

**Global Perception of the Belt and Road Initiative:
A Natural Language Processing Approach**

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Abstract

In less than seven years since the launch of the Belt and Road Initiative (BRI), 138 countries have signed on to the program with by some counts 118 projects being planned. BRI is a Chinese multi-trillion-dollar global infrastructure initiative that has geopolitical implications for both the participating as well as non-participating countries. Some of the very appealing unique selling points of this initiative also make it controversial amongst its stakeholders. This variation in sentiments can be perceived in the media reporting where there is freedom of expression. In this paper, we have used sentiment analysis to gauge the variation in the stakeholder perception over time across three groups, China, participating and non-participating countries. Our analysis of 7,280 news articles has provided quantitative evidence of declining positive sentiment over time.

Overview of Belt and Road Initiative

Historical Context

President Xi Jin Ping of China in 2013 announced, what was then known as, the One Belt One Road (OBOR) strategy (Chatzky & McBride, 2019). The belt in this referred to the terrestrial corridors while the road referred to the maritime lanes. This was a modern take on the ancient Silk Route/Road. The original Silk Road was not a singular road, nor did it only facilitate

silk trade. It was a network of roads that carried different goods from different countries. From West to East these goods included: horses, saddles and riding tack, grapevine and grapes, dogs and other animals both exotic and domestic, animal furs and skins, honey, fruits, glassware, woolen blankets, rugs, carpets, textiles (such as curtains), gold and silver, camels, slaves, weapons and armor. From East to West the goods included: silk, tea, dyes, precious stones, china (plates, bowls, cups, vases), porcelain, spices (such as cinnamon and ginger), bronze and gold artifacts, medicine, perfumes, ivory, rice, paper and gunpowder (Mark, 2019). The road carried more than goods. It also carried migrants, religion, science, and art (UNESCO, 2019). Its amalgamation was therefore very organic. In fact, the network was not called Silk Road until 1877 (Whitfield, 2007). As with the original Silk Road, the modern version is not a single road but a network of roads. The name was therefore subsequently changed One Belt One Road (OBOR) to Belt and Road Initiative (BRI) to reflect this broader scope (Bērziņa-Čerenkova, 2016).

China's plans for its New Silk Road

The idea of rejuvenating the ancient silk road is not new and has been discussed and advocated enthusiastically in the past (Griffiths, 2017). However, the magnitude of China's approach seems to have created apprehension in the minds of policymakers adversely impacted by the project. President Xi's plan is to create a network of roads, railways, pipelines, and ports to facilitate trade with the rest of the world. China's investment in this global initiative is expected to cross well over a trillion dollars. The BRI has six main economic corridors: (1) the New Eurasian Land Bridge; (2) the China-Central Asia-West Asia Corridor; (3) the China-Pakistan Corridor; (4) the Bangladesh-China- Myanmar Corridor; (5) the China-Mongolia-Russia Corridor; (6) the China-Indochina Peninsula Corridor (Indermit Gill & Mathilde, 2019). China claims that this project is economic in nature and would be a mutual win-win for all the parties involved. Others, however, have been skeptical about both the intent as well as the consequences of this mega project on the host nations (Chatzky & McBride, 2019).

Insert Figure 1 about here

Concerns about the Belt and Road Initiative

There are two main categories of concerns regarding this initiative: economic and strategic. Economically the concerns revolve around debt implications for the countries taking on the BRI related projects, while strategically the concerns are about the implication of the indebtedness of the borrowers on their ability to make independent policy decisions (Hurley, Morris, & Portelance, 2019). A good example of this is Sri Lanka's Hambantota port project (Rithmire & Li, 2019). Sri Lanka took a loan of over a billion dollars from the Chinese Ex-Im bank to pay for the Chinese built port in southern Sri Lanka. The port, however, did not generate the projected revenue and the Sri Lankan government ended up handing over the port in lieu to China. This concern on the borrowing countries has led to public opposition to the BRI funded projects in Sri Lanka, Maldives, Malaysia, Kenya, and Pakistan (Balding, 2018). Other countries such as the United States of America and India have reservations due to the strategic implications of the growing Chinese influence on the BRI participating countries. Indeed, infrastructure that is used to support trade can be equally efficiently used to support the military. The Chinese have been accused of being opaque in their dealings and resorting to bribery to get the decisions in their favor. China has made conscious efforts to overcome this image by both being open in its dealings (Bloomberg, 2019) as well as decimating information (Adrien, 2019). China has renegotiated some of its projects while it has also written off some of the loans that it has given. These steps have had some success in resurrecting stalled projects and public opinion. The perception about the BRI has therefore been swinging both in the positive as well as negative direction. In this paper, we are exploring the magnitude and direction of the public opinion in both temporal as well as spatial domains.

