" + 0.015*"saudi" + 0.014*"kishida" + 0.013*"iran" + '
715   '0.010*"palestinian" + 0.010*"region"' )]
716
717 Compute Perplexity
718
719 Compute Topic Coherence Score
720 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
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721     from imp import reload
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736 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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```

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758 alternative uses
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    builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
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806 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
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     alternative uses
817     from imp import reload
818 (list_index, number_topics, c_v_coherence, perplexity)
819 [(1, 2, 0.38712535076330623, -8.01397810823439),
820 (2, 8, 0.46620449735318, -7.938327535921524),
821 (3, 14, 0.46273933570804404, -7.937948890676798),
822 (4, 20, 0.46249651596402624, -7.929775157366636),
823 (5, 26, 0.4214717488590418, -7.939742532215337),
824 (6, 32, 0.44445223645159077, -7.9522886377081585),
825 (7, 38, 0.4417534223978197, -7.965693056394931)]
826
827 Visualize the topics
828 /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.
829     by='saliency', ascending=False).head(R).drop('saliency', 1)
830 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
     builtins/misc.py:45: DeprecationWarning: the imp module is deprecated in favour of
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pyLDAvis/_prepare.py:247: FutureWarning: In a future version of pandas all arguments
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    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.
1297     by='saliency', ascending=False).head(R).drop('saliency', 1)
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