

Time-Frequency Analysis of Chanting Sanskrit Divine Sound “OM” Mantra

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Summary

Our attentiveness and our concentration are pilfered from us by the proceedings take place around us in the world in recent times. Different challenges and impediments are faced by the people work in the software industries. It is tough to handle the stress some times. Therefore, to come out of the aforementioned troubles, Meditation is essential for all human beings. In the same way, for psychological stress, Speech signal is uttered to be a considerable indicator. In the direction of mediating human subject, 'OM' is a spiritual mantra, outstanding to fetch peace and calm. The entire psychological pressure and worldly thoughts are taken away by the chanting of OM mantra. Elimination of disruption and introduction of new dynamism in the body are given by the OM chanting. The consciousness could be promoted through the repetition of OM mantra. Furthermore this mantra transcends the restrictions of a mentality. To systematically understand the meditative chant, termed the divine sound 'OM', is the endeavor of this research work. With wavelet transforms, time-frequency analysis has been carried out for the divine sound OM. By this analysis we could conclude steadiness in the mind is achieved by chanting OM, hence proves the mind is calm and peace to the human subject.

Keywords:

Devine Sound, OM, Meditation, Speech signal, Time-Frequency Analysis, DWT, Haar, Daubechies

1. Introduction

Current advancement in technology and rising workload is often accompanied by stress. As a result of a few physical factors in certain occupational actions, the psychosomatic complication termed psychological stress occurs. To incorporate spiritual welfare in step with our substance welfare, meditation provides as a way. Highly sensitive expressive experienced people are more probable to be satisfied and efficient in their life in recent days. It turns out that simultaneously they cannot give concentration and think discursively. Whether in the medical or technological or social spheres, to develop our excellence of life, human venture has sought all down the ages. Promoting the quality of our mind together with our material standard of living is essential to improve our quality of life.

To deal with the increasing stress of modern standard of living, Humanity is progressively turning in the direction of different meditative practices. People have been

heading for their gawk inwards in propose to attain peace of mind, since they are not capable to locate steadiness in the external world. Modern psychotherapists have begun to discover various therapeutic benefits of meditation practices. Meditation induces the state of relaxation and the altered state of consciousness. They are particularly efficient in psychotherapy. However, for inculcating a more positive attitude in the direction of life at large, meditation is being utilized as a personal growth device over everything else recently.

For psychological stress, Speech signal is uttered to be a considerable indicator. The speech signal expresses the information enclosed in the vocal word. As with several real-world signals, Speech signals are non-stationary. Hence the frequency contents changes diagonally the time; Fourier analysis is unconvincing [1]. Speech signal processing refers to the acquisition, manipulation, storage, transfer and output of human utterances by a computer. The main goals are the recognition, synthesis and compression of human speech [2]. Speech signals are including the features such as temper, physical characteristics and added pragmatic information. Most of these characteristics are audible as well. Concerning 25% of information enclosed in a clean speech signal refers the speaker. Through abstract psychological procedures speech production initiates the aspiration to communicate and the thought that is to be communicated.

There are quantities of human verbal communications that are effectively non-linguistic, even if speech is an oral action which is greatly verbal. Tone of voice excellence, prosody, rhythm and pausing are the non-verbal characteristics. For a non-verbal signaling system, these phenomena stand which interweave with the verbal or linguistic system. In the midst of supplementary things, information about the physiological and psychological condition of the speaker is carried by the non-verbal content of the voice. Since, undoubtedly perceptible (non-verbal) action typifies human beings; they are capable of identifying dissimilar states [3]. Our mind is entirely permitted to focus and give attention extra on sound by the repetition of Mantra i.e. chanting. The additional features that distract our energies for instance other thoughts, sensations and interruptions are too cleaned away by the repetition of mantra. As the mind clears away the mess of

unnecessary internal discourse, our senses become more heightened and mind becomes sharper and perspective [4].

The theory in using mantras or chanting is that the body and mind begin to resonate with the frequency of the voice, helping to organize thoughts and consciousness. Reciting a mantra continuously "purifies the speech and 'protests the mind' by maintaining a constant spiritual connection; and of course it helps disperse mental chatter"[5]. If there is no religious preference then the sound vibration 'OM' is a universally recognized mantra. The sound of OM is also called Pranava, meaning that it sustains life and runs through Prana or breathes [6]. The OM is composed of three letters, A, U, and M. These symbolize the practitioner's impure body, speech, and mind. Chanting OM (AUM) will bring us to a state of purity in body mind and soul [7]. The chanting of 'OM' mantra drives away all worldly thoughts and removes distraction and infuses new vigor in the body [6].