Research Questions

The research questions we investigated in our study are as follows:

1. What is the overall sentiment in the international news media about the Belt and Road Initiative?
2. How does the sentiment change over time?
3. Is there a relative difference in change of the positive and negative sentiments over time?
4. What are some key drivers of the changes in BRI related sentiment over time across the regions?

Methodology

Data

The data consisted of news articles on the Belt and Road Initiative (BRI) collected from the Factiva database. Factiva is an international news database produced by Dow Jones, a leading provider of news and financial information. It offers a powerful research platform, with comprehensive coverage of international news from over 32,000 sources. We searched the Factiva database for the keywords “Belt and Road Initiative” over a time period from the BRI initiative announcement in September 2015 to October 2019, which resulted in 7,280 news articles. Figure 2 shows the distribution of news articles by country and Figure 3 shows the distribution of news articles over time.

Insert Figure 2 and 3 about here

We divided the countries into three regional categories – China, countries that are participating in BRI (henceforth referred to as participating countries) and countries that are not participating in BRI (henceforth referred to as non-participating countries). We felt prudent to divide the countries into three categories i.e., China (the original initiator and sponsor of the project), non-participating countries that have maintained opposition to the project for various reasons including geopolitics and finally participating countries that have at least on paper signed-on to this project. The assumption being made is that there are two primary schools of thought: China, whose vision is reflected in the project and that of the countries that have opposing perspectives regarding this undertaking. At the time of this report, there are 138 countries that have signed cooperation documents with China for the Belt and Road Initiative (See Table 1). These agreements are exploratory in nature and have not necessarily translated into actual projects. It is therefore assumed that they are open to actual projects but are not committed. China as the sponsor could be argued to have a relatively positive outlook of the project while those countries that have consistently held a negative view could be considered as being committed to that perspective. Finally, those that have signed the agreements are probably the ones most open to different perspectives. This paper, therefore, separates the sentiments across the three groups to avoid cross bias between them. Figure 4 shows the countries that we categorized as participating and non-participating.

Insert Table 1 and Figure 4 about here

Analysis

We used Sentiment Analysis to extract the sentiment from the news articles in order to address our research questions. Sentiment Analysis is a Natural Language Processing (NLP) technique that attempts to categorize the emotions and sentiments in a block of text. Most sentiment analysis tools will categorize the sentiment as positive, negative or neutral and also provide indexes for affective states such as anger, sadness, happiness, etc. Sentiment analysis has been widely used to mine emotions from social media posts and news articles and has been effective in identifying depression, anxiety and other emotions (De Choudhury, Gamon, Counts, & Horvitz, 2013).

There are two main approaches to extracting sentiment from text. The lexicon-based approach uses a dictionary of words annotated with their sentiment polarities, while the text classification approach involves building classifiers from labeled instances of texts. Lexicon/dictionary-based approaches work well when there is insufficient human classified data or when human classification is time-consuming and expensive. The lexicon-based approach has several important advantages - first, once the dictionary is selected researcher subjectivity is avoided, second, the method scales to large samples and third, since the dictionaries are publicly available, it is easier to replicate the analysis of other researchers (Loughran & McDonald, 2016).

We have used the lexicon-based approach in this study due to its inherent advantages and also as it would be very time consuming and impractical to hand classify the sentiment in the news articles to create a large enough training dataset. There are several sentiment lexicons publicly available. We use a popular lexicon called the NRC lexicon (Mohammad & Turney, 2013) which consists of 14,182 words, 2317 of which are positive and 3338 are negative.

We preprocessed the data by removing stop words, punctuations, numbers, white spaces and other words that would not be pertinent to conveying sentiment. The sentiment analysis was done on the preprocessed data. The output of the sentiment analysis was a count of positive and negative sentiment words by month and by the three regional categories (China, participating countries and non-participating countries). From this output, we computed a positive, negative

and overall sentiment index by month and by regional category. We computed an index of positive sentiment by dividing the number of positive sentiment words by the total number of words in that month. The negative sentiment index was computed similarly to the positive sentiment index. An overall net sentiment index was computed by subtracting out the count of negative sentiment words from the count of positive sentiment words and dividing this difference by the total number of words. We used the R software to perform the analysis.

Results

Figure 5 shows the overall sentiment aggregated across all the countries that were part of our analysis. As can be noted from the graph the overall positive sentiment is greater than the overall negative sentiment, thus, leading to a net positive overall sentiment for BRI. The overall positive sentiment seems to be declining over time, while the overall negative sentiment has held fairly steady over time. The graph also shows peaks in overall positive sentiment during 2016.

