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1 /Users/nelsonquintanilla/.conda/envs/dissertation/bin/python /Users/nelsonquintanilla/
Documents/repos/nfq160/dissertation/main.py
2 /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
3     from imp import reload
4
5 Step 0: Data before pre-processing
6 Number of articles: 2275
7 Average word count per article: 864 words
8
9 Step 1: Normalisation and tokenization
10
11 Step 2: Stop Words Removal
12
13 Step 3: Lemmatisation
14
15 Step 6: Transform the documents to a vectorized form
16
17 Step 7: Number of tokens and documents to train
18 Number of unique tokens: 31599
19 Number of documents: 2275
20
21 Step 8: Building the Topic Model
22
23 Training model for 5
24
25 Training model for 8
26
27 Training model for 11
28
29 Training model for 14
30
31 Training model for 17
32
33 Training model for 20
34
35 Training model for 23
36
37 Training model for 26
38
39 Training model for 29
40
41 Step 9: View the topics in LDA mode
42
43 Topics for a model trained for 5 number of topics
44 [(0,
45     '0.018*"say" + 0.010*"people" + 0.007*"ukrainian" + 0.006*"go" + 0.006*"war" +
46     '+ 0.006*"ukraine" + 0.006*"one" + 0.005*"day" + 0.005*"leave" +
47     '0.005*"family"),
48     (1,
49     '0.013*"say" + 0.011*"russia" + 0.010*"russian" + 0.009*"putin" +
50     '0.007*"war" + 0.007*"ukraine" + 0.005*"china" + 0.005*"sanction" +
51     '0.005*"we" + 0.004*"also"),
52     (2,
53     '0.026*"say" + 0.022*"russian" + 0.022*"ukraine" + 0.015*"russia" + '
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54   '0.014*"ukrainian" + 0.010*"force" + 0.009*"city" + 0.008*"war" + '
55   '0.006*"military" + 0.006*"kyiv"' ),
56 (3,
57   '0.011*"say" + 0.006*"year" + 0.005*"party" + 0.004*"government" + '
58   '0.004*"right" + 0.004*"people" + 0.004*"new" + 0.004*"would" + '
59   '0.004*"election" + 0.004*"one"' ),
60 (4,
61   '0.019*"say" + 0.015*"russia" + 0.012*"ukraine" + 0.010*"russian" + '
62   '0.009*"would" + 0.009*"country" + 0.009*"eu" + 0.007*"gas" + '
63   '0.006*"sanction" + 0.005*"war"' )]
64
65 Topics for a model trained for 8 number of topics
66 [(0,
67   '0.019*"say" + 0.010*"people" + 0.008*"ukrainian" + 0.006*"war" + 0.006*"go" +
68   '+ 0.006*"ukraine" + 0.006*"one" + 0.005*"day" + 0.005*"leave" +
69   '0.005*"family"' ),
70 (1,
71   '0.013*"say" + 0.012*"russian" + 0.012*"russia" + 0.010*"putin" + '
72   '0.008*"war" + 0.007*"ukraine" + 0.005*"sanction" + 0.004*"also" + '
73   '0.004*"one" + 0.004*"china"' ),
74 (2,
75   '0.027*"say" + 0.023*"russian" + 0.022*"ukraine" + 0.015*"ukrainian" + '
76   '0.015*"russia" + 0.010*"force" + 0.010*"city" + 0.008*"war" + '
77   '0.007*"military" + 0.006*"kyiv"' ),
78 (3,
79   '0.012*"say" + 0.007*"party" + 0.006*"right" + 0.005*"election" + '
80   '0.005*"government" + 0.005*"vote" + 0.004*"people" + 0.004*"year" + '
81   '0.004*"would" + 0.004*"political"' ),
82 (4,
83   '0.022*"say" + 0.018*"ukraine" + 0.017*"russia" + 0.012*"russian" + '
84   '0.010*"would" + 0.009*"country" + 0.009*"eu" + 0.007*"war" + 0.007*"putin" +
85   '+ 0.007*"nato"' ),
86 (5,
87   '0.012*"say" + 0.007*"north" + 0.007*"japan" + 0.006*"korea" + '
88   '0.006*"nuclear" + 0.006*"china" + 0.006*"year" + 0.005*"covid" + '
89   '0.005*"country" + 0.004*"we"' ),
90 (6,
91   '0.016*"gas" + 0.014*"say" + 0.011*"energy" + 0.008*"russia" + 0.008*"price" +
92   '+ 0.008*"would" + 0.007*"year" + 0.007*"government" + 0.006*"country" + '
93   '0.006*"supply"' ),
94 (7,
95   '0.009*"say" + 0.008*"year" + 0.005*"like" + 0.005*"get" + 0.005*"family" + '
96   '0.005*"go" + 0.004*"people" + 0.004*"man" + 0.004*"guardian" + '
97   '0.004*"make"' )]
98
99 Topics for a model trained for 11 number of topics
100 [(0,
101   '0.018*"say" + 0.010*"people" + 0.007*"war" + 0.007*"go" + 0.007*"one" + '
102   '0.006*"day" + 0.005*"ukrainian" + 0.005*"leave" + 0.005*"russian" + '
103   '0.005*"ukraine"' ),
104 (1,
105   '0.014*"russian" + 0.013*"russia" + 0.013*"say" + 0.011*"putin" + '
106   '0.009*"war" + 0.008*"ukraine" + 0.005*"one" + 0.004*"also" + '
107   '0.004*"country" + 0.004*"state"' ),
108 (2,
109   '0.027*"say" + 0.023*"russian" + 0.022*"ukraine" + 0.016*"ukrainian" + '
110   '0.015*"russia" + 0.011*"force" + 0.010*"city" + 0.007*"war" + '