Modern science has to reaffirm that OM mantra chanting allows our mind to focus and clear away unnecessary thoughts, sensations and distractions which divert our energies. In this paper, by utilizing signal processing techniques OM mantra chant signal is analyzed to endorse its effects on consciousness and steadiness of mind. The Time-Frequency analysis is performed on the OM chant signal using wavelet transforms. Our analysis results confirm that the chanting of OM mantra will improve our consciousness and give steadiness to mind by clearing all worldly thoughts.

The paper is organized as follows. Section 2 introduces the concepts and techniques utilized in the proposed work. The steadiness analysis of OM chant signal is discussed detailed in Section 3. The analysis results are given in Section 4. Section 5 concludes the paper.

2. Concepts and Techniques Utilized in the Proposed Work

This section gives a brief introduction of the concepts and techniques utilized in the proposed work.

2.1 Mantra

Mantra is intrinsically related to sound and sound is reverberating in everything in this universe [8]. A Mantra is a sound repeated over and over until it integrates into our consciousness - frees the mind from its constant doing, and elevates us to an altered state of awareness. In this state, we can connect with our soul at its most profound level, achieving a state of universal consciousness [4]. Mantras have some features in common with spells, in that they are a translation of the human will or desire into a

form of action. As symbols, sounds are seen to effect what they symbolize [9]. Mantra has been called the sound-body of God: It is God in the form of sound [8]. Mantra helps to quieten the mind. It works because it actively chases away our errant thoughts. Mantra helps to clear our mind and purify our inner being. This purification is essential to good meditation [12].

2.2 OM Mantra

The basic mantra is OM or 'Aum', which in Hinduism is known as the 'pranava mantra,' the source of all mantras [10]. If there is no religious preference then the sound vibration 'OM' is a universally recognized mantra. It is the representation of the Supreme Being. The past, present and the future are all included in this one sound. Meditation on this sacred syllable is said to satisfy every need and leads to liberation [11]. The power of chanting the OM mantra is as follows:

- The chanting of OM drives away all worldly thoughts and removes distraction and infuses new vigor in the body.
- When we feel depressed, chanting OM fill us with new vigor and strength. The chanting of OM is a powerful tonic. When we chant OM, we feel we are the pure, all pervading light and consciousness.
- Those who chant OM will have a powerful, sweet voice. Whenever we take a stroll, we can chant OM. The rhythmic pronunciation of OM makes the mind serene and pointed, and infuses the spiritual qualifications which ensure self-realization.
- Those who do meditation of OM daily will get tremendous power. They will have lustre in their eyes and faces.

2.3 Time –Frequency Analysis

Time-frequency analysis is a body of techniques for characterizing and manipulating signals whose component frequencies vary in time, such as transient signals [13]. Time-frequency analysis finds its roots in Fourier analysis, where a signal in time can be analyzed in the frequency domain as a sum of sines and cosines. For a non-stationary signal such as speech, the standard Fourier Transform is not useful for analyzing the signal. Information which is localized in time such as spikes and high frequency bursts cannot be easily detected from the Fourier Transform [14]. We have used wavelet transforms for time-frequency analysis in our approach.

2.4 Discrete Wavelet Transform

The wavelet is a smooth and quickly vanishing oscillating function with good localization both in frequency and time. The Wavelet Transform (WT) is a technique for analyzing signals. It was developed as an alternative to the short time Fourier Transform (STFT) to overcome problems related to its frequency and time resolution properties. A discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled. DWT provides high time resolution and low frequency resolution for high frequencies and high frequency resolution and low time resolution for low frequencies. In that respect it is similar to the human ear which exhibits similar time-frequency resolution characteristics.

