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Adverse Impact of Human Sentiments on Cognitive Bias using Natural Language Mode

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ABSTRACT: Cognitive biases are a systematic pattern that affects the decisions and judgments that people make.Decision making involves individual as well as collective stakes, analysing how cognitive biases affect them can be expected to yield important results. In this paper, we consider demonetization issue and suggest a number of cognitive biases that are likely to affect moral intuitions and judgments. Cognitive biases like status quo, loss aversion, anchoring, exaggerated expectation, and pessimism biasare likely to be affected because of positive and negative sentiments. These emotions obtained by opinion mining or sentiment analysis. This research is on analysis of cognitive bias of humans from Twitter data based on bag-of-words Natural Language model.Opinions are extracted from twitter to look correlation between these sentiments. We attempted to perform cognitive bias analysis based on subjective score using bag-of-model from the trained model we found these sentiments significantly influence cognitive bias. In this paper we have discussed a methodology which allows utilization and interpretation of twitter data to determine cognitive bias. The results are displayed by giving the percentage of sentiment categories

KEYWORDS*:* Cognitive bias; Opinion mining; Sentiment Analysis; Bag-of-Words, Demonetization, Twitter, Decision making**.**

I. INTRODUCTION

Cognitive psychology is the branch of psychology that focuses on the way people process information or analysing the human feelings and can be identifying a person's reactions under different situations. It looks at how we process information and respond back to environment. In other words, cognitive psychology is interested in what is happening within our minds that links stimulus (input) and response (output). Cognitive bias includes perception, attention, language, memory, and thinking. Error or mistake in the way of thinking affects decision making[1][2].Causes of cognitive bias would be information processing shortcuts, noisy information processing, emotional and moral motivations. Social influence and also by ignoring the relevant information [3][4][5].

Sentiments Vs Cognitive Bias

We listed the biases related to human sentiments.

EMOTIONAL BIAS: it is a misinterpretation in the cognition emotional aspects. Human believe only those things which give a positive outcome even if the adverse proof is there. We may hesitate to accept the harder things which give mental discomfort or torture. Bias related to sentiments like sadness, irritation, fear, embarrass etc. [11]

OVERCONFIDENCE BIAS: More confident and in ability to act conventionally [12].

LOSS AVERSION: it relates to one's tendency to choose reducing losses to get equal gains. It's good to not to lose 10rs than to find 100rs. Losses are double as powerful as gains. [13]

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CONFIRMATION BIAS: It is a tendency to search for the information or the things which relates to the already existing things [14].

ENDOWMENT BIAS: the fact that people expect a very high rate of good that they deserve on a similar good that they deserve. [15]
HOT COGNITION: it is a process of motivated reasoning by emotional phase [16] [14] causes less quality judgments. Cold cognition opposite to hot cognition and not affected by the emotions [17].

STATUS QUO BIAS: first preference given to present stage affairs. We may thick any change in the current scenario is going to be loss. Examples: retirement plans, health etc.[18] [19].

Negativity bias: Negative things reflect a higher rate on a person's mental state than the positive and neutral things [20] [21].

A. Impact of Demonetization on Cognitive Bias

Bias	Impact on human	Example effects
Anchoring or Focalism	Depends on only one piece of information and make the decisions by one way [6][7]	Listening to early announcementsof demonetization like transaction limit ownership of gold. people who comes under this bias have destroyed their money or cash just by listening or thinking
Continued influence effect	People have the past information and the recent information.Learned information is given max importance than the recently known information and make decisions or judgment on the same [8]	News has been spread 10Rs. coin will not be accepted , it is not valid
Exaggerated Exception	High expectations, and the actual world are actually seems to be less accurate than our assumptions.[9][10]	Demonetization will make a huge amount of change. Expecting LPG price and petrol/diesel rates would come
Pessimism Bias	People will always think that evil or bad will happen. Refers negative opinion in all aspects and make decisions	Committing suicide

Table 1: List of biases, causes and example

This paper is organized as follows. Section 2 discusses on the related work, while Section 3 shows the methodology. Results and discussions are found in Section 4 before the concluding remarks in Section 5.

