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Analysis of Impact of Emotion on Performance

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***Abstract*— Emotions and physiology of the human does the major impact on the performance of goal. Two categories of emotion are considered to study and analysis of impact of emotion that are positive emotion and negative emotions. Energy-in –Motion is also knows as emotion. Change in lifestyle of new generation pulled in a dilemma of decision making also has not a mental and physical strength to face and handle the emotional phases . Right actions at right time can pull out them from the stress. This motivates me to contribute my work in area of Speech signal processing for biomedical application. For our research work we tried to build a system 'Analysis of impact of emotion on performance'. This can help to detect and classify the emotions. Anger, Sadness and the Natural are the base factors for the stress analysis. Anger again classified as Aggressive anger and Depressive anger. Similarly Sadness also classified as Aggressive sadness and Depressive Sadness performance measurement of the stress analysis system is its accuracy of recognition. Using signature base approach of audio feature classification we designed the system and results are compare with existing tools and technology .This Analysis showed that stress affect negatively 10% on performance of the student as compare to normal performance.**

Index Terms*— Stress, Emotions, Classification ,Detection, Signal Processing.*

I. INTRODUCTION

For the performance measurement of the stress analysis system key term is its accuracy of recognition. Researcher Communities in this area provided analysis perform against various methods. Communities are trying to find how emotions and performance are related. Some of work contains few competing theories. The present paper organizes work on Stress and it effect on performance. With the focus of student stress and emotional speech there is a need of implementation of automatic emotion detection system which can analysis the emotion of the students and classify according to mood and extract feature like energy. Different application has been implemented by the researchers with considering the area of audio signal processing and stress management. While implementing this system we had a focus on two steps for processing the voice. 1] Recording the audio through microphone or collect the available sample from sources.2] Fundamental Signature evaluation in the speech signal.

The standard recordings were taken by recording equipment. The complete database is collected and evaluated with preserving their naturalness. The database can be accessed by the public via the internet (http://www.expressive-speech.net/emodb). In the second test, we tried to test real input /sound signals wav file and then compare with standard speech database for better result.

II. LITERATURE REVIEW

In [1] Phd researcher identified issues around complexity of interaction while doing his work. He mentioned that training of speech is important part in design of any speaker recognition system. He contributed in research by adding a novel method Finer grained analysis and behavioral analysis for emotion recognition in Human computer interaction.

In [2] audiovisual recognition method is used for recognizing the emotions along with this Hidden Morkov Model

Approach for phonetic computation was used. Drawback of the system was found that as the length of input speech signal increases execution time also increases. In his paper he gave the idea of language recognition.

In [3] Phd researcher designed a real time application for expression recognition. In his methodology he used SVM and supervised learning approach. By using this he designed a visual application. According to him all primary emotions have direct relation to the adaptive biological process. In cognitive process we feel happy.

[6] is related to emotion detection using speech that is speech processing. He designed a small compact emotion classifier which is able to classify real time speech emotions. As like [2] he also used a support vector machine because he found that SVM achieves highest emotion classification accuracy. All the preprocessing activities including segmentation, feature extraction , Training, testing and the classification has been performed. His result shows that All classes can be accurately detected, with a high proportion of true positives and true negatives.

In [7] with keeping the objective of to improve the performance of Automatic Emotion Recognition systems by mitigating the problem of ambiguity between emotion classes ,researcher had put a proposal in university of Canada. In his proposal Nearest Neighbors model approach is described and Hamming distance was specified for classification purpose. At the end he compared his results with GMM-Bayes system and achieve 3.46% gain in improving the performance. He suggested to improve space dimensionality reduction by using the different approaches like PA or PPCA for giving the flexibility in emotion recognition models.

[8] events and other behavioral cues was considered for analysis in this technical report. In this report mental states and their vocal correlation is described. His result shows that expression change gradually throughout the interaction specially in case of Human Machine Interaction. His experiment was perform by extracting the features such as pitch, energy and spectral content from the speech signal. For the performance evaluation he track the changes and set the tendencies in training phase of the system.

In [9] author observed that speech emotion recognition field has advantageous capability to recognize the affect in spoken utterances. For his Phd research he had proposed a hybrid system architecture for speech emotion recognition system to achieve classification accuracy and classification confidence. He had use linguistic as well as acoustic features for classification. In his research he considered three classification algorithm namely Naïve Bayes, a Decision Trees and SVMs using Sequential Minimal Optimization (SMO) for testing the data performance at different classifiers.

III. Proposed System and Mathematical Model

A. *Proposed System*

In this section we describe about approach toward the detection and classification of stress among the students during the examination period. The prepared dataset had different attributes including energy and f0excursions. The f0 excursions attribute indicates the emotional state of the person and A and D for aggressive stress and Depressive stress respectively. Instead of including all of the different human emotions, we have used only one emotions as it can clearly reveal the impact of stress on the student performance. Figure 1 shows the block diagram of proposed system of stress classification and detection. Our Algorithm follows some important stages including data capturing, background noise filtering, windowing, framing, normalization, feature extraction and classification.