3. Steadiness Analysis Of OM Mantra Chanting

This section details our analysis on the OM mantra chanting signal. Before some decades, Yogis and meditating professional affirmed that chanting mantra improves our concentration, gives peace and steadiness to our mind, reduces the mental stress and clears all worldly thoughts. Although, it's required to verify importance of mantra chanting systematically, no schemes have demonstrated yet. In this proposed method, we have confirmed the significance of OM chanting. Time-frequency analysis is performed on the OM mantra chant signal to analyze the steadiness. Unlike Fourier, wavelets can be used to analyze nonstationary, time-varying, or transient signals [15] [16]. This is an important aspect, since speech signals are considered to be non-stationary. We have utilized Discrete Wavelet Transforms (DWT) instead of Fourier transform for the Time-frequency analysis. We have exploited Haar and Daubechies wavelets for our analysis.

3.1 Haar Wavelet

Haar wavelet is one of the oldest and simplest wavelet. Therefore, any discussion of wavelets starts with the Haar wavelet. The Haar wavelet's mother wavelet function $\psi(t)$ can be described as [15]

$$\psi(t) = \begin{cases} 1 & 0 \leq t < 1/2, \\ -1 & 1/2 \leq t < 1, \\ 0 & \text{otherwise.} \end{cases}$$

and its scaling function $\phi(t)$ can be described as

$$\phi(t) = \begin{cases} 1 & 0 \leq t < 1, \\ 0 & \text{otherwise.} \end{cases}$$

The Haar wavelet uses a rectangular window to sample the time series. The first pass over the time series uses a window width of two. The window width is doubled at each step until the window encompasses the entire time series. Each pass over the time series generates a new time series and a set of coefficients. The new time series is the average of the previous time series over the sampling window [21].

3.2 Daubechies Wavelet

Daubechies wavelets are the most popular wavelets. They represent the foundations of wavelet signal processing and are used in numerous applications. Daubechies wavelets are a family of orthogonal wavelets defining a discrete wavelet transform and characterized by a maximal number of vanishing moments for some given support. The polynomial formed by the first N terms of the binomial expansion

$$(1 - y)^{-N} = \sum_{k=0}^{\infty} \binom{k + N - 1}{k} y^k = \sum_{k=0}^{\infty} \frac{(N)_k}{k!} y^k$$

That is, the polynomial

$$P_N(y) = \sum_{k=0}^{N-1} \binom{k + N - 1}{k} y^k = 1 + Ny + \frac{N(N+1)}{2} y^2 + \dots + \binom{2N-2}{N-1} y^{N-1}, \quad (1.1)$$

Where $\binom{k}{a} = \frac{T(a+k)}{T(a)}$, plays an important role in the construction of the compactly supported Daubechies wavelets. There is a close connection between the zeros of $P_N(n)$ and the $2N$ filter coefficients $h(n)$ of the Daubechies wavelet D_{2N} .

4. Analysis Results

This section details the results of our analysis. The analysis results prove that the steadiness of mind is attained by chanting OM. To avoid disturbances due to ambient noise or other sources of sound, a professional recording was preferred. Therefore, a professional recording of the Divine Sound chanting OM was obtained and used for further scientific investigations. Hence the professionals may possibly not be affected by the stress, the need to analyze their speech signal is unnecessary. Though the professionals constantly practice OM chanting, the steadiness remains in their mind everlastingly. On the other hand, the normal people will not be having steadiness initially in their mind. Although they undergo "Om" chanting process, they have to perform it in an appropriate manner. Subsequent to the proper practicing, the mind of the stressed people reaches steadiness in a few days or weeks. On account of this, it's very imperative to

analyze the speech signal of a previously strained person. The constant analysis of a person's speech signal would give us an enhanced outcome.

During the OM chanting practice, our mind focuses on the repetition of OM chanting. Moreover, this practice helps us to reach steadiness. The frequency of the chant signal Figure 1 represents the initial chanting of OM by a normal person.

achieves steadiness following a continuous chanting. This specifies the attainment of the steadiness in the mind of an OM chanting person. This provides calm and peace to the stressed mind. The mental stress of a person gets reduced while the mind reaches steadiness. In addition, concentration also improves.

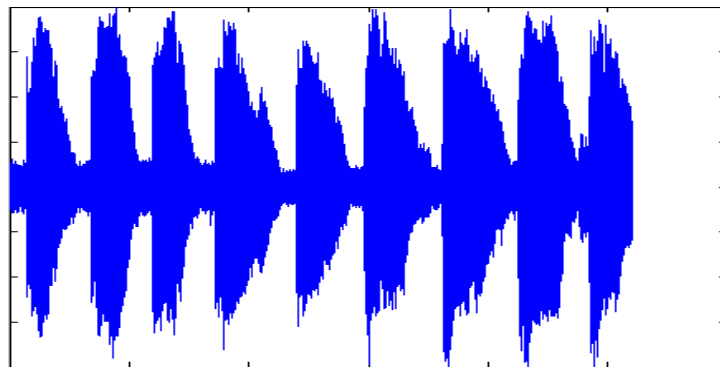


Fig. 1 Initial Chanting of single OM

Figure 2 depicts the chanting of OM by normal person after some days of chanting.