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111   '0.007*"military" + 0.006*"kyiv"'),
112 (3,
113   '0.012*"say" + 0.008*"party" + 0.006*"right" + 0.006*"election" + '
114   '0.005*"vote" + 0.005*"government" + 0.004*"year" + 0.004*"people" + '
115   '0.004*"one" + 0.004*"political"'),
116 (4,
117   '0.023*"say" + 0.019*"ukraine" + 0.018*"russia" + 0.014*"russian" + '
118   '0.010*"eu" + 0.009*"would" + 0.009*"war" + 0.009*"country" + 0.008*"putin" +
119   '+ 0.008*"sanction"'),
120 (5,
121   '0.011*"say" + 0.007*"year" + 0.007*"north" + 0.006*"covid" + 0.006*"korea" +
122   '+ 0.005*"country" + 0.004*"people" + 0.004*"world" + 0.004*"abortion" +
123   '0.004*"case"'),
124 (6,
125   '0.016*"gas" + 0.014*"say" + 0.011*"energy" + 0.009*"russia" + 0.008*"price" +
126   '+ 0.008*"would" + 0.007*"company" + 0.007*"year" + 0.007*"government" +
127   '0.007*"country"'),
128 (7,
129   '0.010*"say" + 0.008*"year" + 0.005*"like" + 0.005*"go" + 0.005*"man" +
130   '0.005*"people" + 0.004*"get" + 0.004*"johnson" + 0.004*"guardian" +
131   '0.004*"make"'),
132 (8,
133   '0.020*"say" + 0.020*"uk" + 0.018*"refugee" + 0.015*"ukrainian" +
134   '0.014*"visa" + 0.013*"home" + 0.013*"family" + 0.012*"government" +
135   '0.010*"people" + 0.009*"ukraine"'),
136 (9,
137   '0.022*"sanction" + 0.015*"yacht" + 0.013*"own" + 0.010*"port" + 0.009*"uk" +
138   '+ 0.009*"asset" + 0.009*"company" + 0.009*"we" + 0.009*"owner" +
139   '0.008*"ship"'),
140 (10,
141   '0.016*"say" + 0.015*"nato" + 0.009*"would" + 0.009*"country" +
142   '0.009*"ukraine" + 0.008*"finland" + 0.008*"grain" + 0.008*"china" +
143   '0.008*"nuclear" + 0.007*"russia")]
144
145 Topics for a model trained for 14 number of topics
146 [(0,
147   '0.018*"say" + 0.010*"people" + 0.007*"go" + 0.006*"one" + 0.006*"day" +
148   '0.006*"war" + 0.006*"leave" + 0.006*"city" + 0.005*"take" + 0.005*"get"'),
149 (1,
150   '0.014*"say" + 0.011*"russia" + 0.011*"china" + 0.009*"putin" +
151   '0.008*"ukraine" + 0.007*"russian" + 0.007*"war" + 0.006*"we" +
152   '0.005*"would" + 0.004*"also"'),
153 (2,
154   '0.028*"say" + 0.023*"ukraine" + 0.023*"russian" + 0.016*"ukrainian" +
155   '0.015*"russia" + 0.011*"force" + 0.010*"city" + 0.007*"war" +
156   '0.007*"military" + 0.007*"kyiv"'),
157 (3,
158   '0.013*"say" + 0.005*"people" + 0.005*"party" + 0.004*"one" + 0.004*"year" +
159   '0.004*"right" + 0.004*"time" + 0.004*"go" + 0.003*"make" + 0.003*"see"'),
160 (4,
161   '0.023*"say" + 0.019*"russia" + 0.017*"ukraine" + 0.016*"russian" +
162   '0.013*"eu" + 0.011*"sanction" + 0.009*"would" + 0.009*"putin" +
163   '0.008*"country" + 0.008*"minister"'),
164 (5,
165   '0.012*"say" + 0.008*"covid" + 0.006*"rape" + 0.006*"cluster" + 0.006*"case" +
166   '+ 0.005*"death" + 0.005*"find" + 0.004*"country" + 0.004*"body" +
167   '0.004*"people"'),

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168 (6,
169   '0.016*"gas" + 0.013*"say" + 0.012*"energy" + 0.010*"price" + 0.008*"year" + '
170   '0.008*"would" + 0.008*"government" + 0.007*"country" + 0.007*"cost" + '
171   '0.006*"crisis"),,
172 (7,
173   '0.010*"say" + 0.008*"year" + 0.008*"johnson" + 0.006*"aslin" + 0.006*"man" +
174   '+ 0.005*"british" + 0.005*"sentence" + 0.004*"aiden" + 0.004*"go" +
175   '0.004*"like"),
176 (8,
177   '0.023*"uk" + 0.021*"refugee" + 0.021*"say" + 0.019*"ukrainian" +
178   '0.017*"visa" + 0.015*"home" + 0.014*"family" + 0.013*"government" +
179   '0.011*"people" + 0.010*"ukraine"),
180 (9,
181   '0.031*"sanction" + 0.019*"yacht" + 0.017*"own" + 0.016*"company" +
182   '0.012*"owner" + 0.011*"abramovich" + 0.011*"uk" + 0.010*"port" +
183   '0.009*"asset" + 0.009*"superyacht"),
184 (10,
185   '0.025*"nato" + 0.014*"finland" + 0.013*"grain" + 0.012*"sweden" +
186   '0.010*"say" + 0.010*"would" + 0.009*"ukraine" + 0.009*"security" +
187   '0.008*"alliance" + 0.008*"country"),
188 (11,
189   '0.018*"say" + 0.014*"russia" + 0.013*"ukraine" + 0.011*"war" +
190   '0.011*"russian" + 0.008*"putin" + 0.008*"country" + 0.005*"would" +
191   '0.005*"one" + 0.005*"ukrainian"),
192 (12,
193   '0.020*"russian" + 0.012*"say" + 0.007*"russia" + 0.006*"one" +
194   '0.005*"journalist" + 0.005*"report" + 0.004*"ukraine" + 0.004*"year" +
195   '0.004*"putin" + 0.004*"war"),
196 (13,
197   '0.010*"say" + 0.005*"one" + 0.005*"year" + 0.005*"government" +
198   '0.004*"world" + 0.004*"nuclear" + 0.004*"new" + 0.004*"would" +
199   '0.004*"people" + 0.004*"japan")]
200
201 Topics for a model trained for 17 number of topics
202 [(0,
203   '0.018*"say" + 0.011*"people" + 0.007*"go" + 0.007*"day" + 0.006*"one" +
204   '0.006*"leave" + 0.006*"war" + 0.005*"city" + 0.005*"get" + 0.005*"take"),
205 (1,
206   '0.012*"putin" + 0.011*"russian" + 0.010*"sanction" + 0.010*"say" +
207   '0.008*"russia" + 0.007*"abramovich" + 0.005*"ukraine" + 0.005*"uk" +
208   '0.005*"company" + 0.004*"government"),
209 (2,
210   '0.028*"say" + 0.024*"russian" + 0.023*"ukraine" + 0.017*"ukrainian" +
211   '0.016*"russia" + 0.012*"city" + 0.011*"force" + 0.007*"kyiv" +
212   '0.006*"military" + 0.006*"war"),
213 (3,
214   '0.012*"say" + 0.005*"people" + 0.004*"one" + 0.004*"year" + 0.004*"time" +
215   '0.004*"right" + 0.004*"go" + 0.004*"day" + 0.003*"see" + 0.003*"make"),
216 (4,
217   '0.023*"say" + 0.019*"russia" + 0.017*"russian" + 0.017*"eu" +
218   '0.015*"ukraine" + 0.012*"sanction" + 0.009*"would" + 0.008*"country" +
219   '0.008*"european" + 0.008*"putin"),
220 (5,
221   '0.015*"north" + 0.015*"korea" + 0.012*"say" + 0.010*"covid" + 0.007*"south" +
222   '+ 0.006*"korean" + 0.006*"test" + 0.006*"kim" + 0.006*"missile" +
223   '0.005*"cluster"),
224 (6,