Data capturing that is input speech signal can be chosen by two way one either by recorded data set which has been already stored in system or you can chose real time input speech. This input is recorded by using microphone. And will get tested in the form of .wav signals. Then, preprocessing is performed to improve the quality of input speech by using filtering. In the filtering process background noise is eliminated to extract the original speech because The collected emotional data usually gets degraded due to external noise (background and "hiss" of the recording machine).

A. *Mathematical Model:*

Power and Energy content are used to calculated. power = mean(x.^2) and energy = sum(x.^2) of the audio signal equation

$$E = T\sum_{n-0}^{N-1}[n] \quad \text{----------eq(1)}$$

$$P = \frac{1}{N}\sum_{n-0}^{N-1} x^2[n] \quad \text{----------eq(2)}$$

E and P shows the Energy E and power P respectively.

where x(n) is the n:th sample within the frame and N is the length of frame in samples. These parameter vectors can be described using GMM as bellow

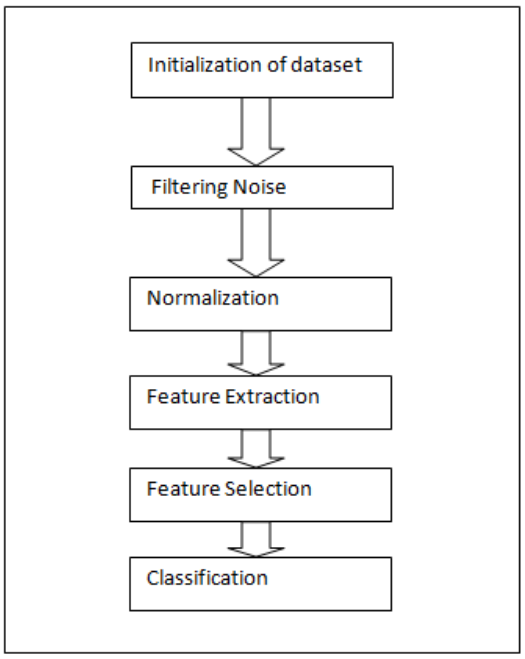

Figure 1: Proposed System Block Diagram

$$p(o \mid \lambda^s) = \sum_{i=1}^{M^s} w_i^s p_i^s(o),$$

where M is components of class, $w\,i$, $i = 1,\ldots, M$ are weights of that sum of all weights is 1, and p means the probability . and others are mean value and covariance matrix $C\,i$.

Gaussian model can be defined by

$$\lambda^s = \{w_i^s, \mu_i^s, C_i^s\}, \quad i, \ldots, M^s.$$

Using above factors we are able to detecting F0 detection in time domain, F0 plays an important role in frequency domain and F0 from cepstral coefficients. Popular autocorrelation function is used to determine the position of the first peak with the help of Pitch extraction concept . Simple formula is use for the final l calculation of the fundamental frequency as given bellow measured in Hz.

$$F0 = \frac{Fs}{K}$$

IV. Experimental Setup

All the setup and experiment was perform on the same platform of Matlab. Three types of datasets was tested. We

determine different frequency ranges for various emotions. Indian database was collected and it also has been trained and tested. Corresponding target matrices are constructed for training and testing data. This trained and tested database is use for analyzing the performance accuracy of the stress analysis system. Speech is Classified and labeled with number according to their type of emotion as shown in table 1 and target is set as shown in table 2.For the final testing of the system subjects were asked to identify the stress during the examination period.

Table 1: Emotion Labels in classifier tool

Emotion	Label
Depressive Anger	1
Aggressive Anger	2
Natural	3
Exited	4
Depressive SAD	5
Aggressive SAD	6

Target for emotion classification and detection are set at various level as shown in table 2. This set is design with various frequency ranges and cestrum values. The set of six different emotions will get classified in the target group according to their features. Different features are extracted by designing a different function of individual features and their signatures. The list of different features in the speech signal is discussed above in table 1

Table 2: Target Values for each Emotion

Emotions	1	2	3	4	5	6
1	1	0	0	0	0	0
2	0	1	0	0	0	0
3	0	0	1	0	0	0
4	0	0	0	1	0	0
5	0	0	0	0	1	0
6	0	0	0	0	0	1

During testing it was observe that for the excitement and for the anger expressing Most aggressive speech give the nearby same result such as when the student is excited and happy with examination then some time system classified Excitement as Aggressive Anger. This misclassification is due to the frequency range of both Happy and Aggressive is almost matched to each other. Table 6 shows the confusion matrix. And table 7 shows the obtain results in the form of accuracy percentage of the proposed method. Table 8 contains the comparison of existing approaches and the proposed approach. From the table 8 we can observe that accuracy of proposed method is better than approach used in[5], and used in [2] of DWT method and HMM method[2] for the angry, Natural and for Happy and SAD emotions but it is our approach is not reach to the accuracy of[4] for three emotions that are Happy, Anger and Natural .Though in case of SAD emotion detection and classification our approach leads as compare to all methods.

