# Topic: Sentimental Analysis for Amazon Reviews

**What is Sentiment Analysis?**

- Sentiment analysis is a natural language processing technique to determine whether the data is positive, negative or neutral.
- It is performed on textual data to help businesses monitor brand and product sentiment in customer feedback, and understand the customer needs.
- Sentiment analysis models focus on polarity (positive, negative, neutral) but also on feelings and emotions (angry, happy, sad, etc.), urgency (urgent, not urgent) and even intentions (interested v. not interested).

**Dataset Description**

The dataset has been created using Amazon Reviews Exporter which is a google chrome extension. This extension helps to export Amazon Product Reviews to CSV format. Our Dataset contains 6 Attributes and 1735 Rows. We are analysing the reviews of a book based on a Japanese concept named - IKIGAI.

- id (type: chr): "R353MEFFMHYAY8" "R57Y9694P00OQ" "R1Y6LYA3EVVHII" "R2UBD10GP97TLL" ...
- profileName (type: chr): chr "Short of a Century" "Seethalakshmikshetty" "LibroReview" "Radhika Saimbi"
- text (type: chr): "\n The book does a decent job of relating the concept of Ikigai to modern day psychology (with Frankl's Logoth"| __truncated__ "\n Just read a back of book and it’s enough dont waste like meðŸ\230¢\n" "\n I personally believe that having a purpose on in life and then giving it your all is the most important to "| __truncated__ "\n IkigaiThe Japanese Secret to a Long and Happy LifeBy Hector Garcia and Francesc MirallesI will be confessin"| __truncated__ ...
- date (type: chr): "Reviewed in India on 12 October 2018" "Reviewed in India on 14 October 2019" "Reviewed in India on 8 April 2019" "Reviewed in India on 22 July 2019"…
- title (type: chr): "Simple & Light Reading. May Disappoint - Dependent on Reader's Expectation." "Ikigai" "The best book to read during your break time." "Little hyped!!"
- rating (type: int): 3 2 4 3 1 4 1 5 1 4

## Aims and Objectives:

- Product reviews are becoming more important with the evolution of online shopping. Customers are posting reviews directly on product pages in real time.

- Customers are more inclined towards the reviews to buy a particular product. So, analysing the data from those customer reviews to make the data more dynamic is essential nowadays.
- Hence, our project aims at performing Sentiment Analysis for Amazon Product Reviews.
- We are analysing the reviews of a book based on a Japanese concept named - IKIGAI.

## Analysis:

***Import Libraries:***

```
> library(tm) # Text analytics - text mining
> library(wordcloud) #Create word cloud
> library(syuzhet) #for sentiment scores and emotion classification
> library(ggplot2) #for plotting graphs
```

***Import and Explore dataset***

```
> # Import data into R
> reviews <- read.csv(file.choose(), header = T)
> # Check the structure of the file
> str(reviews)
```

```
> str(reviews)
'data.frame':   1735 obs. of  6 variables:
 $ id          : chr  "R353MEFFMHYAY8" "R57Y9694P0OOQ" "R1Y6LYA3EVVHII" "R2UBD10GP97TLL"
 ...
 $ profileName: chr  "Short of a Century" "Seethalakshmikshetty" "LibroReview" "Radhika Sa
imbi" ...
 $ text        : chr  "\n  The book does a decent job of relating the concept of Ikigai to
 modern day psychology (with Frankl's Logoth"| __truncated__ "\n  Just read a back of book
 and its enough dont waste like meðŸ\230¢\n" "\n  I personally believe that having a purpo
se on in life and then giving it your all is the most important to "| __truncated__ "\n  I
kigaiThe Japanese Secret to a Long and Happy LifeBy Hector Garcia and Francesc MirallesI w
ill be confessin"| __truncated__ ...
 $ date        : chr  "Reviewed in India on 12 October 2018" "Reviewed in India on 14 Octob
er 2019" "Reviewed in India on 8 April 2019" "Reviewed in India on 22 July 2019" ...
 $ title       : chr  "Simple & Light Reading. May Disappoint - Dependent on Reader's Expec
tation." "Ikigai" "The best book to read during your break time." "Little hyped!!" ...
 $ rating      : int  3 2 4 3 1 4 1 5 1 4 ...
>
```

***Create Corpus***

```
> #Create a corpus of text column in the dataset.
> corpus <- iconv(reviews$text)
> corpus <- Corpus(VectorSource(corpus))
```