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225   '0.016*"gas" + 0.013*"energy" + 0.012*"say" + 0.012*"price" + 0.009*"year" + '
226   '0.009*"government" + 0.008*"cost" + 0.008*"would" + 0.007*"crisis" + '
227   '0.006*"supply"),  

228 (7,  

229   '0.010*"johnson" + 0.009*"say" + 0.009*"year" + 0.007*"aslin" + '  

230   '0.005*"aiden" + 0.004*"story" + 0.004*"like" + 0.004*"pinner" + '  

231   '0.004*"labour" + 0.004*"people"),  

232 (8,  

233   '0.025*"uk" + 0.023*"refugee" + 0.023*"say" + 0.021*"ukrainian" + '  

234   '0.017*"visa" + 0.016*"family" + 0.016*"home" + 0.013*"government" + '  

235   '0.012*"ukraine" + 0.011*"people"),  

236 (9,  

237   '0.026*"yacht" + 0.016*"island" + 0.015*"own" + 0.013*"vessel" + '  

238   '0.012*"superyacht" + 0.011*"sanction" + 0.011*"we" + 0.011*"port" + '  

239   '0.009*"seize" + 0.008*"owner"),  

240 (10,  

241   '0.022*"grain" + 0.019*"nato" + 0.018*"finland" + 0.015*"sweden" + '  

242   '0.013*"turkey" + 0.013*"port" + 0.012*"ukraine" + 0.011*"export" + '  

243   '0.011*"sea" + 0.010*"food"),  

244 (11,  

245   '0.017*"say" + 0.011*"russia" + 0.011*"ukraine" + 0.009*"war" + '  

246   '0.009*"russian" + 0.008*"putin" + 0.008*"country" + 0.005*"year" + '  

247   '0.005*"one" + 0.005*"would"),  

248 (12,  

249   '0.015*"russian" + 0.010*"say" + 0.007*"russia" + 0.006*"one" + '  

250   '0.005*"ukraine" + 0.005*"year" + 0.004*"usmanov" + 0.004*"two" + '  

251   '0.004*"use" + 0.004*"ukrainian"),  

252 (13,  

253   '0.009*"say" + 0.005*"one" + 0.005*"year" + 0.005*"government" + 0.005*"new" + '  

254   '+ 0.004*"people" + 0.004*"world" + 0.004*"would" + 0.004*"make" + '  

255   '0.003*"right"),  

256 (14,  

257   '0.022*"say" + 0.017*"russia" + 0.016*"ukraine" + 0.012*"china" + '  

258   '0.011*"war" + 0.009*"would" + 0.009*"we" + 0.008*"nato" + 0.008*"putin" + '  

259   '0.007*"country"),  

260 (15,  

261   '0.024*"russian" + 0.014*"say" + 0.012*"war" + 0.012*"medium" + '  

262   '0.012*"russia" + 0.009*"news" + 0.007*"journalist" + 0.007*"soldier" + '  

263   '0.007*"channel" + 0.006*"ukraine"),  

264 (16,  

265   '0.023*"say" + 0.020*"ukraine" + 0.016*"russian" + 0.011*"russia" + '  

266   '0.010*"war" + 0.009*"ukrainian" + 0.008*"force" + 0.007*"use" + '  

267   '0.006*"military" + 0.006*"civilian")]
268  

269 Topics for a model trained for 20 number of topics
270 [(0,
271   '0.018*"say" + 0.011*"people" + 0.008*"go" + 0.007*"day" + 0.007*"one" + '  

272   '0.006*"leave" + 0.006*"war" + 0.006*"get" + 0.006*"city" + 0.005*"take"),  

273 (1,
274   '0.013*"sanction" + 0.012*"russian" + 0.012*"putin" + 0.010*"say" + '  

275   '0.008*"russia" + 0.007*"abramovich" + 0.006*"company" + 0.006*"uk" + '  

276   '0.005*"government" + 0.005*"include"),  

277 (2,
278   '0.029*"say" + 0.025*"russian" + 0.017*"ukrainian" + 0.016*"ukraine" + '  

279   '0.014*"russia" + 0.014*"city" + 0.009*"war" + 0.008*"force" + '  