Insert Figure 5 about here

Similar declining trends in positive sentiment are shown in Figures 6 , 7 and 8 for China, the participating countries and the non-participating countries respectively. The negative sentiment in all three regional categories has more or less held steady. The variation in the overall sentiment seems to be highest among non-participating countries ($SD = 0.023$) as opposed to China ($SD = 0.008$) and the participating countries ($SD = 0.015$). Also, in general, across all countries, the variation in positive sentiment ($SD = 0.017$) is greater than variation in negative sentiment ($SD = 0.006$). All three regional categories show a large dip in positive and negative sentiment for the months of May 2017 and April 2019.

Insert Figure 6, 7 and 8 about here

Discussion

We discuss below the four key trends that were unearthed by our analysis and reported in the results section.

1. Overall positive sentiment is greater than the overall negative sentiment

China has been able to create an overall positive outlook on the project. This can be confirmed by the fact that in less than seven years since the project was initially proposed by the President Xi Jin Ping of China, by some counts there are 118 projects planned (Hielscher & Ibold, 2020), spread across 138 countries (Belt and Road Portal, 2020). However, these figures are difficult to verify as the projects are of varying types, across multiple countries and their status is not clear. There are some projects that have been agreed to on paper but have not progressed beyond the planning stage or have been scaled down (Chandran, 2019), others have canceled and then restarted the projects under different terms (e.g. Malaysian East Coast Rail Link (Fook, 2019) and the Sri Lankan Hambantota Port Development Project (Patrick, 2017)), and finally, some projects have been credited to the BRI but may actually not be part of it (e.g. Mumbai Metro Line 4 – India has consistently refused to join BRT). There is no denying that there is considerable excitement about this project and the 7,280 news articles that we collected are a testament to that.

2. The overall positive sentiment seems to be declining over time, while the overall negative sentiment has held fairly steady over time

One of the biggest criticisms of the BRI is the debt trap that some accuse it of creating for the participating countries. The unique selling point of China as a financier, was its no strings attached approach to lending money, unlike other financial organizations like the World Bank. However, this has led to some unviable projects being undertaken and funded, at very high-interest rates (Wibisono, 2019). The resultant debt has caused a backlash in many democratic countries that have the freedom for stakeholders to voice their opinion (Balding, 2018). These experiences seem to have contributed to the declining euphoria about the project (Holland, 2018; Rakhmat & Indramawan, 2019).

This initial positive “euphoria” can best be witnessed by the highest positive sentiment in the eventually participating countries during May 2015. It was also the period of the least negative sentiment (figure 7). A review of the articles published during that period, talk of the outreach by the Chinese government regarding the project and the positive aspects highlighted by them.

3. Across all countries, the variation in positive sentiment is greater than variation in negative sentiment.

We have seen peaks in positive sentiment following the announcement of any new national agreement or project. The negative sentiment on the other hand (note of caution?) seem to be steady across the period. For example, August 2019, which is a peak of both positive and negative sentiment for participating and non-participating countries has announcements and updates of several national agreements (Nepal, Myanmar, Saudi Arabia, Mali, San Marino, Botswana, Thailand, Malaysia, Cambodia, Bulgaria, Turkey, Morocco, Pakistan, Iran, Kazakhstan, Nigeria, Russia, Uzbek and Philippines), along with the usual cautionary note perhaps with a higher tone (e.g. Secretary Bolton's and General David Petraeus' remarks).

4. All three regional categories show a large dip in positive and negative sentiment for the months of May 2017 and April 2019.

May 2017 and April 2019 were periods of Belt and Road Forums for International Cooperation. These periods had the highest number of articles (around 1000 in both the instances), but they seemed to have a generally neutral/factual tone to the reporting.

Conclusion

Our study is among the first to use sentiment analysis, a natural language processing technique, to explore the global perception of the Belt and Road Initiative. Our finding of a declining more volatile positive sentiment and a steady less volatile negative sentiment sheds light on how the global perspective on BRI has changed over time. One of the limitations of our study is that the sentiment analysis technique does not allow for us to make any causal inferences. Further research needs to be performed to explore in detail the causes for the changes in sentiments over time. Other avenues for further research include drilling down to the individual country level and exploring changes in sentiment and further exploring the change in sentiment around certain major BRI related events such as project cancellations.