II. RELATED WORK

WalaaMedhat et al [22] have presented sentiment analysis is reckoning study of emotions, opinions, attitudes towards a situation. Sentiment analysis estimates the sentimental expression from the text and it can be achieved by finding opinions. Authors identified three levels: document level, sentence level and aspect level using polarity.
Joseph Rodman[23] this researcher shown how heuristics and cognitive bias inter-related.It shows how cognitive bias affects decision making using army data and shown how predictable errors in the judgement.
P.A Garety et al. [24] covered misbelief and illusion in one frame work,and explained how social factors contribute to the maintenance or repetition of symptoms. The result of cognitive model of dependson existing theoretical studies. The research generates certain assumptions which lead to theoretical advances.
Alec Go et al [25]proposed classification and analysis of the sentiments using machine learning techniques. Here the training data considered is the twitter messages with emoticons. This paper describes the pre-processing steps needed to achieve high accuracy. The emoticons as noisy labels for trained data are very efficient way to achieve machine learning techniques.

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III. METHODOLOGY

To analyse the cognitive bias of the people we have to understand the sentiments of tweets about demonetization. While social network has lot of users and also have opinion about lot of subject and people. People decision making involves cognitive bias as major factor and some are presumably adaptive. Cognitive bias arises due to various processes, social influence [27] and emotional and moral influences [26] are some of them. This research work challenge is to analyse whether emotions influencing cognitive bias of a human based. Twitter streaming API used for mining tweets, bag of words model was used to predict the sentiments about a subject or topic for example demonetization. Overall system methodology is represented in fig 1. The most commonly used document classification method Bag of words is natural language processing model in which text are represented as bag of words.

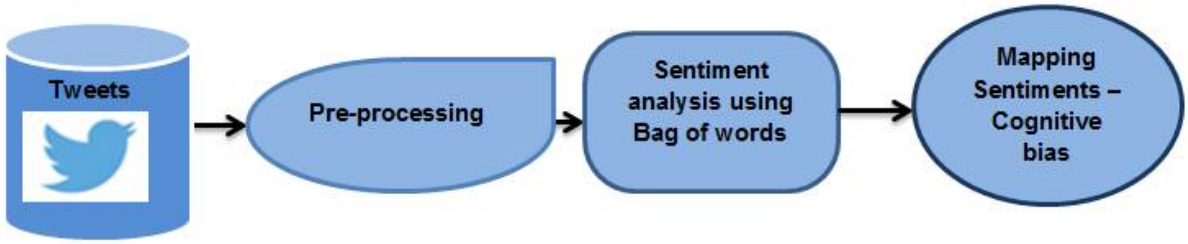

Fig 1: Workflow of proposed model

This model used as feature extraction method for training the classifier. Bag of words method transforms text in to independent variable. Transformed data was used to train the classifier. Based on the classifier output we have analysed which cognitive bias was influenced due to sentiments or opinions.

Data Pre-processing

Data inconsistencies are removed by performing following data pre-processing steps 1. Punctuation removal, 2. Stop words removal, 3. Stemming using rule based algorithm proposed by porter [28]. We had 8000 observations of 15 variables shown fig 2.

```
> View(demonetization_tweets)
> tweets <- read.csv("C:/Program Files/RStudio/demonetization-tweets.csv", stringsAsFact
ors = FALSE)
> str(tweets)
'data.frame':   8000 obs. of  15 variables:
 $ X            : int  1 2 3 4 5 6 7 8 9 10 ...
 $ text         : chr  "RT @rssurjewala: Critical question: Was PayTM informed about #De
monetization edict by PM? It's clearly fishy and requires full "| __truncated__ "RT @Hem
ant_80: Did you vote on #Demonetization on Modi survey app?" "RT @roshankar: Former FinS
ec, RBI Dy Governor, CBDT Chair + Harvard Professor lambaste #Demonetization.\n\nIf not
for Aam Aadmi"| __truncated__ "RT @ANI_news: Gurugram (Haryana): Post office employees p
rovide cash exchange to patients in hospitals #demonetization https://"| __truncated__ .
```

Fig 2: Example tweet observation

IV. RESULTS AND DISCUSION

Creating Bag of words model

The bag-of-words NLP model used to make an unigram model of the text by keeping track of the number of occurrences of each word and used as a features for classifiers. This model collects specific subjectivity score. This subjectivity score can be calculated based on the data collected from the bank of words [29]. If the total score is negative thetext will be classified as negative and if its positive the text will be classified as positive. As the next step, we divided the corpus of sentiments into a training set and a test set.