280   '0.008*"mariupol" + 0.008*"people"),  

281 (3,

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282   '0.012*"say" + 0.005*"people" + 0.005*"one" + 0.005*"year" + 0.004*"time" + '
283   '0.004*"go" + 0.004*"guardian" + 0.004*"make" + 0.004*"good" + '
284   '0.004*"right"' ),
285 (4,
286   '0.023*"say" + 0.021*"russian" + 0.020*"eu" + 0.019*"russia" + '
287   '0.017*"sanction" + 0.012*"ukraine" + 0.009*"european" + 0.008*"oil" + '
288   '0.008*"country" + 0.008*"putin"' ),
289 (5,
290   '0.015*"crime" + 0.013*"body" + 0.012*"say" + 0.011*"rape" + '
291   '0.010*"prosecutor" + 0.010*"bucha" + 0.009*"cluster" + 0.008*"evidence" + '
292   '0.008*"civilian" + 0.008*"find"' ),
293 (6,
294   '0.012*"government" + 0.011*"say" + 0.011*"cost" + 0.010*"price" + '
295   '0.009*"year" + 0.008*"gas" + 0.007*"rise" + 0.007*"energy" + 0.007*"bank" + '
296   '0.007*"bn"' ),
297 (7,
298   '0.010*"aslin" + 0.010*"year" + 0.009*"say" + 0.007*"johnson" + '
299   '0.007*"aiden" + 0.006*"pinner" + 0.004*"people" + 0.004*"man" + '
300   '0.004*"like" + 0.004*"first"' ),
301 (8,
302   '0.027*"uk" + 0.024*"refugee" + 0.023*"say" + 0.021*"ukrainian" + '
303   '0.018*"visa" + 0.017*"family" + 0.016*"home" + 0.014*"government" + '
304   '0.012*"ukraine" + 0.011*"people"' ),
305 (9,
306   '0.013*"island" + 0.008*"we" + 0.007*"missile" + 0.007*"korea" + '
307   '0.006*"tikhonova" + 0.005*"north" + 0.005*"ballistic" + 0.004*"snake" + '
308   '0.004*"yacht" + 0.004*"report"' ),
309 (10,
310   '0.013*"nuclear" + 0.012*"reactor" + 0.009*"plant" + 0.008*"nato" + '
311   '0.007*"power" + 0.006*"sri" + 0.006*"lanka" + 0.005*"ukraine" + '
312   '0.005*"mine" + 0.004*"safety"' ),
313 (11,
314   '0.016*"say" + 0.012*"russia" + 0.011*"russian" + 0.011*"ukraine" + '
315   '0.009*"war" + 0.007*"country" + 0.007*"putin" + 0.005*"one" + 0.005*"year" + '
316   '+ 0.004*"people"' ),
317 (12,
318   '0.013*"orban" + 0.011*"russian" + 0.011*"say" + 0.009*"hungary" + '
319   '0.008*"hungarian" + 0.007*"year" + 0.006*"ukrainian" + 0.005*"church" + '
320   '0.005*"one" + 0.004*"government"' ),
321 (13,
322   '0.009*"say" + 0.005*"year" + 0.005*"one" + 0.005*"government" + '
323   '0.005*"people" + 0.004*"new" + 0.004*"world" + 0.004*"would" + '
324   '0.004*"north" + 0.004*"make"' ),
325 (14,
326   '0.020*"say" + 0.016*"russia" + 0.015*"china" + 0.014*"ukraine" + '
327   '0.013*"war" + 0.009*"putin" + 0.008*"would" + 0.007*"we" + 0.006*"russian" + '
328   '+ 0.006*"country"' ),
329 (15,
330   '0.023*"russian" + 0.011*"say" + 0.010*"medium" + 0.010*"russia" + '
331   '0.009*"soldier" + 0.007*"war" + 0.007*"platform" + 0.007*"social" + '
332   '0.007*"internet" + 0.006*"facebook"' ),
333 (16,
334   '0.023*"say" + 0.015*"ukraine" + 0.015*"russian" + 0.011*"russia" + '
335   '0.008*"war" + 0.007*"soldier" + 0.006*"ukrainian" + 0.006*"use" + '
336   '0.005*"would" + 0.005*"force"' ),
337 (17,
338   '0.026*"ukraine" + 0.025*"say" + 0.021*"russian" + 0.015*"russia" + '

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339   '0.014*"ukrainian" + 0.011*"force" + 0.008*"military" + 0.007*"city" + '
340   '0.007*"kyiv" + 0.006*"war"'),
341 (18,
342   '0.017*"say" + 0.011*"russia" + 0.010*"ukraine" + 0.010*"would" + '
343   '0.008*"country" + 0.006*"gas" + 0.006*"germany" + 0.005*"nato" + '
344   '0.005*"minister" + 0.005*"russian"'),
345 (19,
346   '0.009*"war" + 0.008*"say" + 0.007*"chicken" + 0.004*"conscription" + '
347   '0.004*"ukraine" + 0.004*"well" + 0.003*"grow" + 0.003*"fox" + '
348   '0.003*"include" + 0.003*"welfare"]')
349
350 Topics for a model trained for 23 number of topics
351 [(0,
352   '0.018*"say" + 0.011*"people" + 0.008*"go" + 0.008*"day" + 0.007*"one" + '
353   '0.007*"war" + 0.006*"leave" + 0.006*"city" + 0.006*"get" + 0.006*"take"'),
354 (1,
355   '0.014*"putin" + 0.013*"sanction" + 0.013*"russian" + 0.010*"say" + '
356   '0.009*"russia" + 0.008*"abramovich" + 0.006*"company" + 0.006*"uk" + '
357   '0.005*"government" + 0.005*"ukraine"'),
358 (2,
359   '0.029*"say" + 0.025*"russian" + 0.017*"ukraine" + 0.017*"ukrainian" + '
360   '0.015*"russia" + 0.014*"city" + 0.009*"war" + 0.008*"force" + '
361   '0.008*"people" + 0.008*"mariupol"'),
362 (3,
363   '0.011*"say" + 0.005*"people" + 0.005*"one" + 0.005*"time" + '
364   '0.004*"guardian" + 0.004*"go" + 0.004*"make" + 0.004*"year" + 0.004*"good" '
365   '+ 0.004*"story"'),
366 (4,
367   '0.025*"say" + 0.022*"russian" + 0.021*"russia" + 0.019*"eu" + '
368   '0.018*"sanction" + 0.013*"ukraine" + 0.009*"country" + 0.009*"oil" + '
369   '0.008*"putin" + 0.008*"minister"'),
370 (5,
371   '0.013*"rape" + 0.013*"say" + 0.009*"cluster" + 0.007*"sexual" + '
372   '0.006*"woman" + 0.006*"crime" + 0.005*"violence" + 0.005*"case" + '
373   '0.005*"prosecutor" + 0.004*"victim"'),
374 (6,
375   '0.018*"gas" + 0.012*"government" + 0.011*"energy" + 0.010*"say" + '
376   '0.007*"payment" + 0.007*"would" + 0.007*"italy" + 0.007*"bank" + '
377   '0.007*"cost" + 0.006*"bn"'),
378 (7,
379   '0.015*"taiwan" + 0.010*"say" + 0.008*"year" + 0.007*"johnson" + '
380   '0.005*"people" + 0.005*"pelosi" + 0.005*"pride" + 0.004*"island" + '
381   '0.004*"go" + 0.004*"come"'),
382 (8,
383   '0.032*"uk" + 0.025*"refugee" + 0.023*"say" + 0.022*"ukrainian" + '
384   '0.019*"visa" + 0.018*"family" + 0.017*"home" + 0.016*"government" + '
385   '0.012*"ukraine" + 0.012*"scheme"'),
386 (9,
387   '0.024*"island" + 0.017*"venezuela" + 0.016*"maduro" + 0.014*"we" + '
388   '0.011*"cuba" + 0.009*"snake" + 0.008*"gonzalez" + 0.007*"tikhonova" + '
389   '0.005*"latin" + 0.004*"university"'),
390 (10,
391   '0.051*"nato" + 0.031*"finland" + 0.025*"sweden" + 0.016*"membership" + '
392   '0.014*"alliance" + 0.014*"say" + 0.013*"join" + 0.012*"would" + '
393   '0.011*"country" + 0.011*"security"'),
394 (11,
395   '0.017*"say" + 0.012*"russia" + 0.010*"ukraine" + 0.010*"russian" + '