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Appendix: Figures and Table

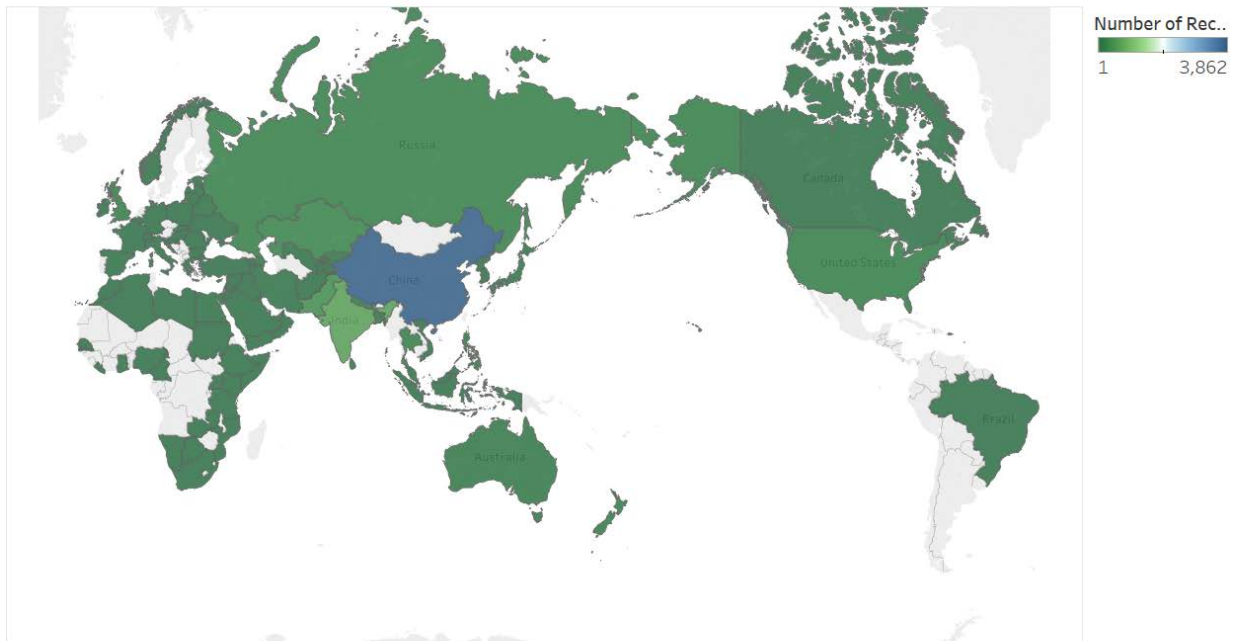
Land and Sea Corridors of the Belt and Road Initiative

-- Silk Road Economic Belt -- 21st Century Maritime Silk Road



Figure 1 Land and Sea Corridors of the Belt and Road Initiative (Chatzky & McBride, 2019)

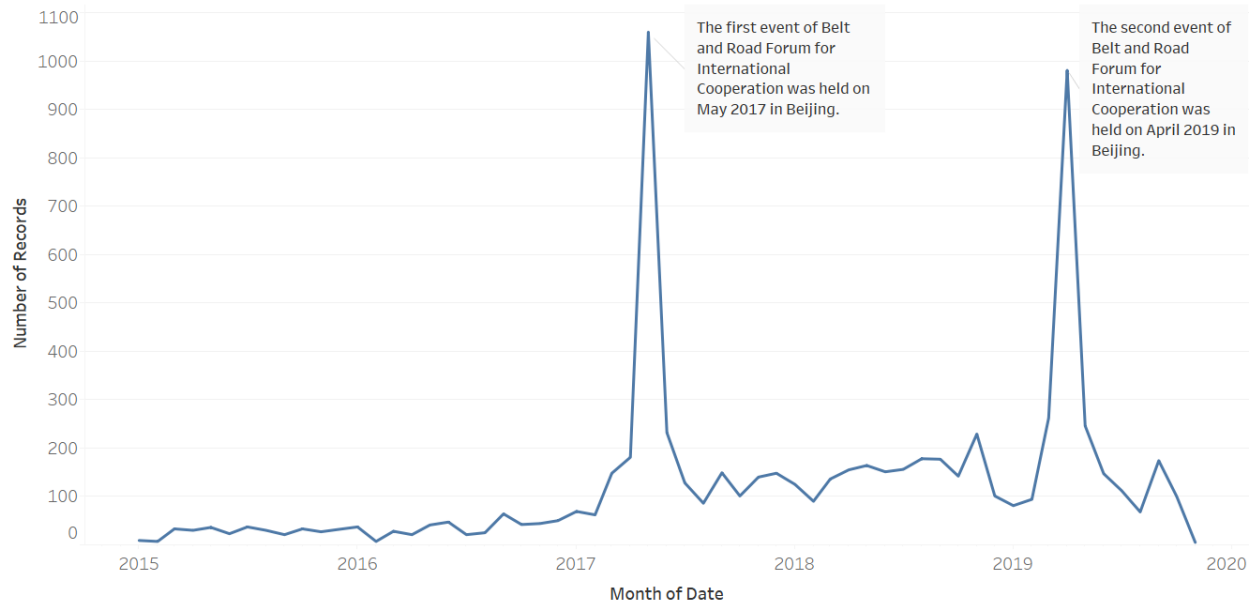
Distribution of Documents



Map based on Longitude (generated) and Latitude (generated). Color shows sum of Number of Records. Details are shown for Country.