Table 3: Confusion Matrix for Excitement and Angry

Emotions	1	2	3	4	5	6
1	3	0	0	0	0	0
2	0	3	0	0	0	0
3	0	0	3	0	0	0
4	0	0	3	3	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0

Confusion matrix Table 3 is generated by misclassification. Reason behind the misclassification is boundary between the two frequencies. The ending frequency of the normal speech and the starting of Angry emotion frequency has a minute difference which can't be accurately classified. By considering the confusion matrix we obtain the various results which is shown bellow in table 4.

Table 4: Result with percentage of Accuracy of proposed System

Emotion	Accuracy
Depressive Anger	98%
Aggressive Anger	97%
Natural	99%
Exited	98%
Depressive SAD	100%
Aggressive SAD	100%

Table 5: Comparative analysis of accuracy in percentage

Emotions	Result from[4]	Result from[5]	Result from[2] DWT	Result From[2] HMM	Proposed method
Anger	100	95	76.5	91.3	97.5
Natural	100	10	-	-	99
Exited or Happy	100	80	78.9	88.1	98
SAD	0	35	83.7	86.7	100

In addition to analysis of stress we perform some emotion analysis by adding some extra features. Figure 1 shows the additional performance with different emotions.

From the study we observe that there is a big impact of the emotions on the performance of student during the examination periods. Those students have prepared there study are found more excited about the examination. But those who are not prepared for examination undergoes in stress and cannot perform well. Table 6 shows the random sample testing of students which compare performance of student under stress against Normal and Exited Condition.

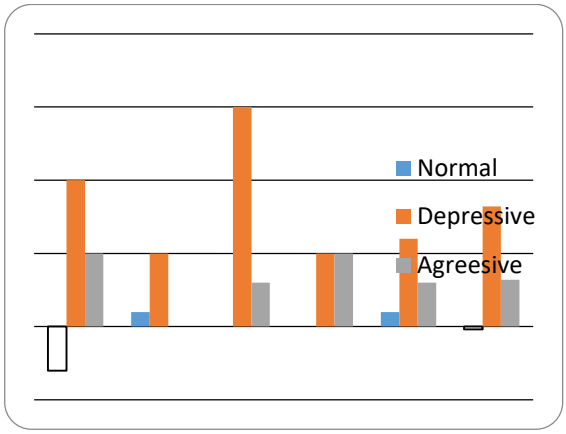

Figure 1: Difference between various performances

For this testing we have done real time testing where to the 50 students ware ask about their preparation of examination. These 50 subjects include the male and female

Table 6: Performance Analysis of some samples

Subjects	Original mood	Capture Mood	Performance before examination
Subjects 1	Normal	Normal	75%
Subjects 2	Normal	Normal	60%
Subjects 3	Normal	Normal	65%
Subjects 4	Normal	Anger	70%
Subjects 5	Normal	Normal	75%
Subjects 6	Depressive	Depressive	75%
Subjects 7	Depressive	Depressive	60%
Subjects 8	Depressive	Depressive	65%
Subjects 9	Depressive	Depressive	70%
Subjects 10	Depressive	Depressive	75%
Subjects 11	Aggressive	Aggressive	75%
Subjects 12	Aggressive	Aggressive	60%
Subjects 13	Aggressive	Aggressive	65%
Subjects 14	Aggressive	Aggressive	70%
Subjects 15	Aggressive	Aggressive	75%

From above table performance can be clearly observe as in case of Normal stage of emotion student results varies by only 1 to 2 % and when student in stage of dilemma what to do and what to do not then at that time they get aggressive stage of emotions. In this case Result get affected by 3 to 4 or sometime stable. On the opposite side when Students could not complete their preparation for the examination then they are in stress or in depressive Stress which majorly affect on the result of examination from experimental analysis average percentage difference is about 10 %. Figure 2 shows the variation in performance under different emotional stress.

Table 7 given bellow shows how much performance affect in aggressive, Depressive stress as compare to normal or natural performance. Natural performance was recorded by providing the Questions to the student before 1 day for class test.

