Mining Movie Intention using Bayes and Maximum Entropy Classifiers

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ABSTRACT
Sentiment analysis is becoming one of the most thoughtful research areas for prediction and classification. This paper analyzes and predicts the result for movie reviews. Machine learning techniques Bayes and Maximum entropy for classifying text messages. Movie comments from twitter are retrieved. The two classifiers are analyzed for Hindi movies ‘Sultan’ and ‘Madaari.’ Tweets before and after the release of the movie are retrieved. Accuracy is evaluated to compare the Bayes and Maximum entropy methods. R technology is used for the movie review analysis.

General Terms
Intention Mining, machine learning, normalization, Twitter API.

Keywords
Bayes, Maximum Entropy, polarity, emotions, mean absolute error.

1. INTRODUCTION
Social networks today contains enormous amount of text data, which is growing everyday. Intention mining aims to cover the attitude of the author on a particular topic from text data. It is natural language processing and machine learning techniques reveal the attitude. In the recent years it has gained popularity due to its immediate application in business, customer feedback from product reviews, spots reviews and assisting in election campaigns. Movie reviews are an important way to analyze the performance of a movie. Text movie reviews tell us the strong and weak points of the movie which tells us whether the movie in general meets the expectations of the reviewer. Using intention mining, we can find the state of mind of the reviewer and understand the polarity and emotions. Polarity is positive, negative and neutral. Emotions are anger, disgust, fear, joy, sadness, surprise, and unknown. In this paper we use intention mining on a set of movie reviews extracted from twitter and try to understand the overall reaction about the movie. Whether people liked or they disliked it. We analyzed the movie reviews using machine learning methods Bayes and maximum entropy. We compare the two methods for accuracy.

2. RELATED WORK
Mingqin Hu and Bing Liu [1], studied the problem of generating feature-based summaries of customer reviews of products sold online. Here, features broadly mean product features (or attributes) and functions. Given a set of customer reviews of a particular product, the task involves three subtasks: (1) identifying features of the product that customers have expressed their opinions on (called product features); (2) for each feature, identifying review sentences that give positive or negative opinions; and (3) producing a summary using the discovered information. Varsha D. Jadhav and S.N. Deshmukh [2] presented the model to predict the intentions of the people who tweet on twitter about a specific topic. They predicted the cricket match result which serves as strategic guidance to the captains so as to improve the performance of the team. Kamal Nigam et.al [3] proposes the use of maximum entropy techniques for text classification. In their text classification scenario, maximum entropy estimates the conditional distribution of the class label given a document. A document is represented by a set of word count features. The labeled training data is used to estimate the expected value of these word counts on a class-by-class basis. Improved iterative scaling finds a text classifier of an exponential form that is consistent with the constraints from the labeled data. Kuat Yessenov, et.al [4], presented an empirical study of efficacy of machine learning techniques in classifying text messages by semantic meaning. They used movie review comments from popular social network Digg as the data set and classify text by subjectivity/objectivity and negative/positive attitude. Changlin Ma, et.al [5], proposed a novel topic and sentiment unification maximum entropy LDA model in this paper for fine-grained opinion mining of online reviews. Oaindrila Das, et.al [6] presented a novel approach for classification of online movie reviews using parts of speech and machine learning algorithms. Borislav Kapukaranov and Preslav Nakov[7] presented experiments in predicting fine- rated stars, including halves, for Bulgarian movie reviews. This is a challenging task, that can be seen as (a) multi-way classification, i.e., choosing one out of eleven classes, (b) regression, i.e., predicting a real number, or (c) something in between, namely ordinal regression, i.e., predicting eleven values, but taking ordering into account, e.g., predicting 4 when the actual value is 3.5 would be better than predicting 1.

3. METHODOLOGY
Fig. 1 shows the framework for intention mining system.
The movie tweets are extracted using a keyword. The tweets are pre-processed which are classified for polarity and emotions using Bayes method and maximum entropy method. The intention is mined and decision is made.

4. TWITTER API
Twitter API is a twitter platform which connects the application with the world conversation happening on twitter. Once the twitter API is created we need to obtain credentials such as API keys, API secret, Access token and Access token secret on the twitter developer site to access the twitter API. Twitter authentication is setup using these credentials. Using a keyword, tweets related to the specified keyword and language are searched. The language parameter that we have specified is English. The twitter library lets the use of Twitter API. The tweets retrieved are saved in .csv (comma separated file).

