ABSTRACT
Understanding customers’ needs is the most critical aspect in every business. Today most companies utilize customer feedback to understand customers’ desires. Analyzing what factors affect customers’ feedback is therefore important for any company. This paper analyses the effect of day of the week in the way a user reacts. SAS® Enterprise Miner™ and SAS® Sentiment Analysis Studio is used to analyze reviews written on weekdays and weekends. By understanding the differences in the opinions expressed on weekdays versus weekends, a company would have better understanding of their customer reviews. In this paper reviews written on Amazon.com for two products from Electronics product category are explored.

INTRODUCTION
In the recent times most manufacturers give utmost importance to the reviews written by users on social networking sites and ecommerce websites. It is very crucial for a firm to know the key feedback and thereby providing synthesized services to their customers [1]. With the huge number of reviews and comments available it is an arduous job to narrow down to the most significant reviews for the betterment of the business. One most important factor that a manufacturer could keep in mind while eliminating non-useful reviews is the effect of day of the week on the way a user writes a review.

According to a research [4], human beings react differently in different times. They tend to over react when they have some pressures and are more accepting in nature when they are relaxed and calm. As most individuals are stressed on weekdays because of the work load and the things that happen in a day they are bit more arrogant whereas they are more peaceful and calm on weekends. Going by this concept, in this paper analysis is done on weekday and weekend review so as to understand the contributing factors of a user comment. This can greatly aid for a company to understand if a review on a particular specification is written out of a real reason or was it just because of a user’s bad mood on that day.

This way analyzing the user reviews and thereby providing synthesized services would greatly aid a company in multiple ways. First valuable point is that a company gets to know the true voice of the customers. The company would also save lot of money and effort that would have been spent on non-significant requirements. This way a company can not only attain excellent customer satisfaction but also be efficient in providing the services.

METHODOLOGY
The process that is followed in this analysis is broadly classified into following steps:

- Data Extraction using Python.
- Data Preparation and initial analysis using Base SAS.
- Initial Text analysis and filtration of the text.
- Review analysis using SAS Enterprise Miner.
- User sentiment analysis using SAS Sentiment Studio.

Figure 1. Process flow diagram
DATA EXTRACTION USING PYTHON

For the purpose of the paper, the first step is to collect user ratings and reviews written. Python web scraper is used to extract the reviews from Amazon.com [5] website and are parsed. Reviews written for two products pertaining to Cell phones accessories product category are extracted. The data has the information regarding the rating given, review written, date on which review was written and few other fields.

DATA PREPARATION AND INITIAL ANALYSIS USING SAS FOUNDATION

After extracting the data from the website, the second step is to format the data in a proper way suitable for the analysis. The day of the week needed to be obtained from the posted date and also separation of the reviews written on weekdays and weekends are to be sorted and should be classified as either positive review or a negative review.

Reviews that had a rating of 5 and 4 are classified as positive reviews and reviews with a rating of 1 and 2 are classified as negative reviews. As an initial step, ANOVA is performed so as to see the differences in the ratings given on weekdays and weekends. The results are visualized as shown below. We can clearly see from the below plots that the percentage of lower ratings (1 and 2) on a weekday is more on a weekday compared to the percentage on a weekend. This clearly shows numerically that users tend to given comparatively lower ratings on a weekday than on a weekend.

![Figure 2. Product -1 Percentage of ratings on different weekdays.](image_url)

![Figure 3. Product -2 Percentage of ratings on different weekdays.](image_url)
TEXT MINING AND REVIEW ANALYSIS USING SAS ENTERPRISE MINER

After preparing the data suitably for text mining, data is brought into SAS Enterprise Miner. In this step initially basic text analysis is performed using text filter and text parsing nodes [3] and the frequencies of terms and documents are observed. The initial results are as follows

<table>
<thead>
<tr>
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<th>Attribute</th>
<th>Freq</th>
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</table>

Figure 4. Results of Terms using Text parsing node SAS EM

Figure 5. Results of Number of Documents by weight using Text filtering node SAS EM

REVIEW ANALYSIS USING SAS ENTERPRISE MINER

Once the initial filtration and analysis is done the following steps are followed so as to analyze the reviews written and extract the information that would be useful for eliminating the non-significant reviews and also determine the effect of day of the week on the reviews written. This step is the most crucial and the core process of the analysis.

- As the reviews are already classified as positive and negative within weekday and weekend, the negatives reviews written on a weekday are of utmost concern. This dataset is analyzed using the text cluster, text topic and concept links.
- By performing the above mentioned process few significant and moderately important topics are picked.
- Now the weekend positive reviews are analyzed using the text cluster, text topic and concept links. The previous picked topics from weekday negative reviews are looked for presence in this weekend positive reviews.
• After comparing, if the significant negative comments present in the weekday reviews are also present in the positive reviews of the weekend then most likely those reviews are because of the mood of the customer.