Figure 2 Distribution of news articles by country

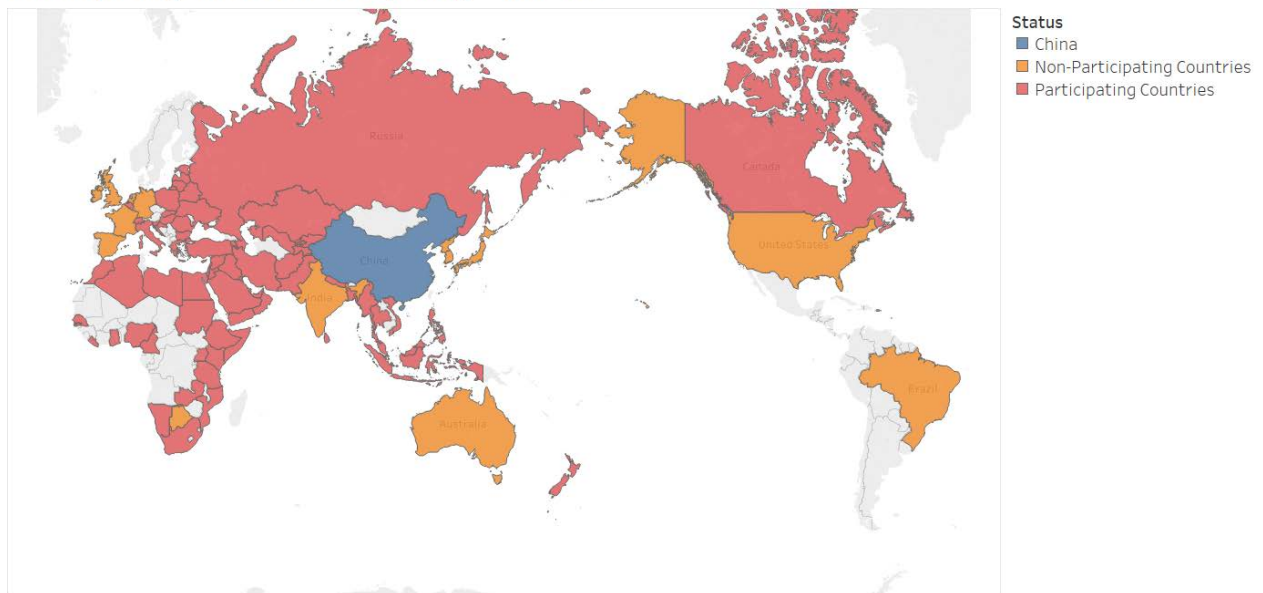
Count of Documents over a timeperiod



The trend of sum of Number of Records for Date Month.

Figure 3 Distribution of number of news articles over time

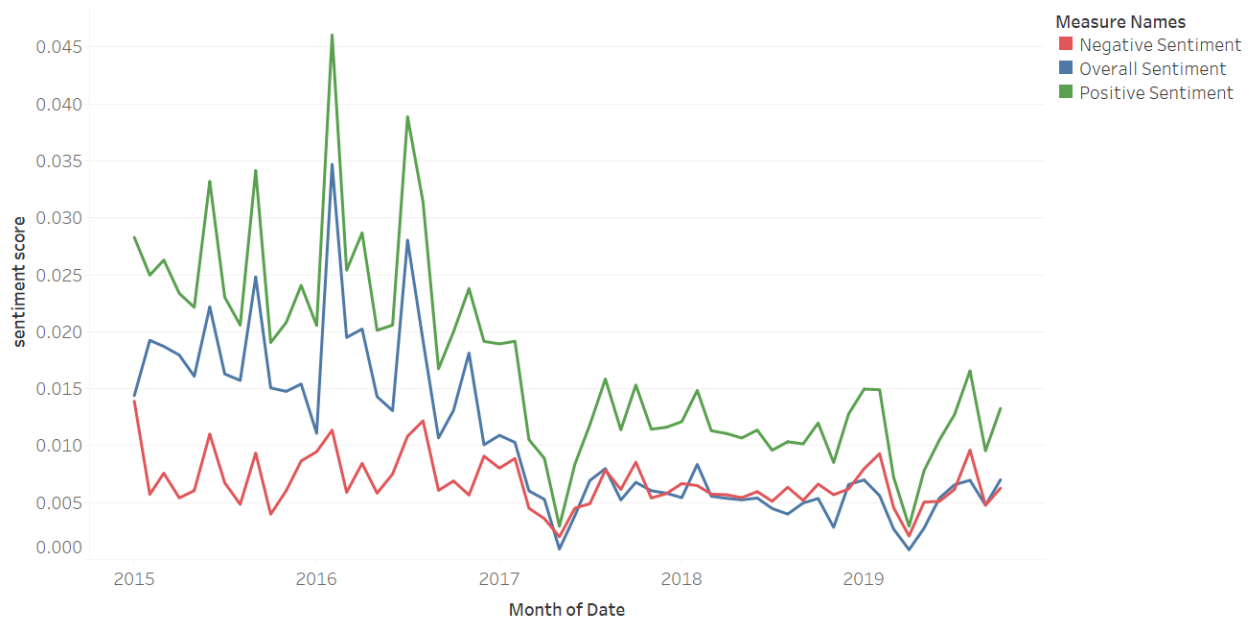
Participating and Non-Participating Countries