5. DATA COLLECTION
The tweets for the movie reviews were collected using the keyword ‘Sultan movie,’ using Twitter API from 5th July 11, 2016 to 9th July 2016. Total 34,694 tweets were retrieved for polarity and emotion intention. The tweets collected each day for the movie Sultan are shown in table 1. The movie Sultan was released on 6th July 2016. Also the tweets for the movie reviews using keyword ‘Madaari movie,’ was collected from 20th July to 24th July 2016. Total 8033 tweets were retrieved. Table 2 shows the tweets collected on each day for the movie Madaari. The movie Madaari was released on 22th July 2016.

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of tweets collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th July 2016</td>
<td>6723</td>
</tr>
<tr>
<td>6th July 2016</td>
<td>6997</td>
</tr>
<tr>
<td>7th July 2016</td>
<td>6990</td>
</tr>
<tr>
<td>8th July 2016</td>
<td>6993</td>
</tr>
<tr>
<td>9th July 2016</td>
<td>6991</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34,694</strong></td>
</tr>
</tbody>
</table>

Table 2. Daywise tweet collection for the movie ‘Madaari’

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of tweets collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>20th July 2016</td>
<td>514</td>
</tr>
<tr>
<td>21st July 2016</td>
<td>736</td>
</tr>
<tr>
<td>22nd July 2016</td>
<td>1518</td>
</tr>
<tr>
<td>23rd July 2016</td>
<td>2233</td>
</tr>
<tr>
<td>24th July 2016</td>
<td>3032</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8033</strong></td>
</tr>
</tbody>
</table>

6. DATA PREPROCESSING
The raw data is pre-processed. The pre-processing includes

6.1 Tokenization
Text data is collection of sentences which is split into terms or tokens by removing white spaces, commas and other symbols etc.

6.2 Stopword removal
Removes articles such as (a, an, the).

6.3 Stemming
is the process of reducing related word to the root word. E.g. generalization is generally represented as general.

6.4 Case Normalization
English text contains both higher and lower case characters. This process converts the complete sentences in lowercase or uppercase.

6.5 Usernames
removes @ symbol. Users often include twitter usernames by using @ symbol.

6.6 Usage links
Retweeting is copying another user’s tweet and posting to another users account. It is abbreviated with “RT”. All tweets with RT are removed.
6.7 Usage of N-gram and part of speech (POS) tags
An n-gram is a N-character slice. N-gram of several different lengths are used simultaneously. POS feature is used because depending on the usage the same word may have different meaning.

7. BAYES METHOD
Whether a review is negative, positive or neutral is predicted using the text. In order to do this, train an algorithm to make predictions on the reviews. Error is calculated to see how good the predictions are.

Bayes classifier is used for classification. A Bayes classifier works by figuring out the probability of different attributes of the data being associated with a certain class. This is based on Bayes theorem. The theorem is

\[ P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)} \]

8. MAXIMUM ENTROPY METHOD
The maximum entropy classifier is a discriminative classifier commonly used in natural processing and information retrieval problems.

The Max Entropy classifier is a probabilistic classifier which belongs to the class of exponential models. Unlike the Naïve Bayes classifier, the Max entropy does not assume that the features are conditionally independent of each other. It is based on the principle of maximum entropy and from all the models that fit the training data, selects the one which has the largest entropy. The Entropy can be used to solve a large variety of text classification problems such as language detection, topic classification, sentiment analysis and more.

Principle of MaxEnt states, take precisely stated prior data or testable information about probability function. Consider the set of all trial probability distribution that would encode the prior data. Of those the one with maximal information entropy is the proper distribution.

The model is represented as

\[ P(c \mid d, \lambda) = \frac{1}{Z(d)} \exp[\sum \lambda_i f_i(c, d)] \]

P(c|d) is the probability that a class occurs for a given tweet, c is the class, d is the tweet, and \( \lambda \) is a weight vector. The weight vector decide the weight vector decide the significance of the feature in classification. Z(d) is a normalization function, \( f_i \) is a feature class function.