***To see the corpus***

```
> inspect(corpus[1:5])
```

```
> # Create Corpus
> corpus <- iconv(reviews$text)
> corpus <- Corpus(VectorSource(corpus))
> # To see the corpus
> inspect(corpus[1:5])
<<SimpleCorpus>>
Metadata:  corpus specific: 1, document level (indexed): 0
Content:  documents: 5

[1] \n  The book does a decent job of relating the concept of Ikigai to modern day p
sychology (with Frankl's Logotherapy from Man's Search for Meaning among others) and
 a few scientific references in a simple manner. It talks about how purpose plays an
 important role in a man's life and the different ways in which it manifests itself.
 It also tackles some ways to 'find your flow' and ensure that what you do receives
 100% of your attention and that you enjoy whatever you are creating.The book also d
iscusses certain other Japanese concepts like takumi (specialized workers) and moai
 (connections with community or friend-circle). The brief discussions have the benef
it of being to the point and simple but also pose the risk of trivializing them into
 regular self-help advice. The book also delves into Japanese perspectives on living
 life and persevering without getting caught up in artificially-created urgency. But
 again, maybe the authors wished for the readers to research more or meditate more o
n the content given the concise treatment of the same.The chapters on diet and exerc
ises have more details and thus, may be more useful. Certain foods are dealt with in
 greater detail as is the concept of 'hara hachi bu' wherein one eats only 80% of wh
at would actually assuage his hunger. The chapter on exercises includes illustration
s and steps. While they may suffice for some of the purposes mentioned in the book -
 the philosophy behind them, progressive increments and other essential details are
 missing or insufficient.I was interested in the concept of Ikigai and wanted to rea
d more about it. Despite being well-written and presenting modern applications, the
 book did not fulfill my requirements at all. Some of the condensed content made me
 think that the extended research, including on-site interviews, done by the authors
 for writing this book was clearly lost in translation or presentation in certain pa
rts.The hardcover is pretty and soothing with its matte texture. Inner pages are smo
oth and heavy with a cream tinge. The font size is good. The spine as well as pages
 hold up well. Overall, the book is quite light and sturdy. Bought it for INR 460 ag
ainst MRP of INR 499.\n
[2] \n  Just read a back of book and its enough dont waste like meðŸ˜¢\n
```

***Cleaning the Corpus***

Clean the corpus:

1. Make all text lowercase
2. Remove punctuation
3. Remove numbers
4. Remove common repeated words
5. Remove white spaces

```
> # Cleaning Corpus
> corpus <- tm_map(corpus, tolower)
> corpus <- tm_map(corpus, removePunctuation)
> corpus <- tm_map(corpus, removeNumbers)
> corpus <- tm_map(corpus, removeWords, stopwords('english'))
> corpus <- tm_map(corpus, removeWords, c("book", "read", "life", "will", "the", "and",
"this","for","you","that"))
> corpus <- tm_map(corpus, stripWhitespace)
> inspect(corpus[1:5])
> reviews_final <- corpus
```

```
> inspect(corpus[1:5])
<<SimpleCorpus>>
Metadata:  corpus specific: 1, document level (indexed): 0
Content:  documents: 5

[1] \n  the book does a decent job of relating the concept of ikigai to modern day psychology
 with frankls logotherapy from mans search for meaning among others and a few scientific refe
rences in a simple manner it talks about how purpose plays an important role in a mans life a
nd the different ways in which it manifests itself it also tackles some ways to find your flo
w and ensure that what you do receives  of your attention and that you enjoy whatever you are
 creatingthe book also discusses certain other japanese concepts like takumi specialized work
ers and moai connections with community or friendcircle the brief discussions have the benefi
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elfhelp advice the book also delves into japanese perspectives on living life and persevering
 without getting caught up in artificiallycreated urgency but again maybe the authors wished
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 being wellwritten and presenting modern applications the book did not fulfill my requirement
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ite interviews done by the authors for writing this book was clearly lost in translation or p
resentation in certain partsthe hardcover is pretty and soothing with its matte texture inner
 pages are smooth and heavy with a cream tinge the font size is good the spine as well as pag
es hold up well overall the book is quite light and sturdy bought it for inr  against mrp of
 inr \n
[2] \n  just read a back of book and its enough dont waste like meðÿ˜¢\n
```

```
[3] \n  personally believe  purpose  life  giving  important  lead  happy life  boo
k validates soikigai  short  short book based  japanese concept according  concept  find
  deeply sown purpose  lives  within  defining  passion mission vocation  profession  gives
  tips  simplest things  life like sometimes taking  pause  will give us  long  happy li
fei bought  hardcover  itâ€™s extremely pretty cover  cover  will soothe  mind whenever  loo
k  title  go  book  personally  thought  wouldif  expecting  help  find  ikigai give
  step  step solution  can find  reward  millions  dollars youâ€™ll  disappointed  book
 full  facts real life experience  japanâ€™s okinawa  compels  focus  health  choices  f
ocus  inner happiness  will probably  book youâ€™ll come across  tells  take  relax  also
 burn  passionthe language  simplistic  beautiful  cover  itâ€™s content  many tough words
  beginnerfriendly  reading world  structure  great  prologue  chapters  epilogue  list
  suggestions  explore  endcoming  overall feel  book itâ€™s  cozy  itâ€™s  way  also  h
elp  slightly  find  ikigaii thought  full  hustle kind  book  felt relaxed  read  rea
dy  take  tasks stressfree though  something extremely crazy  different  definitely  onet
ime read  hustlers  nonhustlers  think  punish  get  want\n



[4] \n  ikigaithe japanese secret  long  happy lifeby hector garcia  francesc mirallesi will
  confessing  saying  bought  book just  attractive cover  soothing color combination  c
almed methis book  finding  passion  life  â€œikigaiâ€\u009d  will help  live  happy conte
nt active  long life  talks  art  staying young  growing old  relaxing  running behind mater
ialistic things  improve  performance  daily routine  stay focusedone  best lesson  liked
  anti fragile  talked  creating  options  devoting time  passion taking small risks  i
ncreasing  experience  get rid  things  makes us  fragilebefore reading  book  felt  ma
noeuvre  follow  finding  ikigai  just overview  many therapies  left  little unsatisfied
 disappointed  things like proverbs quotes  traditions  centritains  found  really requir
ed  rocket science written  book  facts  eye openingp s  seriously  wish  learn sun s
alutation  exercise  readingoverall  will say itâ€™s  easy simple read  beginners  setting
 small goalsonly staying active will make  want  live  hundred yearsâ€”â€”japanese proverbboo
k starts  proverb  literally summarises  book\n



[5] \n  book  good read  seller definitely  duping readers  book  neither  hardcover  aut
hentic print  cheap copy  can  bought  roadside\n
```