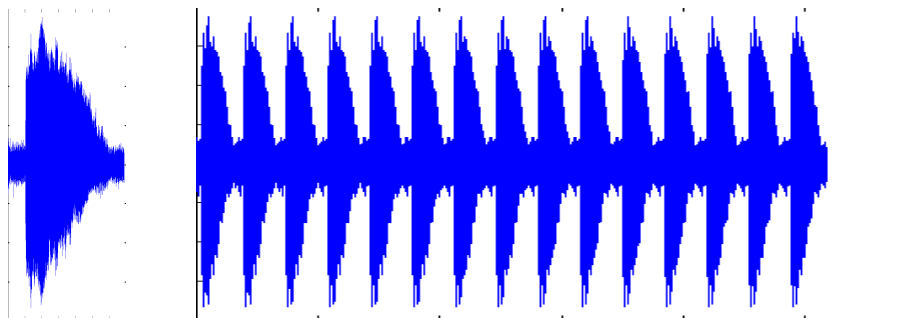


Fig. 2 Chanting of OM after some days

Figure 3 and 4 portrays the analysis using the Haar and Daubechies wavelet transform respectively

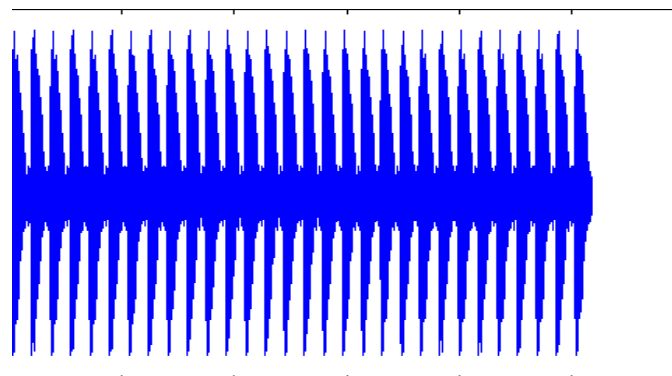


Fig.3 Haar Transform of OM chant signal

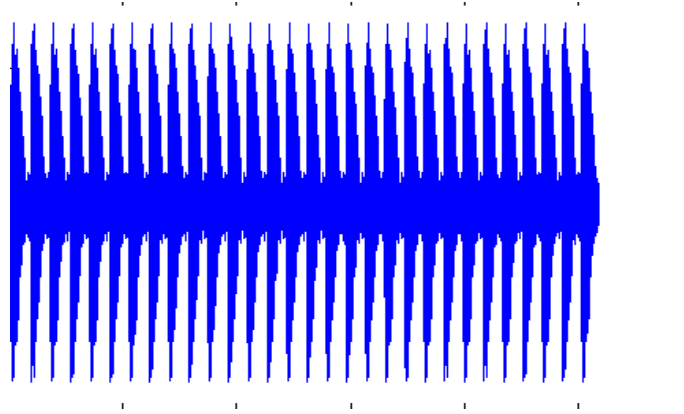


Fig. 4 Daubechies (D6) Transform of OM chant signal

5. Conclusion

Our attentiveness and our concentration are pilfered by the events around us. Different challenges and impediments have been faced by the humans due to their occupational activities. Meditation is essential for the human beings to come out of the above troubles. OM is a spiritual mantra, important to obtain peace and calm. The entire mental pressure has been taken away by chanting OM mantra. Consciousness has been improved by the repetition of OM mantra. In this work, we have confirmed the significance of OM chanting. The time-frequency analysis has been carried out using wavelet transforms for the divine sound OM. We have concluded that OM chanting affords steadiness in the mind scientifically. This provides calm and peace too to the stressed mind. The mental stress of a person gets reduced while the mind reaches steadiness. As a final point, we have confirmed scientifically the accomplishments of OM chanting in reducing the stress from the human mind.

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