9. NORMALIZATION
Data should be normalized to bring all the variables into proportion with one another when doing comparison analysis. The aim of normalization is to make variables comparable to each other. Normalization means to transform observations x into f(x) such that they look normally distributed. It simply means putting different variables on common scale.

As seen from table 1. The number of tweets collected each day is different. The number of positive, negative and neutral polarities each day is different so we need to normalize it.

10. ACCURACY MEASURES
The accuracy measures such as

i. Mean error (ME)
ii. Root mean square error (RMSE)
iii. Mean absolute error (MAE)
iv. Mean Percentage Error (MPE)
v. Mean Absolute Percentage Error (MAPE)

are used to measure the accuracy. MAE is simply the mean of the absolute errors. The absolute error is the absolute value of the difference between the forecasted value and the actual value. MAE tells us how big of an error we can expect from the forecast on average. Cort J. Willmott et.al [8] indicated that MAE is the most natural measure of average error magnitude than RMSE.

11. RESULTS AND DISCUSSION
The results are obtained for Bayes and Maximum Entropy classifiers. Movie reviews of two movies, Sultan and Madaari were retrieved of which polarity and emotion intentions were obtained. The daywise polarity intention and the daywise emotion intention are obtained.

Table 3. shows the daywise intention polarity using Bayes and MAXENT methods for the movie ‘Sultan.’ The polarity is positive, negative and neutral.

The graph for daywise polarity intention using Bayes and MAXENT is shown in Fig.2. Using the graph the polarity intention can be easily seen and the polarity intention for positive, negative and neutral for both the classifiers, that is Bayes and MAXENT can be compared.

The numbers of positive intentions are more than that of the negative and neutral intentions each day.
Table 3. Daywise intention polarity using Bayes and MAXENT methods for the movie ‘Sultan.’

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
</tr>
<tr>
<td>Positive</td>
<td>4874</td>
<td>2699</td>
<td>3774</td>
<td>2664</td>
<td>4873</td>
</tr>
<tr>
<td>Negative</td>
<td>1043</td>
<td>1017</td>
<td>2304</td>
<td>2233</td>
<td>1212</td>
</tr>
<tr>
<td>Neutral</td>
<td>806</td>
<td>3007</td>
<td>919</td>
<td>2100</td>
<td>905</td>
</tr>
<tr>
<td>Total</td>
<td>6723</td>
<td>6723</td>
<td>6997</td>
<td>6997</td>
<td>6990</td>
</tr>
</tbody>
</table>

Fig. 2. Daywise Intention Polarity for the movie Sultan

The positive intention polarity for ‘Sultan’ for Bayes method is more than the maximum entropy method each day. Table 4. shows the daywise intention emotions using Bayes and MAXENT methods for the movie ‘Sultan.’

Using Bayes method we can see that the number of joy emotions is more. Figure 3 shows the intention emotions for the movie Sultan. Unknown emotion is the limitation of our research. The number of joy emotion is the highest.
### Table 4. Daywise intention emotions using Bayes and MAXENT methods for the movie ‘Sultan’

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
</tr>
<tr>
<td>Anger</td>
<td>75</td>
<td>3437</td>
<td>139</td>
<td>5066</td>
<td>160</td>
</tr>
<tr>
<td>Disgust</td>
<td>9</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fear</td>
<td>44</td>
<td>44</td>
<td>46</td>
<td>46</td>
<td>28</td>
</tr>
<tr>
<td>Joy</td>
<td>1081</td>
<td>1081</td>
<td>1462</td>
<td>1462</td>
<td>1625</td>
</tr>
<tr>
<td>Sadness</td>
<td>160</td>
<td>160</td>
<td>114</td>
<td>114</td>
<td>52</td>
</tr>
<tr>
<td>Surprise</td>
<td>82</td>
<td>82</td>
<td>306</td>
<td>306</td>
<td>684</td>
</tr>
<tr>
<td>Unknown</td>
<td>5272</td>
<td>9</td>
<td>4927</td>
<td>3</td>
<td>4441</td>
</tr>
<tr>
<td>Total</td>
<td>6723</td>
<td>6723</td>
<td>6997</td>
<td>6997</td>
<td>6990</td>
</tr>
</tbody>
</table>

![Twitter Intention Emotion for movie 'Sultan'](image)

**Fig 3.** Daywise Intention Emotion for the movie Sultan

Table 5 shows the Mean Absolute Error and the accuracy using Bayes and MAXENT methods.