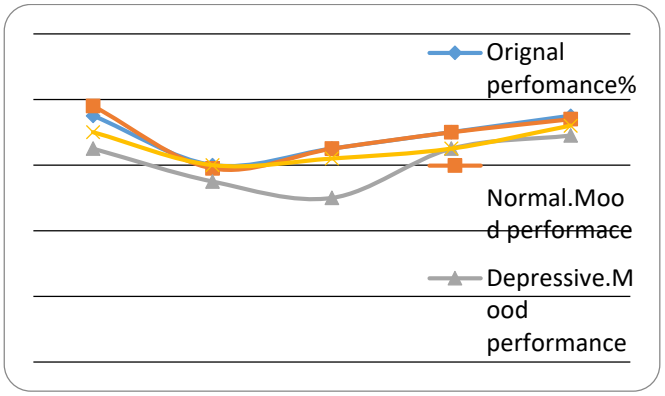

Figure 2: performance under different emotions

Table 7: Average effective difference of performance in different emotion

No/Type	Normal	Depressive	Aggressive
1	-3%	10%	5%
2	1%	5%	0%
3	0%	15%	3%
4	0%	5%	5%
5	1%	6%	3%
Avg	0%	8%	3%

Aggressive and depressive parameter obtains by asking student for examination before 1 day. Table 7 shows that when Students do regular study then they appear Normal and sometime result get increase or decrease any time. But when student in depression or in any stress then they lack their performance.

RESULT:

For a clean experimental setup everything except the issue under study is kept constant. Number of student speakers' specks naturally with the emotions that they have to perform. Recordings are at high audio quality and without noise without which spectral measurements would not been possible. This experiment shows the emotion detection whose accuracy outperforms a Better than a number of papers Moreover, it achieves this in real-time, as opposed to previous work base on stored data. The novel application of the system for speech quality assessment also achieves high detection accuracies. Figure 3-B Shows the Output classification result of Emotions and Table 8 shows the performance and the result.

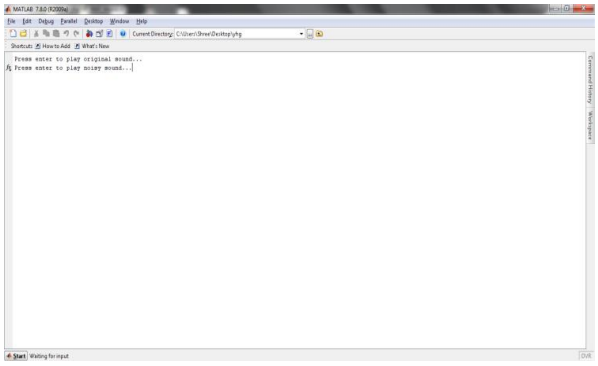

Figure 3-A: Input for the testing.

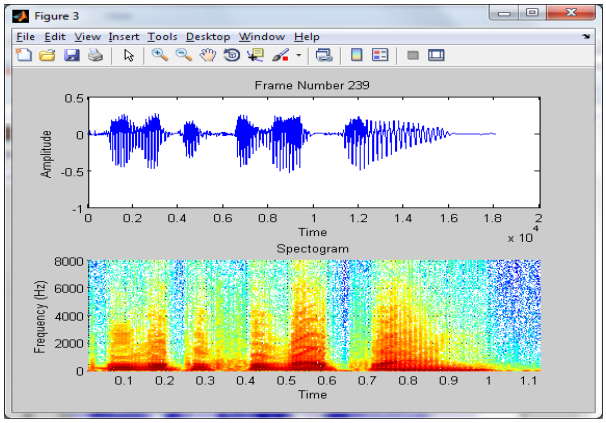

Figure 3-B: Input and spectrogram of input sound

Table 8: Classification of emotion

Category	Happy	Sad	Angry	Natural	Fear	bored	Error%
Happy	49	0	1	0	0	0	0.5
Fear	0	1	0	0	48	1	1
Natural	1	0	2	47	0	0	2
Bored	0	2	0	0		48	1
Angry	0	0	50	0	0	0	0
Sad	0	49	0	0	0	1	0.5

CONCLUSION

Almost all nationalities were having their uniqueness geographically and culturally. It is observe that in case of emotion vibration the range of very high frequency is 30Mhz to 300MHz with the wave length 1m to 10m which get captured in aggressive stress and the range of very low frequency is 3KHz to 30KHz with the wavelength 100km to 10Km which are captured in the depressive stress. During the testing it has been seen that for the Mongolian dataset high frequency 1.0 classified as the aggressive stress in early stage on the other hand same frequency 1.0 indicate the normal speech in case if Indian dataset. From this observation we can easily understand that the extent of F0 -excursions in speech increases slightly with age and also geography and cultural affects the Fo .while comparing the approach with dynamic programming we obtain the better satisfactory results. Studies have found that stress affect the performance of the student at an average percentage 10% as compare to normal performance .This system can be extend for the medical application in case of physiological testing.

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