***Data Visualisation***

```
> # Create Term Document
> TextDoc_dtm <- TermDocumentMatrix(reviews_final)
> dtm_m <- as.matrix(TextDoc_dtm)
> dtm_m[1:10, 1:5]
```

```
> dtm_m[1:10, 1:5]
                     Docs
Terms                 1 2 3 4 5
  actually            1 0 0 0 0
  advice              1 0 0 0 0
  also                4 0 2 0 0
  among               1 0 0 0 0
  applications        1 0 0 0 0
  artificiallycreated 1 0 0 0 0
  assuage             1 0 0 0 0
  attention           1 0 0 0 0
  authors             2 0 0 0 0
  behind              1 0 0 1 0
```

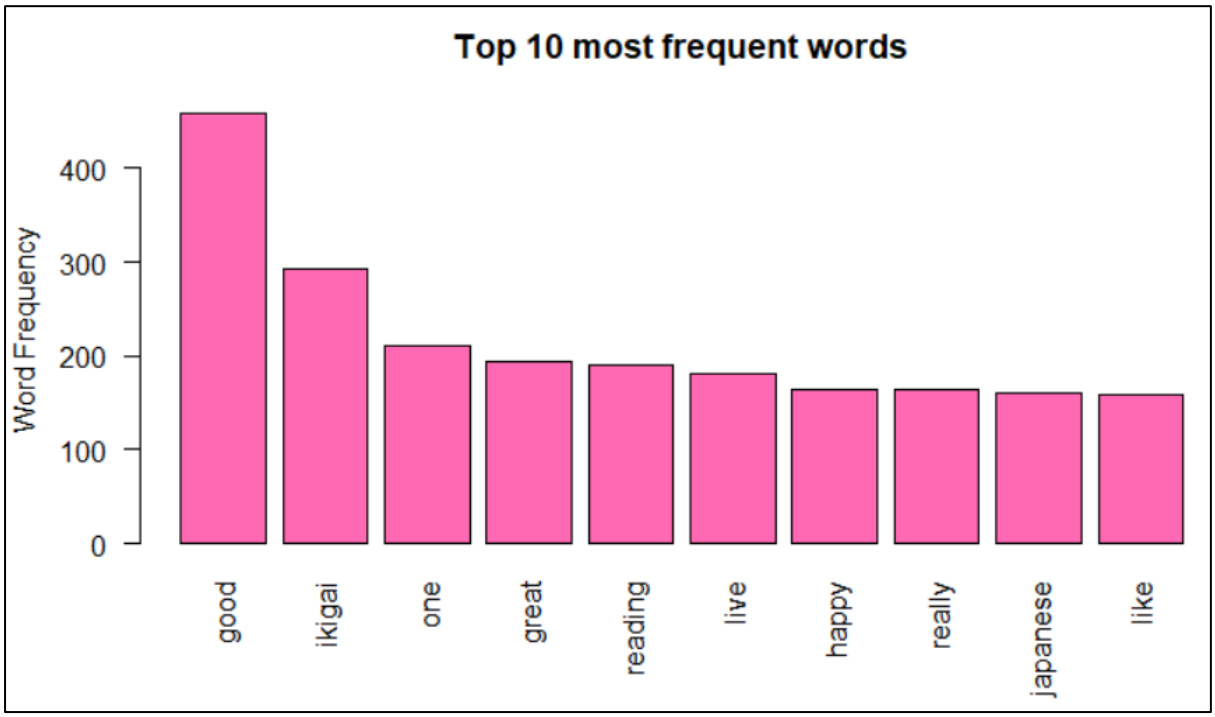
After cleaning the text data, the next step is to count the occurrence of each word, to identify popular or trending words. Using the function TermDocumentMatrix() from the text mining package, we have built a Document Matrix – a table containing the frequency of words. As you can see here are the top 10 most frequently found words in the review. The following table of word frequency is the expected output of the head command.

```
> # Sort by descending value of frequency
> dtm_v <- sort(rowSums(dtm_m),decreasing=TRUE)
> dtm_d <- data.frame(word = names(dtm_v),freq=dtm_v)
> # Display the top 10 most frequent words
> head(dtm_d, 10)
```

```
             word freq
good         good  458
ikigai     ikigai  292
one           one  211
great       great  194
reading   reading  191
live         live  180
happy       happy  164
really     really  164
japanese japanese  161
like         like  158
```

```
> # Plot the most frequent words
> barplot(dtm_d[1:10,]$freq,
```