Map based on Longitude (generated) and Latitude (generated). Color shows details about Status. Details are shown for Country.

Figure 4 Participating and non-participating countries

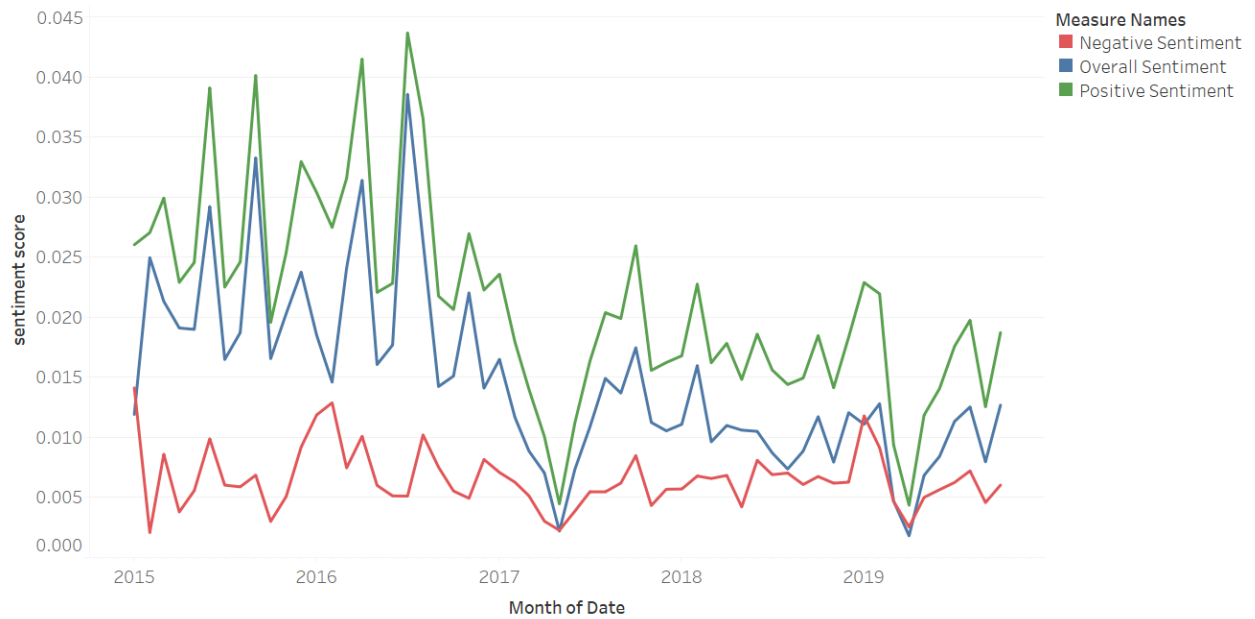
Sentiment Analysis Altogether



The trends of Negative Sentiment, Overall Sentiment and Positive Sentiment for Date Month. Color shows details about Negative Sentiment, Overall Sentiment and Positive Sentiment. The data is filtered on Country, which keeps Altogether.

