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COMPARSION OF FFT AND CONTINEOUS WAVELET TRANSFORM TO ANALYSIS OF ECG SIGNAL

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ABSTRACT

Wavelets are mathematical operations that cut data into different parts of a frequency, and then read each component with a solution that is matched to its scale. They are more advantageous than conventional Fourier methods in analyzing visual conditions where the signal contains a dent and sharp nails. Wavelets are developed independently in the fields of mathematics, quantum physics, electrical engineering, and seismic geology. This paper introduces wavelets to an interested technician outside of the digital signal processing platform. In this paper describe the history of the waves that started with Fourier transform and compared the Wavelet conversion with the Fourier transforms of ECG (electro cardio gram) signal in the medical field.

1. INTRODUCTION

The majority of TIME-DOMAIN signals are in green format. In other words, when adjusting the signal, one axis is usually time and the other is typically amplitude. When plotting time zone signals, the amplitude of the signal time is represented. (Block 2) This presentation is not always the best signal representation for many signal processing applications. In most cases, the most obvious information is hidden in the signal's bulk content. The signal SPECTRUM frequency is a component of the signal's frequency [1]. The frequency spectrum of a signal indicates which frequencies are present in the signal. In the ECG signal (ElectroCardioGraphy, an image recording of cardiac activity). The general shape of the healthy ECG signal, as shown in Figure 1, is well understood., by cardiologists. Any significant deviation from the norm is typically regarded as a symptom of a pathological condition. However, this pathological condition is not always visible in the first-time domain signal. Cardiologists frequently analyse ECG signals using time-bound ECG signals recorded on strip charts. Nowadays, new computerised ECG records are used to analyse frequency data in order to determine the existence of a medical condition. The pathological condition can sometimes be easily detected when the content of the signal frequency is analyzed

Wavelet modification is a change of this type. Time frequency representation is provided. Because the Wavelet version can provide simultaneous and frequent information, it can represent signal frequency.. The frequency and frequency of signals at a specific location on a frequency plane are unknown. In other words it does not indicate which part of the spectral is available at any time in an instant. The best we can do is investigate which spectral components are available at any given time. FT always provides a consistent solution, while WT provides a flexible solution such as following high waves are better resolved in time and lower waves are better resolved in bulk. This means that a certain fraction of the high frequency can be better achieved while part of the lower frequency. [2]

Figure 1 (ECG) Electrocardiogram Signal

2. WAVELET TRANSFORM INTRODUCTION

It is well known in Fourier theory that the signal can be expressed as a sum of a possible, possibly endless, series of sines and cosines shown in Figure 2.1. This amount is also called the Fourier expansion. The main disadvantage of the Fourier extension however is that it has only frequency adjustments and no time adjustment. This means that, while we can determine all of the frequencies in the signal, we don't know when they appear.. To overcome this problem in the last few decades a number of solutions have been developed that are able to represent the signal on a time and frequency basis at the same time.

Wavelet conversion or wavelet analysis is probably the most recent solution to overcome Fourier transform shortcomings. In wavelet analysis the use of a fully modified converted window solves the problem of four transformations. The window is moved next to the signal and everywhere the spectrum is calculated. Then this process is repeated several times with a slightly shorter window throughout the new cycle. Eventually the result will be a set of time signal representations all with different resolutions shown in the figure. Thanks to this collection of presentations we can talk about multiresolution analysis. In the case of wavelengths we are usually not talking about the representation of the frequency of the time but about the measure of the representation of the mean time in the opposite direction because the term frequency is set to four variables [2]

Fourier's transformation statistically represents the Fourier analysis process::

$$F(\omega) = \int_{-\infty}^{\infty} f(t) e^{-j\omega t} dt$$

which is the sum of the signal f(t) over all time multiplied by a complex exponential (Recall that a complex exponential has real and imaginary sinusoidal components).

Figure 2.1 Fourier transform of the signal

The Fourier coefficients are the transform's output, which when multiplied by a sinusoid of frequency yield the original signal's constituent sinusoidal components. Figure 2.2 depicts the procedure.

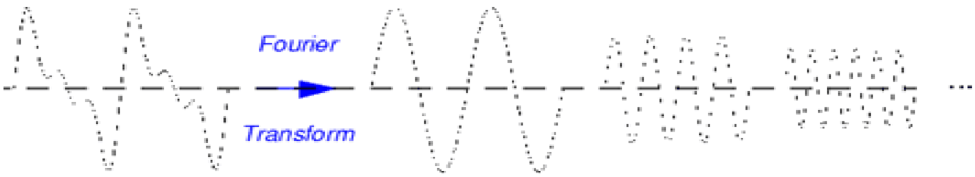


Figure 2.2 Graphical fourier transform of signal

Similarly, the continuous wavelet transform (CWT) is defined as the sum over all time of the signal multiplied by scaled, shifted versions of the wavelet function :

$$C(scale, position) = \int_{-\infty}^{\infty} f(t)\psi(scale, position, t) dt$$

The CWT produces a large number of wavelet coefficients C that vary with scale and position. The constituent wavelets of the original signal are obtained by multiplying each coefficient by the appropriately scaled and shifted wavelet:

(a)

(b)

Figure 2.3(a) Wavelet transform of the signal (b)Graphical Wavelet transform

3. APPLY CONTINEOUS WAVELET TRANSFORM TO ECG SIGNAL

ECG analysis is widely used to diagnose many cardiovascular ischemic heart disease and arrhythmias. Much of the clinically useful information carried by the ECG is found in the QRS architectural signal and the T-wave measured as amplitude and duration decreases. The ECG signal is characterized by the emergence of a pattern of patterns with different frequent content (QRS complexes, P and T waves). The QRS complex is a signal that must be an ECG signal feature indicating left ventricular depolarization as a manifestation of electrical activity within the heart during ventricular function. Its shape, duration and duration of the event provide important information about the current state of the heart.