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396   '0.009*"war" + 0.007*"putin" + 0.007*"country" + 0.005*"year" + 0.005*"one" +
397   '+ 0.004*"soviet"' ),
398 (12,
399   '0.016*"orban" + 0.012*"russian" + 0.011*"hungary" + 0.010*"hungarian" + '
400   '0.009*"say" + 0.008*"usmanov" + 0.006*"ukrainian" + 0.004*"year" + '
401   '0.004*"opposition" + 0.004*"one"' ),
402 (13,
403   '0.009*"say" + 0.005*"government" + 0.005*"one" + 0.005*"year" + '
404   '0.004*"johnson" + 0.004*"right" + 0.004*"would" + 0.004*"people" + '
405   '0.004*"make" + 0.004*"new"' ),
406 (14,
407   '0.021*"say" + 0.017*"russia" + 0.016*"china" + 0.015*"ukraine" + '
408   '0.015*"war" + 0.010*"putin" + 0.007*"would" + 0.007*"we" + 0.007*"russian" +
409   '+ 0.006*"invasion"' ),
410 (15,
411   '0.024*"russian" + 0.015*"medium" + 0.012*"say" + 0.012*"russia" + '
412   '0.011*"war" + 0.010*"news" + 0.009*"journalist" + 0.008*"information" + '
413   '0.007*"social" + 0.007*"report"' ),
414 (16,
415   '0.022*"say" + 0.015*"russian" + 0.014*"ukraine" + 0.011*"russia" + '
416   '0.008*"war" + 0.007*"use" + 0.006*"ukrainian" + 0.006*"soldier" + '
417   '0.006*"force" + 0.006*"crime"' ),
418 (17,
419   '0.027*"ukraine" + 0.025*"say" + 0.021*"russian" + 0.016*"russia" + '
420   '0.014*"ukrainian" + 0.012*"force" + 0.008*"military" + 0.007*"city" + '
421   '0.007*"kyiv" + 0.006*"war"' ),
422 (18,
423   '0.016*"say" + 0.010*"would" + 0.010*"russia" + 0.008*"ukraine" + '
424   '0.007*"germany" + 0.007*"macron" + 0.007*"gas" + 0.006*"country" + '
425   '0.006*"eu" + 0.005*"german"' ),
426 (19,
427   '0.009*"say" + 0.009*"war" + 0.007*"chicken" + 0.005*"conscription" + '
428   '0.005*"ukraine" + 0.004*"body" + 0.004*"grow" + 0.003*"well" + '
429   '0.003*"welfare" + 0.003*"fox"' ),
430 (20,
431   '0.013*"say" + 0.011*"year" + 0.009*"price" + 0.009*"food" + 0.008*"country" +
432   '+ 0.006*"rise" + 0.006*"world" + 0.005*"people" + 0.005*"ukraine" + '
433   '0.005*"covid"' ),
434 (21,
435   '0.020*"say" + 0.015*"ukraine" + 0.011*"ukrainian" + 0.008*"grain" + '
436   '0.007*"russian" + 0.006*"people" + 0.006*"go" + 0.006*"port" + '
437   '0.005*"country" + 0.005*"one"' ),
438 (22,
439   '0.030*"nuclear" + 0.016*"say" + 0.013*"missile" + 0.013*"korea" + '
440   '0.013*"north" + 0.010*"japan" + 0.008*"weapon" + 0.007*"south" + 0.007*"we" +
441   '+ 0.006*"ship"' )
442
443 Topics for a model trained for 26 number of topics
444 [(0,
445   '0.018*"say" + 0.011*"people" + 0.008*"go" + 0.008*"day" + 0.008*"one" + '
446   '0.007*"war" + 0.006*"leave" + 0.006*"take" + 0.006*"city" + 0.006*"get"' ),
447 (1,
448   '0.016*"sanction" + 0.014*"russian" + 0.013*"putin" + 0.010*"say" + '
449   '0.009*"russia" + 0.008*"company" + 0.008*"abramovich" + 0.008*"uk" + '
450   '0.006*"government" + 0.005*"include"' ),
451 (2,
452   '0.027*"say" + 0.026*"russian" + 0.018*"ukraine" + 0.017*"ukrainian" + '