Figure 5 Overall sentiment across all countries

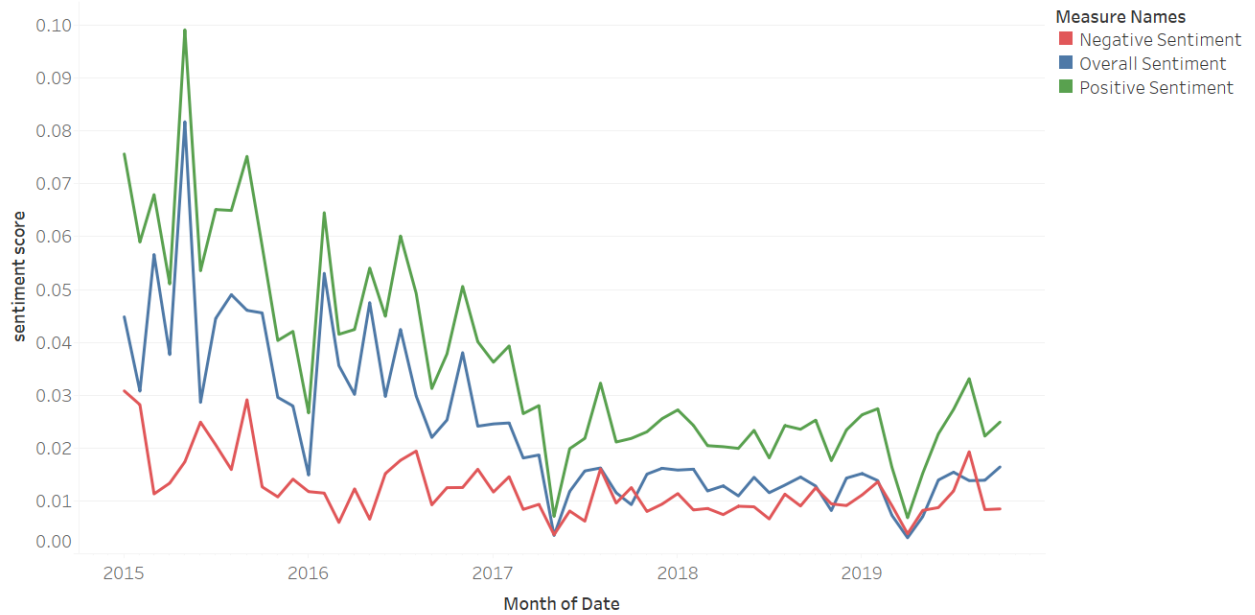
China Sentiment Analysis



The trends of Negative Sentiment, Overall Sentiment and Positive Sentiment for Date Month. Color shows details about Negative Sentiment, Overall Sentiment and Positive Sentiment. The data is filtered on Country, which keeps China.

Figure 6 Sentiment analysis of news articles from China

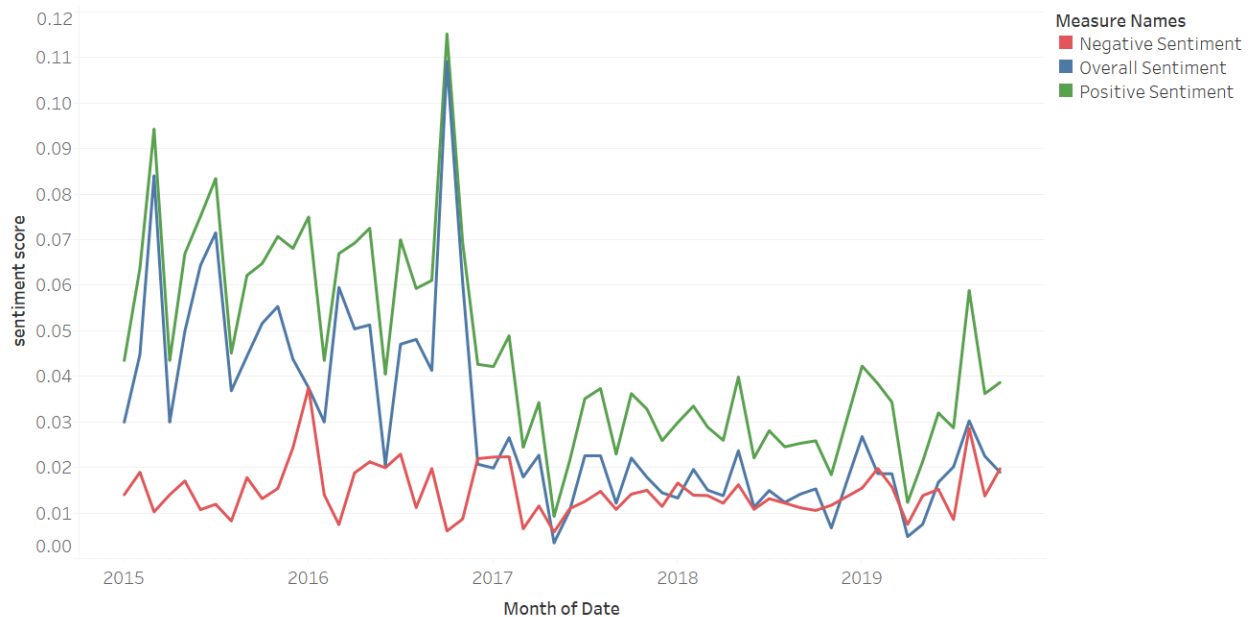
Sentiment Analysis for Participating countries



The trends of Negative Sentiment, Overall Sentiment and Positive Sentiment for Date Month. Color shows details about Negative Sentiment, Overall Sentiment and Positive Sentiment. The data is filtered on Country, which keeps Participating Countries.