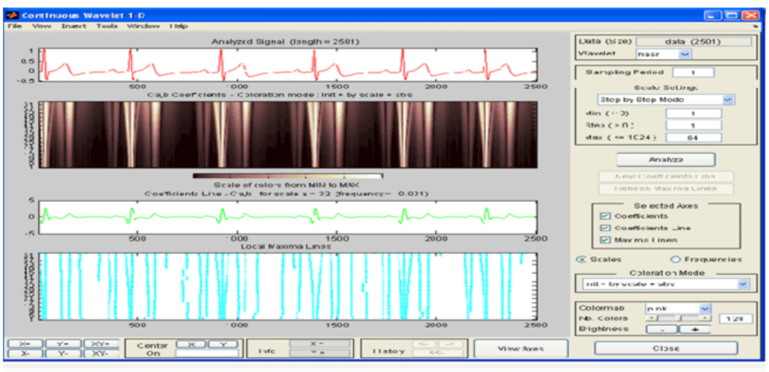
Cardiologists can use the features of these symptoms to obtain important data about the clinical condition of their patients. These characteristics are characterized by morphology and the duration of ECG waves (P, QRS complex, and T waves). From a clinical point of view, ECG analysis is a milestone in patient evaluation, considering the clinical method of determining the starting and ending points of the P wave, QRS complex and T wave as important.

But in the meantime, we are also considering that on the surface of the body the ECG stores more information. At this point of view, we have used in our paper, the conversion of contineous waves as a separate method of clinical ECG analysis. Over the years, wavelet modification has proven to be an important tool in many application areas for the analysis of continuous signals and ECG in particular. Wavelet conversion has two sides at the same time and frequency, and allows data for both domains to be analyzed simultaneously. The wavelet conversion provides time - a representation of the frequency signal that provides the image representation, the ECG signal spectrogram on different scales with different resolutions. [3]

4. METHOD

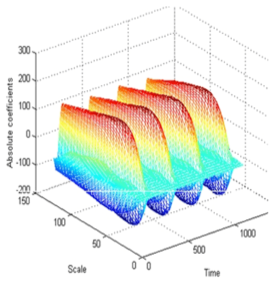
Wavelet conversion is a useful tool for analyzing ECG signal, which is characterized by the emergence of a cycle of patterns with different frequent content (P wave, QRS complex, T wave). In our study we obtained ECG signals using the BIOPACK MP100 module containing Acknowledge DAQ software information. For this purpose we selected sinus rhythm ECGs, with average QRS duration (<= 120 ms) for different heart rates and ECGs from stored heart failure information, in which we analyzed ECGs with QRS> 120 ms time frame. The sample frequency for those signals is 250 Hz. We used Matlab 7.3 on Windows VISTA using the wavelet toolbox from the Wave menu to make a wave change. Our research was conducted in the clinical trials of ECG symptoms from a medical point of view.

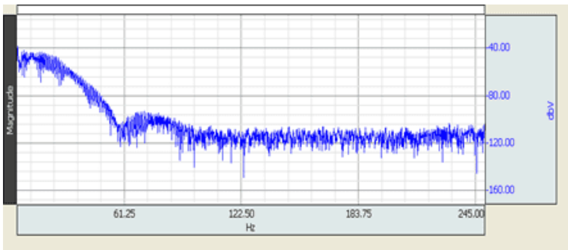
We like to discover after waveform conversion, ECG as waves, formed by slopes and local maxima (or minima) with different scales that occur at different times during the cardiac cycle. The change in the input ECG signal corresponds to the size of the area in the decomposition modulus on different scales. The frequency of wavelengths of the ECG feature varies so they are divided into different decay scales. The wavelet conversion is designed to provide good time correction and wrong frequency correction at high frequencies as well as positive frequency correction and negative timing correction at low frequency. This method works well with ECG signals that have both short-term high frequency and long-term low frequency components.. In Figure 3.1 the transineous wavelength of the ECG signal is the beter introduction of the fourer transform. [4] [5]



(a)

Figure 3(a) Contineous Wavelet transform to ECG signal





(b) **(c)**

(b) Contineous Wavelet transform to ECG signal on 3D **(c)Fourier transform of ECG signal**

5. RESULTS AND CONCLUSIONS

This study is intended to compare FFT with WT. Therefore, an appropriate method for the analysis of ECG symptoms is being investigated. The fact is that ECG signals are stagnant and using Fourier to modify small changes may not be noticeable and my analysis changes depending on the length of the data. Thus in spectral analysis, it can be said that WT is more suitable than Fourier transform. The reason for this success depends on the measurement and dynamic characteristics of the mother wavelet. Another advantage of wavelet conversion is 3D representation of signals such as amplitude, frequency and time. 3D representation is much easier in pathological conditions as epilepsy extraction using WT subspectral components can also be represented as shown in Figure3. In addition to the above statements we can say that WT is a new strategy and also WT has been upgraded depending on the Fourier transitional version. Namely WT uses FFT to add a time domain view.

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