By following the above steps, it yields the results and helps us better understand the true voice of the customers. In addition to the analysis performed we could also perform sentimental analysis using SAS Sentiment Analysis Studio. This can clearly depict what a customer exactly feel on a weekday and what does he have in mind on a weekend.

Figure 6. SAS Enterprise Miner model for the analysis

USER SENTIMENT ANALYSIS USING SAS SENTIMENT ANALYSIS STUDIO

In order to see what a user in general believes on a weekday and if it is different from weekend, sentiment analysis is performed using SAS Sentiment Analysis. By this one can get fair understanding if the reviews written are different on both the cases or are the same.

Using the current data the results of sentiment analysis is as below.

BEST MODEL is Smoothed Relative Frequency and Chi Square

Figure 7. Best model selected by the sentimental analysis studio
RESULTS

- In the current scenario, for the product Motorola Stereo Headset, the term volume seems to be one of the significant topics in negative weekday reviews. The same term appears in the weekend significant positive reviews list too.

- This clearly raised the flag of uncertainty of the proper feedback. For this purpose, the reviews which consisted of that term are pulled and are analyzed.

- After analyzing the reviews, it is clearly seen that there is actually no problem with the volume aspect of the device. So the negative reviews written on weekday regarding volume are only because of bad mood of the customer and not really a problem of the product.

- Similarly, with the second product LG Tone HBS-730 wireless stereo headset. There were negative reviews written about earbuds on weekdays but lot of positive feedback is written on weekend. Thus it clearly shows the presence of day of the week effect on the way people write a review.

So, it seems that there is an effect of the day of the week on the way people write a review. By performing such analysis, companies can better understand the nature of the reviews.
MODEL: LG TONE HBS-730 WIRELESS STEREO HEADSET – BLACK

Figure 10. Clusters formed for negative reviews on Weekday

Figure 11. Clusters formed for positive reviews on Weekend

Figure 12. Terms connected to “Bad” on weekday

Figure 13. Terms connected to “Earbud” on weekend
Figure 14. Examples of positive reviews about earbud on Weekend

Figure 15. Examples of negative reviews about earbud on Weekday

MODEL: MOTOROLA S305 BLUETOOTH STEREO HEADSET W/ MICROPHONE (BLACK)

Figure 16. Terms connected to Volume on Weekend

Figure 17. Terms connected to Volume on Weekday
CONCLUSION

This paper illustrated the influence of day of the week on the way a customer writes a review. Specifically, in the two examples, data is extracted and prepared for text analytics, performed text analytics, prepared data for exploration and reporting. Manufacturers can leverage this analysis or elements thereof, in their own analysis.

In this paper I explored the behavior changes observed using text analysis. Text cluster node and text topic node helped in finding out the significant review written by the customer. Text filter node helped in finding out the terms that are related to those significant topics. By this way a company can greatly synthesize its services and optimize the efforts spent on the betterment of the product.
FUTURE SCOPE AND LIMITATIONS

- The analysis performed in this paper does not take into consideration of the nature of the customer. So if the type of a customer could be known then evaluation of the results would make much more sense.
- The paper applies to a working customer who has workload on Monday through Friday and has an off from work on Saturday and Sunday.
- May be product from product categories specific to certain age groups could be analyzed so as to understand if there is an age factor. For example, mostly video games products are used by younger generations and home appliances are purchased by elder people so products from those products categories would help us understand if there is any age factor on how the behavior changes according to day of week.
- The length of the review written also has a significance in the intension of the review written. Survey tells us that when customers write just a short but harsh comment then in most cases it is not a true one and biased by some factor. So we can add the length of a comment factor so as to tune the comments.
- Time of the day is one more important factor which need to track of. Comments would be better in the early part of the day than in later part by following the concept of change in behavior because of work pressures. So if we could bring in the time factor that would greatly aid the company.

REFERENCES

2. Tom Sabo, SAS Federal LLC “Uncovering Trends in Research Using Text Analytics with examples from Nanotechnology and Aerospace Engineering”.
3. Chakraborty, Goutam and Pagolu, Murali Krishna “Analysis of Unstructured Data: Applications of Text Analytics and Sentiment Mining”.

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RECOMMENDED READING

- Chakraborty, Goutam, Pagolu, Murali Krishna and Satish Garla Text Mining and Analysis: Practical Methods, Examples, and Case Studies Using SAS
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