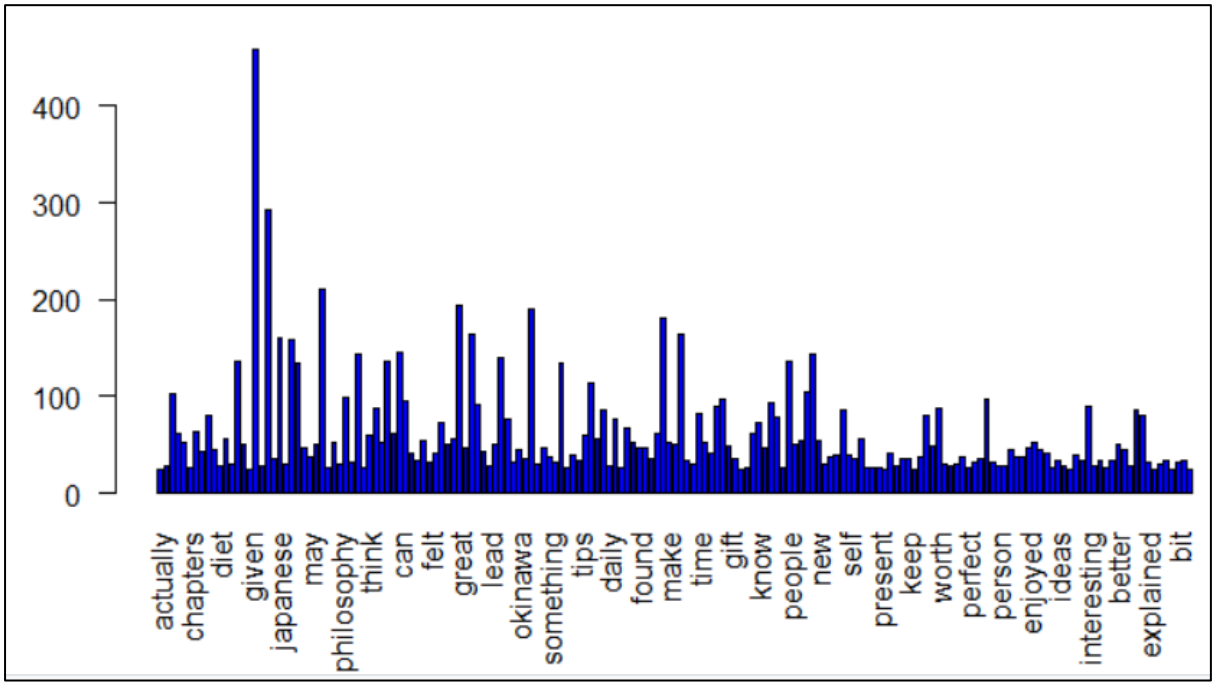
```
+       las = 2,
+       names.arg = dtm_d[1:10,]$word,
+       col ="hotpink",
+       main ="Top 10 most frequent words",
+       ylab = "Word Frequency")
```