Figure 7 Sentiment analysis of news articles from participating countries

Sentiment Analysis for Non-Participating countries



The trends of Negative Sentiment, Overall Sentiment and Positive Sentiment for Date Month. Color shows details about Negative Sentiment, Overall Sentiment and Positive Sentiment. The data is filtered on Country, which keeps Non-Participating Countries.

Figure 8 Sentiment Analysis of news articles from non-participating countries

Table 1: List of countries that have signed cooperation documents for the Belt and Road Initiative (Belt and Road Portal, 2020)

| # | Country | # | Country | # | Country | # | Country |
|-----|------------------------------|-----|--------------------------------|------|-------------------|------|----------------------|
| 1. | Afghanistan | 36. | El Salvador | 71. | Luxembourg | 106. | Senegal |
| 2. | Albania | 37. | Equatorial Guinea | 72. | Madagascar | 107. | Serbia |
| 3. | Algeria | 38. | Estonia | 73. | Malaysia | 108. | Seychelles |
| 4. | Angola | 39. | Ethiopia | 74. | Maldives | 109. | Sierra Leone |
| 5. | Antigua and Barbuda | 40. | Federated States of Micronesia | 75. | Mali | 110. | Singapore |
| 6. | Armenia | 41. | Fiji | 76. | Malta | 111. | Slovakia |
| 7. | Austria | 42. | Gabon | 77. | Mauritania | 112. | Slovenia |
| 8. | Azerbaijan | 43. | Gambia | 78. | Moldova | 113. | Solomon Islands |
| 9. | Bahrain | 44. | Georgia | 79. | Mongolia | 114. | Somalia |
| 10. | Bangladesh | 45. | Ghana | 80. | Montenegro | 115. | South Africa |
| 11. | Barbados | 46. | Greece | 81. | Morocco | 116. | South Sudan |
| 12. | Belarus | 47. | Grenada | 82. | Mozambique | 117. | Sri Lanka |
| 13. | Benin | 48. | Guinea | 83. | Myanmar | 118. | Sudan |
| 14. | BiH (Bosnia and Herzegovina) | 49. | Guyana | 84. | Namibia | 119. | Suriname |
| 15. | Bolivia | 50. | Hungary | 85. | Nepal | 120. | Tajikistan |
| 16. | Brunei | 51. | Indonesia | 86. | new Zealand | 121. | Tanzania |
| 17. | Bulgaria | 52. | Iran | 87. | Niger | 122. | Thailand |
| 18. | Burundi | 53. | Iraq | 88. | Nigeria | 123. | Togo |
| 19. | Cambodia | 54. | Island | 89. | Niue | 124. | Tonga |
| 20. | Cameroon | 55. | Italy | 90. | North Macedonia | 125. | Trinidad and Tobago |
| 21. | Cape verde | 56. | Ivory Coast | 91. | Oman | 126. | Tunisia |
| 22. | Chad | 57. | Jamaica | 92. | Pakistan | 127. | Turkey |
| 23. | Chile | 58. | Kazakhstan | 93. | Panama | 128. | Uganda |
| 24. | Comoros | 59. | Kenya | 94. | Papua New Guinea | 129. | Ukraine |
| 25. | Costa rica | 60. | Kiribati | 95. | Peru | 130. | United Arab Emirates |
| 26. | Croatia | 61. | Korea | 96. | Philippines | 131. | Uruguay |
| 27. | Cuba | 62. | Kuwait | 97. | Poland | 132. | Uzbekistan |
| 28. | Cyprus | 63. | Kyrgyzstan | 98. | Portugal | 133. | Vanuatu |
| 29. | Czech Republic | 64. | Laos | 99. | Qatar | 134. | Venezuela |
| 30. | Djibouti | 65. | Latvia | 100. | Republic of Congo | 135. | Vietnam |
| 31. | Dominic | 66. | Lebanon | 101. | Romania | 136. | Yemen |
| 32. | Dominica | 67. | Lesotho | 102. | Russia | 137. | Zambia |
| 33. | East Timor | 68. | Liberia | 103. | Rwanda | 138. | Zimbabwe |
| 34. | Ecuador | 69. | Libya | 104. | Samoa | 139. | |
| 35. | Egypt | 70. | Lithuania | 105. | Saudi Arabia | 140. | |