Figure 4 shows the Accuracy for Bayes and MAXENT methods.
The accuracy for Bayes method is more on each day as compared to maximum entropy. But the number of tweets collected each day is different. So the data needs to be normalized. The positive, negative and neutral polarities obtained needs to be normalized. Normalization is performed by adding all the positive polarities obtained on each day and divide it by the total number of tweets retrieved. Normalization is performed for Bayes and MAXENT methods and then compared to get the best results.
11.1 Normalization of data for the movie Sultan

11.1.1 For Bayes method
Let $P_1$ be the sum of all positive intentions.

\[ P_1 = 23437 \]

Normalization factor for positive intention
\[ = \frac{23437}{34697} = 0.6754 \quad (1) \]

Let $N_1$ be the sum of all Negative intentions.

\[ N_1 = 6694 \]

Normalization factor for Negative intention
\[ = \frac{6694}{34697} = 0.1929 \quad (2) \]

Let $NE_1$ be the sum of all Neutral intentions.

\[ NE_1 = 4563 \]

Normalization factor for Neutral intention
\[ = \frac{4563}{34697} = 0.1315 \quad (3) \]

11.1.2 For MAXENT method
Let $P_2$ be the sum of all positive intentions.

\[ P_2 = 16786 \]

Normalization factor for positive intention
\[ = \frac{16786}{34697} = 0.4837 \quad (4) \]

Let $N_2$ be the sum of all Negative intentions.

\[ N_2 = 6224 \]

Normalization factor for Negative intention
\[ = \frac{6224}{34697} = 0.1793 \quad (5) \]

Let $NE_2$ be the sum of all Neutral intentions.

\[ NE_2 = 11684 \]

Normalization factor for Neutral intention
\[ = \frac{11684}{34697} = 0.3367 \quad (6) \]

The normalization factor for positive intention of Bayes method is more than the normalization factors of negative and neutral intention of the Bayes method. Also the normalization factor of positive intention of the MAXENT method is more than the normalization factor of negative and neutral intention of the MAXENT method. When comparing Bayes and MAXENT the normalization factor of positive intention of Bayes method is highest than that of the positive intention of MAXENT method. Table 6 shows the average of positive tweets for the movie Sultan.

\begin{center}
\begin{tabular}{|c|c|c|c|c|}
\hline
\textbf{Date} & \textbf{Bayes} & \textbf{MAXENT} & \\
& \textbf{No. of Positive tweets} & \textbf{Average} & \textbf{No. of Positive tweets} & \textbf{Average} \\
\hline
5th July 2016 & 4874 & 72.4973 & 2699 & 40.1457 \\
6th July 2016 & 3774 & 53.9374 & 2664 & 38.0734 \\
7th July 2016 & 4873 & 69.7138 & 3898 & 55.7653 \\
8th July 2016 & 4959 & 70.9137 & 3797 & 54.2971 \\
9th July 2016 & 4957 & 70.9054 & 3728 & 53.3257 \\
\hline
Total & 23,437 & 337.9678 & 16,786 & 241.6074 \\
\hline
\end{tabular}
\end{center}

The Accuracy for all the 5 days is more for Bayes method. Considering the Bayes method alone, the numbers of positive tweets are more than negative and neutral tweets. Also, considering MAXENT method alone the numbers of positive tweets are more than that of negative and neutral tweets. Making comparison of Bayes and MAXENT the number of positive tweets for Bayes method are more than the number of positive tweets of MAXENT method every. Also the average of positive for Bayes and MAXENT methods for each day is calculated, as shown in table 6. Again calculating the average of total average for both Bayes and MAXENT it gives...
67.5935% for Bayes method and 48.3214% for MAXENT method.