Plotting the top 10 most frequent words using a bar chart is a good basic way to visualize this word frequency data. So, I could interpret the following from this bar chart:

- The most frequently occurring word is “good”. Also notice that negative words like “not” don’t feature in the bar chart, which indicates there are no negative prefixes to change the context or meaning of the word “good” (In short, this indicates most responses don’t mention negative phrases like “not good”).
- Then the 2nd most frequent word used is IKIGAI which itself is the name of the book and the book is great.
- “Reading”, “happy”, “really” and “japanese” are the next four most frequently occurring words, which indicate that most of the people are really feeling happy by reading about the japanese book.
- Finally, the word like is also on the chart, which says that the readers liked the book in the positive context.

```
> # Bar plot
> w <- rowSums(dtm_m)
> w <- subset(w, w>=25)
> barplot(w, las = 2, col = "blue")
```




```
> # Create Word cloud
> w <- sort(rowSums(dtm_m), decreasing = T)
> set.seed(2000)
> wordcloud(words = names(w),
+           freq = w,
+           max.words = 60,
+           random.order = T,
+           min.freq = 5,
+           colors = brewer.pal(25, 'Dark2'),
+           scale = c(3, 0.6))
```

A word cloud is one of the most popular ways to visualize and analyse qualitative data. It's an image composed of keywords found within a body of text, where the size of each word indicates its frequency in that body of text. Use the word frequency data frame (that table) created previously to generate the word cloud. The word cloud shows additional words that occur frequently and could be of interest for further analysis. Words like "content", "quality", "worth" (root for "worth-it" or "worthless", etc. could provide more context around the most frequently occurring words and help to gain a better understanding of the main insight.

```
> # Find associations
> findAssocs(TextDoc_dtm, terms = c("recommend","ikigai","happy","people"), corlimit = 0.25)
```

```
$recommend
highly
  0.32

$ikigai
                find              concept              finding           activities
                0.39                 0.33                 0.29                 0.29
            includes            different               inside              pulled
                0.28                 0.27                 0.27                 0.27
           highlevel                 long                still                 bowl
                0.27                 0.26                 0.26                 0.26
              decode                 grab              gushing               limits
                0.26                 0.26                 0.26                 0.26
             optimal              outdoor        selfdiscovery           showcasing
                0.26                 0.26                 0.26                 0.26
supercentenariansabove            worldevery            discovers                itso
                0.26                 0.26                 0.26                 0.26
          meaning"-              notifies          puigcerverthe               refine
                0.26                 0.26                 0.26                 0.26
             andres           components            concerning            diagramm
                0.26                 0.26                 0.26                 0.26
       diagrammits             generalto          gorgeousnice               itnow
                0.26                 0.26                 0.26                 0.26
            pictured                taint             theirfore              youbut
                0.26                 0.26                 0.26                 0.26
            zuzunaga                 also            particular
                0.26                 0.25                 0.25
```

```
$happy
          long         secret         rocket     amazonians           balk        bulking
          0.45           0.31           0.28           0.27           0.27           0.27
       endless          etcif        foolish      futurefor       gleaning       hobbies
          0.27           0.27           0.27           0.27           0.27           0.27
        impart infinitesimally       marriage         minded     noticeably       passes
          0.27           0.27           0.27           0.27           0.27           0.27
       payment      reinforce   sciencegood       scottish        sifting          views
          0.27           0.27           0.27           0.27           0.27           0.27
        waffle            web          wifei         things         active          smile
          0.27           0.27           0.27           0.26           0.26           0.26

$people
    island       live     okinawa cultivated     figure   involves  somebodys      japan      enjoy
      0.34       0.32       0.31       0.30       0.30       0.30       0.30       0.28       0.26
```

Correlation is a statistical technique that can demonstrate whether, and how strongly, pairs of variables are related. This technique can be used effectively to analyze which words occur most often in association with the most frequently occurring words in the review of the book, which helps to see the context around these words.