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453   '0.017*"russia" + 0.011*"war" + 0.010*"city" + 0.007*"putin" + 0.007*"force" +
454   '+ 0.006*"moscow"' ),
455 (3,
456   '0.011*"say" + 0.005*"people" + 0.005*"one" + 0.005*"time" +
457   '0.005*"guardian" + 0.005*"go" + 0.005*"year" + 0.004*"make" + 0.004*"good" +
458   '+ 0.004*"story"' ),
459 (4,
460   '0.026*"say" + 0.021*"russian" + 0.021*"eu" + 0.020*"russia" +
461   '0.016*"sanction" + 0.014*"ukraine" + 0.010*"european" + 0.009*"would" +
462   '0.009*"country" + 0.009*"minister"' ),
463 (5,
464   '0.015*"say" + 0.014*"rape" + 0.011*"crime" + 0.011*"cluster" + 0.010*"case" +
465   '+ 0.009*"prosecutor" + 0.009*"woman" + 0.008*"sexual" + 0.008*"body" +
466   '0.006*"victim"' ),
467 (6,
468   '0.012*"government" + 0.012*"cost" + 0.011*"price" + 0.010*"say" +
469   '0.010*"year" + 0.008*"rise" + 0.007*"bank" + 0.007*"inflation" +
470   '0.007*"new" + 0.007*"italy"' ),
471 (7,
472   '0.023*"taiwan" + 0.010*"say" + 0.008*"year" + 0.008*"pelosi" +
473   '0.007*"island" + 0.007*"pride" + 0.006*"people" + 0.005*"go" +
474   '0.005*"drill" + 0.004*"first"' ),
475 (8,
476   '0.020*"aslin" + 0.017*"british" + 0.014*"aiden" + 0.012*"family" +
477   '0.012*"prisoner" + 0.011*"pinner" + 0.011*"sentence" + 0.010*"say" +
478   '0.009*"foreign" + 0.007*"uk"' ),
479 (9,
480   '0.013*"island" + 0.009*"tikhonova" + 0.007*"snake" + 0.006*"daughter" +
481   '0.006*"we" + 0.005*"vylkove" + 0.005*"vorontsova" + 0.005*"italian" +
482   '0.004*"university" + 0.004*"carrara"' ),
483 (10,
484   '0.052*"nato" + 0.028*"finland" + 0.023*"sweden" + 0.016*"say" +
485   '0.015*"membership" + 0.014*"alliance" + 0.013*"would" + 0.013*"join" +
486   '0.011*"country" + 0.011*"security"' ),
487 (11,
488   '0.015*"say" + 0.010*"russia" + 0.009*"russian" + 0.008*"ukraine" +
489   '0.008*"war" + 0.007*"putin" + 0.007*"country" + 0.006*"year" + 0.005*"one" +
490   '+ 0.005*"soviet"' ),
491 (12,
492   '0.017*"orban" + 0.013*"russian" + 0.013*"hungary" + 0.011*"say" +
493   '0.010*"hungarian" + 0.009*"ukrainian" + 0.007*"opposition" + 0.006*"year" +
494   '0.006*"ukraine" + 0.005*"war"' ),
495 (13,
496   '0.009*"say" + 0.006*"government" + 0.005*"one" + 0.004*"year" +
497   '0.004*"johnson" + 0.004*"would" + 0.004*"people" + 0.004*"new" +
498   '0.004*"abortion" + 0.004*"right"' ),
499 (14,
500   '0.020*"say" + 0.016*"russia" + 0.016*"war" + 0.016*"china" +
501   '0.014*"ukraine" + 0.010*"putin" + 0.007*"would" + 0.007*"russian" +
502   '0.006*"we" + 0.006*"invasion"' ),
503 (15,
504   '0.022*"russian" + 0.012*"soldier" + 0.011*"war" + 0.009*"say" +
505   '0.007*"russia" + 0.007*"gazeta" + 0.007*"journalist" + 0.007*"novaya" +
506   '0.006*"report" + 0.006*"prisoner"' ),
507 (16,
508   '0.025*"say" + 0.017*"russian" + 0.017*"ukraine" + 0.011*"russia" +
509   '0.008*"ukrainian" + 0.008*"war" + 0.007*"soldier" + 0.007*"force" +