Table 7 shows the daywise intention polarity for the movie ‘Madaari.’ Figure 5 shows the graph for the daywise polarity. As seen from the graph the numbers of positive intentions are more than that of negative and neutral intentions for Bayes approach. For the maximum entropy method the numbers of neutral intentions were more before the movie was released. The movie was released on 22nd July 2016. On 22nd, 23rd and 24th July 2016 the number of positive intentions are more. While comparing Bayes and maximum entropy methods the number of positive intentions obtained by Bayes method is more than that of the positive intentions obtained by maximum entropy method. Table 8 shows the intention emotions for the movie Madaari, and figure 6 shows the graph for the intention emotions. For Bayes method the numbers of joy emotions are highest. Unknown is the limitation of our research. For MAXENT method the numbers of anger intentions are more. But on the contrary the positive intention polarity if more, so we neglect it and consider other emotions. Making this assumption, the numbers of joy emotions are highest.

Table 7. Daywise intention polarity using Bayes and MAXENT methods for the movie ‘Madaari.’

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
</tr>
<tr>
<td>Positive</td>
<td>265</td>
<td>149</td>
<td>394</td>
<td>232</td>
<td>929</td>
</tr>
<tr>
<td>Negative</td>
<td>191</td>
<td>80</td>
<td>248</td>
<td>132</td>
<td>431</td>
</tr>
<tr>
<td>Neutral</td>
<td>58</td>
<td>285</td>
<td>94</td>
<td>372</td>
<td>158</td>
</tr>
<tr>
<td>Total</td>
<td>514</td>
<td>514</td>
<td>736</td>
<td>736</td>
<td>1518</td>
</tr>
</tbody>
</table>

Fig. 5. Twitter intention polarity for the movie ‘Madaari’
Table 8. Daywise Intention Emotions for the movie Madaari

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
<td>MAXENT</td>
<td>Bayes</td>
</tr>
<tr>
<td>Anger</td>
<td>13</td>
<td>343</td>
<td>13</td>
<td>534</td>
<td>19</td>
</tr>
<tr>
<td>Disgust</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fear</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Joy</td>
<td>0</td>
<td>18</td>
<td>33</td>
<td>33</td>
<td>145</td>
</tr>
<tr>
<td>Sadness</td>
<td>152</td>
<td>152</td>
<td>162</td>
<td>162</td>
<td>178</td>
</tr>
<tr>
<td>Surprise</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>54</td>
</tr>
<tr>
<td>Unknown</td>
<td>330</td>
<td>0</td>
<td>521</td>
<td>0</td>
<td>1121</td>
</tr>
<tr>
<td>Total</td>
<td>514</td>
<td>514</td>
<td>736</td>
<td>736</td>
<td>1518</td>
</tr>
</tbody>
</table>

Fig.6. Daywise Intention Emotion for the movie Madaari
Table 9 shows the Mean Absolute Error and the accuracy using Bayes and MAXENT methods for the movie 'Madaari.' Figure 7 shows the graph of Accuracy for Bayes and MAXENT methods.

<table>
<thead>
<tr>
<th>Date</th>
<th>Mean Absolute Error</th>
<th>% Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bayes</td>
<td>MAXENT</td>
</tr>
<tr>
<td>20th July</td>
<td>2.0381</td>
<td>2.4320</td>
</tr>
<tr>
<td>21st July</td>
<td>1.9463</td>
<td>2.3186</td>
</tr>
<tr>
<td>22nd July</td>
<td>1.9486</td>
<td>2.2427</td>
</tr>
<tr>
<td>23rd July</td>
<td>1.9440</td>
<td>2.2383</td>
</tr>
<tr>
<td>24th July</td>
<td>1.9496</td>
<td>2.2469</td>
</tr>
</tbody>
</table>

The accuracy for Bayes method is more each day as compared to that of the Maximum Entropy method.

Fig. 7. Accuracy for Bayes and MAXENT for the movie Madaari
The number of tweets collected each day is different. The data needs to be normalized for each day as well as for the positive, negative and neutral polarities. The total numbers of tweets collected for the movie Madaari are 8033.