This script shows which words are most frequently associated with the top 4 terms (corlimit = 0.25 is the lower limit/threshold I have set. We can set it lower to see more words, or higher to see less). The output indicates that "highly" occurs 32% of the time with the word "recommend". We can interpret this as the context around the most frequently occurring word ("recommend") is positive. Similarly, the name of the book "ikigai" is highly correlated with the "concept", "finding" and "activities". This indicates that most responses are saying that the book "includes optimal and conceptual findings" and can be interpreted in a positive context. Also, the output indicates that "happy" is strongly associated with the "long", "secret" and "exciting". This shows that most of the responses say that the book "has the secret of long and exciting life". Also "island" occurs 34% and "japan" occurs 28% of the time with the word "people". We can interpret this as the context as "most of the people described in the book lived on an island which is in japan".

```
> # Obtain Sentiment Scores
> sentiment_data <- iconv(reviews$text)
> s <- get_nrc_sentiment(sentiment_data)
> s[1:10,]
```

| | anger | anticipation | disgust | fear | joy | sadness | surprise | trust | negative | positive |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 7 | 1 | 3 | 9 | 3 | 3 | 11 | 6 | 24 |
| 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 3 | 3 | 14 | 1 | 2 | 9 | 3 | 1 | 13 | 6 | 22 |
| 4 | 2 | 10 | 2 | 1 | 9 | 4 | 3 | 12 | 4 | 14 |
| 5 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 2 | 2 | 2 |
| 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 2 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 8 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 5 | 0 | 3 |
| 9 | 0 | 2 | 0 | 0 | 3 | 0 | 2 | 4 | 0 | 4 |
| 10 | 1 | 3 | 1 | 0 | 2 | 2 | 0 | 4 | 2 | 11 |

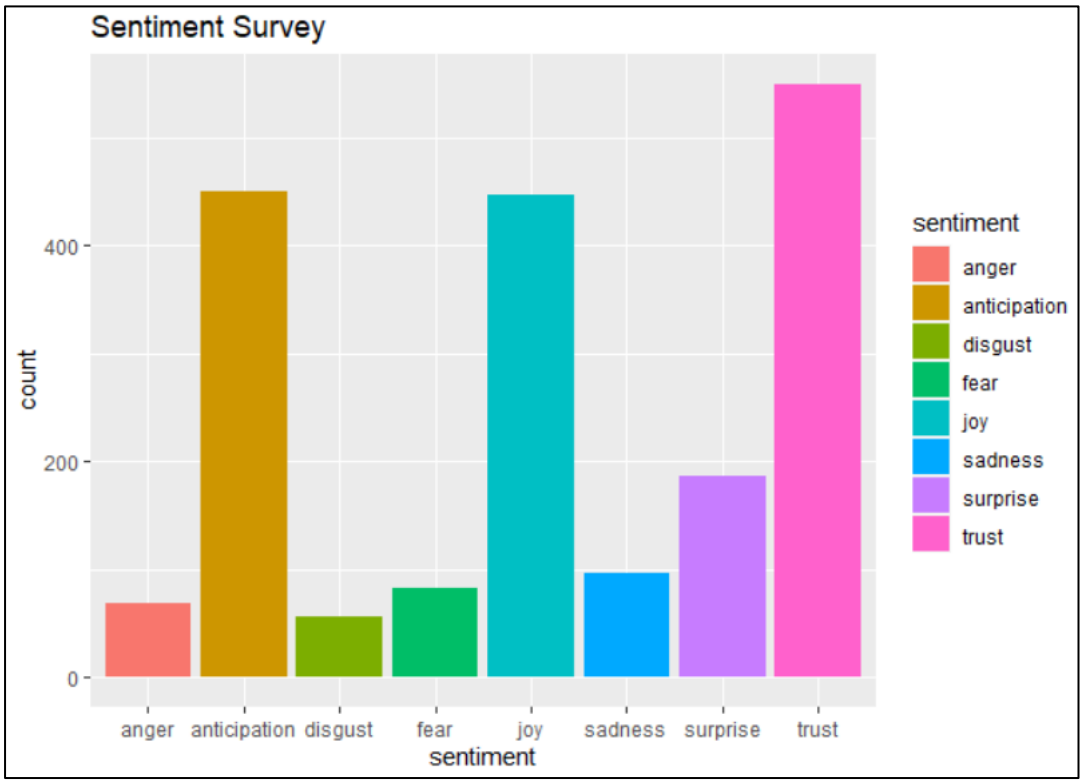
*Sentiments can be classified as positive, neutral or negative. They can also be represented on a numeric scale, to better express the degree of positive or negative strength of the sentiment contained in a body of text.*

Emotion classification is built on the NRC Word-Emotion Association Lexicon. The NRC Emotion Lexicon is a list of English words and their associations with eight basic emotions (anger, fear, anticipation, trust, surprise, sadness, joy, and disgust) and two sentiments (negative and positive). To understand this, the get_nrc_sentiments function, which returns a data frame with each row representing a sentence from the original file. The data frame has ten columns (one column for each of the eight emotions, one column for positive sentiment valence and one for negative sentiment valence). The data in the columns (anger, anticipation, disgust, fear, joy, sadness, surprise, trust, negative, positive) can be accessed individually. The output shows that the first line of text has;