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510   '0.006*"would" + 0.005*"use"' ),
511   (17,
512     '0.028*"ukraine" + 0.025*"say" + 0.021*"russian" + 0.016*"russia" + '
513     '0.015*"ukrainian" + 0.012*"force" + 0.009*"military" + 0.006*"war" + '
514     '0.006*"defence" + 0.006*"kyiv"' ),
515   (18,
516     '0.017*"say" + 0.014*"russia" + 0.010*"ukraine" + 0.010*"gas" + '
517     '0.010*"would" + 0.009*"country" + 0.009*"germany" + 0.007*"russian" + '
518     '0.007*"energy" + 0.006*"german"' ),
519   (19,
520     '0.011*"war" + 0.009*"chicken" + 0.007*"say" + 0.006*"conscription" + '
521     '0.006*"ukraine" + 0.004*"body" + 0.004*"fox" + 0.004*"welfare" + '
522     '0.004*"grow" + 0.004*"include"' ),
523   (20,
524     '0.017*"macron" + 0.013*"le" + 0.013*"say" + 0.012*"pen" + 0.010*"france" + '
525     '0.008*"french" + 0.008*"vote" + 0.008*"election" + 0.008*"right" + '
526     '0.008*"year"' ),
527   (21,
528     '0.018*"say" + 0.016*"ukraine" + 0.013*"grain" + 0.010*"ukrainian" + '
529     '0.009*"port" + 0.007*"russian" + 0.006*"food" + 0.006*"ship" + '
530     '0.005*"country" + 0.005*"go"' ),
531   (22,
532     '0.028*"nuclear" + 0.017*"say" + 0.013*"korea" + 0.013*"missile" + '
533     '0.013*"north" + 0.010*"japan" + 0.008*"weapon" + 0.007*"south" + 0.007*"we" +
534     '+ 0.006*"test"' ),
535   (23,
536     '0.026*"say" + 0.022*"city" + 0.016*"russian" + 0.012*"mariupol" + '
537     '0.012*"ukraine" + 0.012*"people" + 0.010*"ukrainian" + 0.010*"civilian" + '
538     '0.009*"force" + 0.009*"russia"' ),
539   (24,
540     '0.022*"say" + 0.018*"uk" + 0.017*"ukrainian" + 0.017*"refugee" + '
541     '0.013*"family" + 0.012*"visa" + 0.012*"home" + 0.012*"ukraine" + '
542     '0.010*"people" + 0.010*"government"' ),
543   (25,
544     '0.020*"say" + 0.015*"russia" + 0.014*"russian" + 0.012*"ukraine" + '
545     '0.009*"medium" + 0.007*"government" + 0.006*"state" + 0.005*"invasion" + '
546     '0.005*"include" + 0.005*"social"' )
547
548 Topics for a model trained for 29 number of topics
549 [(0,
550   '0.018*"say" + 0.010*"people" + 0.008*"go" + 0.008*"day" + 0.008*"one" + '
551   '0.007*"war" + 0.006*"leave" + 0.006*"city" + 0.006*"take" + '
552   '0.006*"russian"' ),
553   (1,
554     '0.015*"sanction" + 0.014*"putin" + 0.013*"russian" + 0.010*"say" + '
555     '0.009*"russia" + 0.008*"abramovich" + 0.008*"uk" + 0.007*"company" + '
556     '0.006*"government" + 0.005*"asset"' ),
557   (2,
558     '0.028*"say" + 0.027*"russian" + 0.018*"ukraine" + 0.017*"ukrainian" + '
559     '0.016*"russia" + 0.011*"war" + 0.009*"city" + 0.007*"force" + 0.007*"putin" +
560     '+ 0.006*"people"' ),
561   (3,
562     '0.010*"say" + 0.006*"people" + 0.005*"one" + 0.004*"go" + 0.004*"guardian" +
563     '+ 0.004*"year" + 0.004*"time" + 0.004*"get" + 0.004*"day" + 0.004*"make"' ),
564   (4,
565     '0.025*"say" + 0.022*"russian" + 0.021*"eu" + 0.019*"russia" + '
566     '0.016*"sanction" + 0.012*"ukraine" + 0.009*"gas" + 0.009*"european" + '

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567   '0.009*"minister" + 0.009*"would"' ),
568 (5,
569   '0.029*"crime" + 0.017*"prosecutor" + 0.016*"say" + 0.014*"rape" + '
570   '0.012*"case" + 0.011*"body" + 0.011*"evidence" + 0.010*"bucha" + '
571   '0.009*"cluster" + 0.008*"investigation"' ),
572 (6,
573   '0.017*"italy" + 0.012*"payment" + 0.011*"debt" + 0.010*"government" + '
574   '0.010*"default" + 0.010*"draghi" + 0.009*"say" + 0.008*"bank" + '
575   '0.008*"russia" + 0.007*"party"' ),
576 (7,
577   '0.023*"taiwan" + 0.010*"say" + 0.008*"pelosi" + 0.008*"year" + '
578   '0.006*"island" + 0.005*"people" + 0.005*"pride" + 0.005*"johnson" + '
579   '0.004*"go" + 0.004*"drill"' ),
580 (8,
581   '0.017*"british" + 0.017*"aslin" + 0.015*"sentence" + 0.014*"prisoner" + '
582   '0.013*"say" + 0.013*"family" + 0.012*"aiden" + 0.010*"pinner" + '
583   '0.010*"fight" + 0.010*"foreign"' ),
584 (9,
585   '0.046*"island" + 0.032*"yacht" + 0.016*"snake" + 0.013*"vessel" + '
586   '0.008*"we" + 0.008*"seize" + 0.008*"superyacht" + 0.008*"crew" + '
587   '0.008*"own" + 0.008*"sea"' ),
588 (10,
589   '0.009*"mine" + 0.007*"ukraine" + 0.006*"sea" + 0.005*"war" + 0.004*"peace" +
590   '+ 0.004*"nato" + 0.004*"garden" + 0.003*"time" + 0.003*"make" + '
591   '0.003*"would"' ),
592 (11,
593   '0.016*"say" + 0.010*"russia" + 0.009*"russian" + 0.008*"ukraine" + '
594   '0.008*"war" + 0.007*"putin" + 0.007*"country" + 0.006*"year" + 0.005*"one" +
595   '+ 0.005*"soviet"' ),
596 (12,
597   '0.015*"russian" + 0.011*"say" + 0.010*"ukrainian" + 0.006*"ukraine" + '
598   '0.006*"year" + 0.006*"one" + 0.005*"work" + 0.005*"russia" + '
599   '0.005*"journalist" + 0.004*"war"' ),
600 (13,
601   '0.009*"say" + 0.007*"johnson" + 0.005*"one" + 0.005*"year" + '
602   '0.005*"government" + 0.005*"make" + 0.004*"new" + 0.004*"right" + '
603   '0.004*"would" + 0.004*"people"' ),
604 (14,
605   '0.021*"say" + 0.018*"russia" + 0.016*"war" + 0.015*"ukraine" + '
606   '0.015*"china" + 0.011*"putin" + 0.008*"would" + 0.007*"russian" + '
607   '0.007*"country" + 0.007*"invasion"' ),
608 (15,
609   '0.021*"russian" + 0.013*"soldier" + 0.010*"war" + 0.008*"say" + '
610   '0.008*"novaya" + 0.007*"gazeta" + 0.006*"video" + 0.006*"report" + '
611   '0.006*"fsb" + 0.005*"russia"' ),
612 (16,
613   '0.022*"say" + 0.016*"russian" + 0.013*"ukraine" + 0.010*"russia" + '
614   '0.007*"war" + 0.007*"soldier" + 0.007*"use" + 0.006*"force" + '
615   '0.006*"ukrainian" + 0.005*"would"' ),
616 (17,
617   '0.029*"ukraine" + 0.026*"say" + 0.021*"russian" + 0.017*"russia" + '
618   '0.015*"ukrainian" + 0.012*"force" + 0.009*"military" + 0.006*"war" + '
619   '0.006*"kyiv" + 0.006*"defence"' ),
620 (18,
621   '0.016*"say" + 0.013*"russia" + 0.010*"would" + 0.010*"gas" + '
622   '0.010*"ukraine" + 0.009*"germany" + 0.008*"country" + 0.008*"energy" + '
623   '0.006*"eu" + 0.006*"russian"' ),