### 11.2 Normalization of data for the movie Madaari

#### 11.1 For Bayes method

Let $P_1$ be the sum of all positive intentions.

\[ P_1 = 4955 \]

Normalization factor for positive intention

\[ \frac{4955}{8033} = 0.6168 \] \hspace{1cm} (7)

Let $N_3$ be the sum of all Negative intentions.

\[ N_3 = 2068 \]

Normalization factor for Negative intention

\[ \frac{2068}{8033} = 0.2574 \] \hspace{1cm} (8)

Let $NE_1$ be the sum of all Neutral intentions.

\[ NE_1 = 683 \]

Normalization factor for Negative intention

\[ \frac{683}{8033} = 0.0850 \] \hspace{1cm} (9)

#### 11.1.2 For MAXENT method

Let $P_2$ be the sum of all positive intentions.

\[ P_2 = 1379 \]

Normalization factor for positive intention

\[ \frac{1379}{8033} = 0.1716 \] \hspace{1cm} (10)

Let $N_2$ be the sum of all Negative intentions.

\[ N_2 = 578 \]

Normalization factor for Negative intention

\[ \frac{578}{8033} = 0.0719 \] \hspace{1cm} (11)

Let $NE_2$ be the sum of all Neutral intentions.

\[ NE_2 = 1075 \]

Normalization factor for Negative intention

\[ \frac{1075}{8033} = 0.1338 \] \hspace{1cm} (12)

Considering Bayes method, the normalization factor for positive intention is more than the negative and neutral intentions. Also, for MAXENT method, the normalization factor for positive intention is more than that of the negative and neutral intentions. Comparing Bayes and MAXENT the normalization factor of positive intention of bayes method is highest than the normalization factor of positive intention of MAXENT method.

Table 10 shows the average of positive tweets for the movie Sultan

<table>
<thead>
<tr>
<th>Date</th>
<th>Bayes</th>
<th>MAXENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Positive tweets</td>
<td>Average</td>
</tr>
<tr>
<td>20(^{th}) July 2016</td>
<td>256</td>
<td>49.8054</td>
</tr>
<tr>
<td>21(^{th}) July 2016</td>
<td>394</td>
<td>53.5326</td>
</tr>
<tr>
<td>22(^{th}) July 2016</td>
<td>929</td>
<td>61.1989</td>
</tr>
<tr>
<td>23(^{th}) July 2016</td>
<td>1420</td>
<td>63.5915</td>
</tr>
<tr>
<td>24(^{th}) July 2016</td>
<td>1956</td>
<td>64.5118</td>
</tr>
<tr>
<td>Total</td>
<td>4955</td>
<td>292.6402</td>
</tr>
</tbody>
</table>

The accuracy for Bayes method is more than the accuracy of MAXENT method. Again calculating average of the total average of both Bayes and MAXENT methods, we get 67.5534% for Bayes method and 48.3830% for MAXENT method.

### 12. CONCLUSIONS

In comparison of machine learning classifiers, Bayes and Maximum Entropy, mining intention for movie review prediction, the Bayes classifier is more efficient than the MAXENT. 67.5935% accuracy is obtained for movie ‘Sultan’ using Bayes method and 48.3214% using MAXENT method. The movie Sultan was released on 6\(^{th}\) July 2016. According to the Hindi movie reviews of Times of India dated 6\(^{th}\) July 2016 the review rating is 3.5 out of 5, which is 70%. Prediction using Bayes and MAXENT is close to the Hindi movie reviews of Times of India. For the movie Madaari Bayes classifier is giving 67.5935% and MAXENT classifier is giving 48.3830% accuracy. The movie Madaari was released on 22\(^{nd}\) July 2016. According to the Hindi movie reviews of Times of India dated 22\(^{nd}\) July 2016 the review rating is 3.5 out of 5, which is 70%. Prediction using Bayes
classifier for the movie Madaari is close to the Hindi movie reviews of Times of India. Also the normalization factor for the positive intention for Bayes method is highest than that of MAXENT method for both Sultan and Madaari movies. It is 0.6754 for Sultan movie and 0.6168 for Madaari movie. Hence, Bayes method is efficient than Maximum entropy method for text classification.

13. FUTURE WORK
More machine learning classifiers can be used to analyze text data. Also anger and unknown emotions can be further analyzed to get more accurate results.

14. ACKNOWLEDGMENTS
The authors are deeply thankful to the Department of Computer Science and Information Technology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad. The authors are also thankful to Prof. R.R. Deshmukh, Head of department of Computer Science and Information Technology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad. We express our Gratitude to Dr. Abhijeet P. Wadekar, Principal, P.E.S. College of Engineering, Aurangabad, for the support during the research work.

15. REFERENCES