- Least occurrences of words associated with emotions of anger, disgust, fear, sadness and negative sentiment
- Highest occurrences of words associated with emotions of joy, trust and positive sentiment
- Total of 6 occurrence of words associated with negative sentiment
- Total of 24 occurrences of words associated with positive sentiment

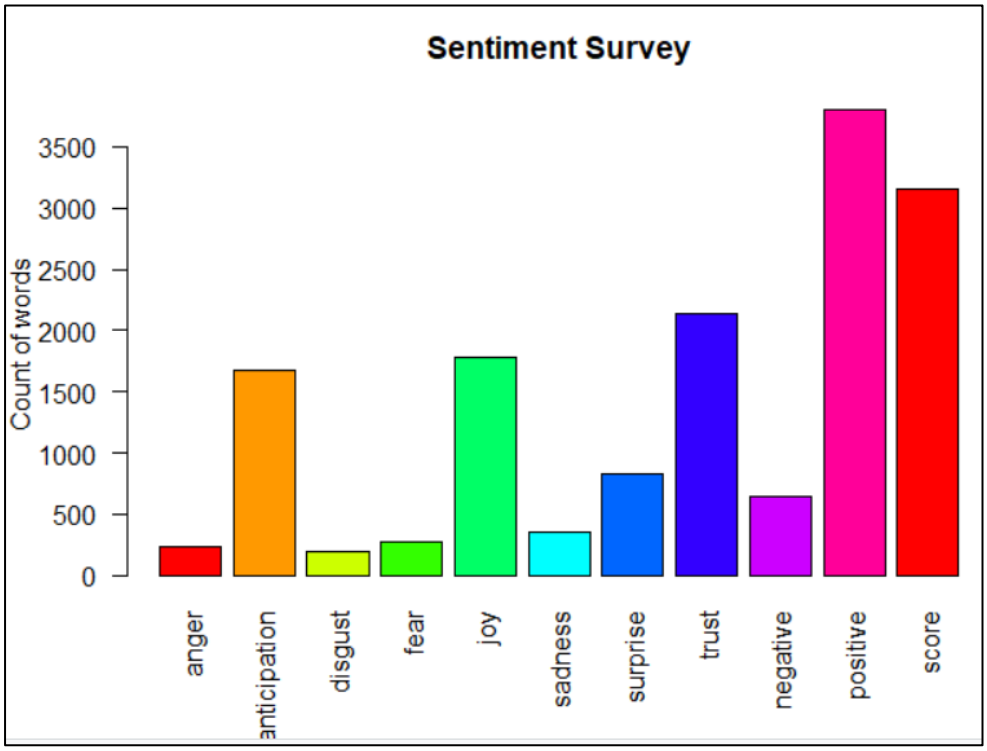
The next step is to create two plots charts to help visually analyze the emotions in this review text. First, perform some data transformation and clean-up steps before plotting charts. The first plot shows the total number of instances of words in the text, associated with each of the eight emotions.

```
> #transpose
> td<-data.frame(t(s))
> #The function rowSums computes column sums across rows for each level of a grouping va
riable.
> td_new <- data.frame(rowSums(td[2:253]))
> #Transformation and cleaning
> names(td_new)[1] <- "count"
> td_new <- cbind("sentiment" = rownames(td_new), td_new)
> rownames(td_new) <- NULL
> td_new2<-td_new[1:8,]
> #Plot One - count of words associated with each sentiment
> quickplot(sentiment, data=td_new2, weight=count, geom="bar", fill=sentiment, ylab="coun
t") + ggtitle("Sentiment Survey")
```