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624 (19,
625   '0.009*"say" + 0.009*"war" + 0.008*"chicken" + 0.006*"conscription" + '
626   '0.005*"ukraine" + 0.005*"include" + 0.004*"director" + 0.004*"welfare" + '
627   '0.004*"grow" + 0.004*"news"' ),
628 (20,
629   '0.014*"macron" + 0.013*"say" + 0.011*"le" + 0.010*"pen" + 0.009*"year" + '
630   '0.008*"france" + 0.007*"vote" + 0.007*"election" + 0.007*"french" + '
631   '0.006*"right"' ),
632 (21,
633   '0.019*"say" + 0.016*"ukraine" + 0.013*"grain" + 0.011*"ukrainian" + '
634   '0.009*"port" + 0.008*"russian" + 0.006*"food" + 0.005*"go" + 0.005*"ship" + '
635   '0.005*"country"' ),
636 (22,
637   '0.026*"nuclear" + 0.017*"say" + 0.013*"korea" + 0.013*"north" + '
638   '0.013*"missile" + 0.012*"japan" + 0.008*"south" + 0.008*"we" + '
639   '0.007*"weapon" + 0.006*"country"' ),
640 (23,
641   '0.027*"say" + 0.022*"city" + 0.016*"russian" + 0.013*"ukraine" + '
642   '0.012*"mariupol" + 0.012*"people" + 0.011*"ukrainian" + 0.009*"civilian" + '
643   '0.009*"russia" + 0.009*"kyiv"' ),
644 (24,
645   '0.022*"say" + 0.017*"refugee" + 0.017*"uk" + 0.017*"ukrainian" + '
646   '0.013*"family" + 0.013*"visa" + 0.012*"ukraine" + 0.012*"home" + '
647   '0.011*"people" + 0.010*"government"' ),
648 (25,
649   '0.021*"say" + 0.017*"russia" + 0.016*"russian" + 0.013*"ukraine" + '
650   '0.010*"medium" + 0.007*"government" + 0.006*"invasion" + 0.006*"state" + '
651   '0.005*"include" + 0.005*"social"' ),
652 (26,
653   '0.038*"oil" + 0.017*"abe" + 0.011*"export" + 0.010*"price" + 0.009*"palm" + '
654   '0.008*"police" + 0.008*"supply" + 0.008*"indonesia" + 0.007*"ban" + '
655   '0.006*"import"' ),
656 (27,
657   '0.018*"new" + 0.015*"say" + 0.012*"zealand" + 0.009*"turkey" + '
658   '0.009*"party" + 0.007*"minister" + 0.007*"ardern" + 0.006*"government" + '
659   '0.006*"erdogan" + 0.004*"kurkish"' ),
660 (28,
661   '0.021*"nato" + 0.017*"say" + 0.016*"finland" + 0.012*"sweden" + '
662   '0.011*"country" + 0.011*"russia" + 0.009*"membership" + 0.009*"would" + '
663   '0.008*"ukraine" + 0.007*"security"' )
664
665 Step 11: Compute Topic Coherence Score
666 /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
667   from imp import reload
668 /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
669   from imp import reload
670 /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
671   from imp import reload

```

```
672 /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
673     from imp import reload
674 /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
675     from imp import reload
676 /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
677     from imp import reload
678 /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
679     from imp import reload
680 /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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791     from imp import reload
792 (list_index, number_topics, u_mass_coherence_, c_v_coherence)
793 [(1, 5, -0.6839803442358539, 0.3864560159225446),
794 (2, 8, -0.7870243399460861, 0.38433110829125244),
795 (3, 11, -1.03282394001266, 0.4145768866773433),
796 (4, 14, -0.9445267169370922, 0.4037943115420513),
797 (5, 17, -0.9923916365568206, 0.3935894396350686),
798 (6, 20, -1.5727589272538411, 0.3905326394940621),
799 (7, 23, -1.6918063126335152, 0.40416556066186576),
800 (8, 26, -1.6440576818581039, 0.4316790608911575),
801 (9, 29, -1.443544600251307, 0.4041499581447533)]
802
803 Step 12: Visualize the topics
804 /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.
805     by='saliency', ascending=False).head(R).drop('saliency', 1)
806 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/past/
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824 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/
     setuptools/_distutils/version.py:351: DeprecationWarning: distutils Version classes are
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     pyLDAvis/_prepare.py:247: FutureWarning: In a future version of pandas all arguments
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1270 of DataFrame.drop except for the argument 'labels' will be keyword-only.
1271     by='saliency', ascending=False).head(R).drop('saliency', 1)
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pyLDAvis/_prepare.py:247: FutureWarning: In a future version of pandas all arguments
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1451     by='saliency', ascending=False).head(R).drop('saliency', 1)
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    are deprecated. Use packaging.version instead.  
1605     other = LooseVersion(other)  
1606 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/joblib/  
    backports.py:36: DeprecationWarning: distutils Version classes are deprecated. Use  
    packaging.version instead.  
1607     if LooseVersion(np.__version__) < '1.13':  
1608 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/  
    setuptools/_distutils/version.py:351: DeprecationWarning: distutils Version classes  
    are deprecated. Use packaging.version instead.  
1609     other = LooseVersion(other)  
1610 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/joblib/  
    backports.py:36: DeprecationWarning: distutils Version classes are deprecated. Use  
    packaging.version instead.  
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1612 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/  
    setuptools/_distutils/version.py:351: DeprecationWarning: distutils Version classes
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1612 are deprecated. Use packaging.version instead.
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    packaging.version instead.
1627     if LooseVersion(np.__version__) < '1.13':
1628 /Users/nelsonquintanilla/.conda/envs/dissertation/lib/python3.10/site-packages/
    setuptools/_distutils/version.py:351: DeprecationWarning: distutils Version classes
    are deprecated. Use packaging.version instead.
1629     other = LooseVersion(other)
1630
1631 Process finished with exit code 0
1632
```