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Algorithm for Bag of Model of Construction

1. *List1 = []*
2. *For each tweet in the training set:*
   a. *Insert the newline character "n" at the end of each tweet.*
   b. *Input the tweet :(sentences like "RT @Dipankar_cpiml: The Modi app on #DeMonetization proves once again that the govt is totally indifferent to the mounting misery and hards…" being interpreted as ["The", "Modi", " app" ,"on", "DeMonetization","proves" …])*
   c. *Remove tokens which consist of only a space, empty string or punctuation marks.*
   d. *Append the tokens to list1*
3. *List1 contains all words occurring in the training set.*
4. *Place list1 on a Counter element and checked against the word bank. This counter now contains all occurring words together with their frequencies and these entries can be sorted.*

Result of bag of words of model shown in figure 3

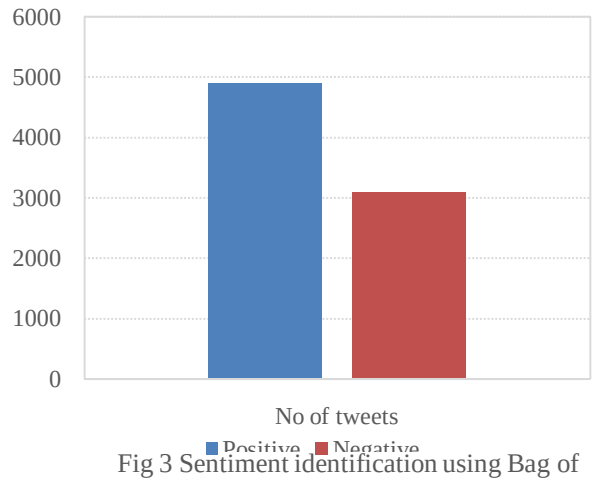

Fig 3 Sentiment identification using Bag of Words

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Cognitive bias is directly associated with sentiments/emotions of a human. Our system identifies some of them leads to incorrect understanding, inaccurate decisions, and thinking without the logic Figure 4 shows the sentiment score of emotions which are related to some of the biases like emotional bias, overconfidence, loss aversion etc.,

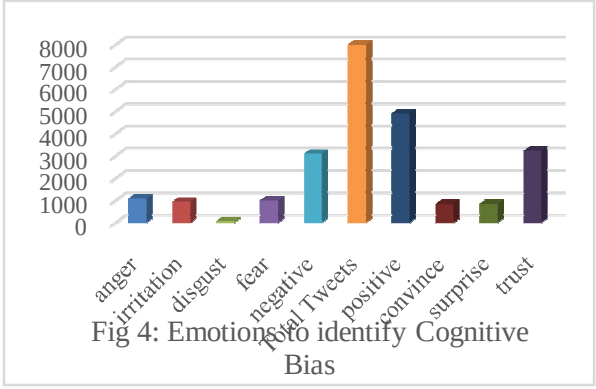

Fig 4: Emotions to identify Cognitive Bias

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We have generated an emotion vector for each extracted vector containing these eight emotions. Correlation computation between sentiments and the factors cause's cognitive biases will prove our concepts into an acceptable level of accuracy. There is also much to do to enhance the correlation analysis.

According to the results fig 3 and fig 4shows that the emotions disgust and anger are very close to the negative sentiment great which may influence pessimism bias, hot cognition and emotional bias. Moreover, the rational sentiment died should be closer to the emotion sadness than to the emotion anger

V. CONCLUSION AND FUTURE ENHANCEMENT

In this paper, cognitive analysis through emotions towards discussion on Demonetization issue is presented. We found there is direct impact on cognitive biases because of people sentiments. People's emotion towards the issue can be determined if the overall feedback of people is happy, unhappy or emotionless. The results are beneficial in many cases especially in decision making.

But this model run based on subjectivity score. It is less accurate because it does not take the word order or grammar into account and will be improved. Future developments may need to include Emoticons. These are facial expressions pictorially represented using punctuation and letters and expresses the user's mood.

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BIOGRAPHY

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