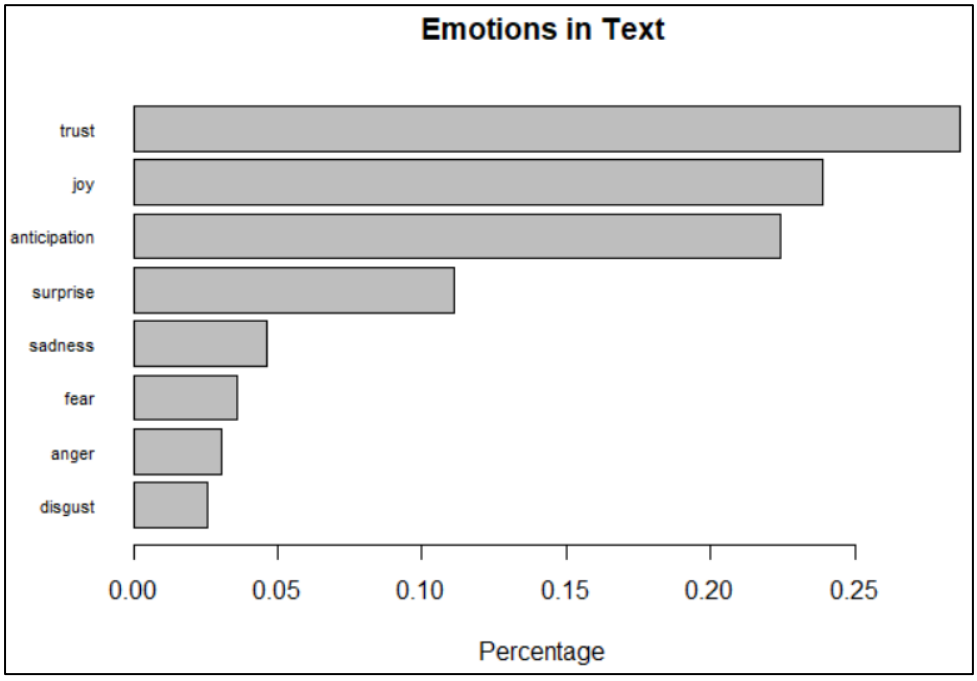

This bar chart demonstrates that words associated with the positive emotion of “trust” occurred about five hundred times in the text, whereas words associated with the negative emotion of “disgust” occurred less than 25 times. A deeper understanding of the overall emotions occurring in the review response can be gained by comparing these numbers as a percentage of the total number of meaningful words.

```
> # Simple Bar plot
> barplot(colSums(s),
+         las = 2,
+         col = rainbow(10),
+         ylab = 'Count of words',
+         main = 'Sentiment Survey')
```




```
> #Plot two - count of words associated with each sentiment, expressed as a percentage
> barplot(
+   sort(colSums(prop.table(s[, 1:8]))),
+   horiz = TRUE,
+   cex.names = 0.7,
+   las = 1,
+   main = "Emotions in Text", xlab="Percentage"
+ )
```

This bar plot allows for a quick and easy comparison of the proportion of words associated wi th each emotion in the text. The emotion “trust” has the longest bar and shows that words asso ciated with this positive emotion constitute just over 35% of all the meaningful words in this t ext. On the other hand, the emotion of “disgust” has the shortest bar and shows that words ass ociated with this negative emotion constitute less than 2% of all the meaningful words in this t ext. Overall, words associated with the positive emotions of “trust” and “joy” account for alm ost 60% of the meaningful words in the text, which can be interpreted as a good sign of positi ve review of the book.




```
> # Calculate Review wise Scores
> s$score <- s$positive - s$negative
> s[1:10,]
```

| | anger | anticipation | disgust | fear | joy | sadness | surprise | trust | negative | positive | score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 7 | 1 | 3 | 9 | 3 | 3 | 11 | 6 | 24 | 18 |
| 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -1 |
| 3 | 3 | 14 | 1 | 2 | 9 | 3 | 1 | 13 | 6 | 22 | 16 |
| 4 | 2 | 10 | 2 | 1 | 9 | 4 | 3 | 12 | 4 | 14 | 10 |
| 5 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 2 | 2 | 2 | 0 |
| 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 2 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 8 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 5 | 0 | 3 | 3 |
| 9 | 0 | 2 | 0 | 0 | 3 | 0 | 2 | 4 | 0 | 4 | 4 |
| 10 | 1 | 3 | 1 | 0 | 2 | 2 | 0 | 4 | 2 | 11 | 9 |

```
> # Check overall sentiment of the product
> review_score <- colSums(s[,])
> print(review_score)
```

```
 anger anticipation      disgust         fear          joy      sadness     surprise
   229         1676          192          270         1786          347          829
 trust     negative     positive        score
  2141          641         3801         3160
```

This is the overall review score of the following sentiments which shows that the lowest senti ment score is 229 of anger and highest score is 3801 of positive. Which clearly states that the book ikigai has more positive reviews than the negative ones. And people have rated the book in a positive and effective context.

## Conclusion:

1. In our project, we have created a word frequency table and plotted a word cloud, to id entify prominent insights in the review.
2. Word association analysis using correlation, explored four methods to generate sentim ent scores, which proved useful in assigning a numeric value to strength (of positivity or negativity) of sentiments in the text and allowed interpreting that the average sentim ent through the text is trending positive.
3. Lastly, our project demonstrates how to implement an emotion classification with NR C sentiment and creates plots to analyse and interpret emotions found in the text.
4. Now by performing the exploratory sentimental analysis on Amazon book review we have found out that the Japanese book ikigai has more positive and productive reviews
5. Overall, the book is rated in a good context.