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APPLICATION OF WSOLA & GWSOLA ALGORITHMS FOR PACKET LOSS CONCEALMENT

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ABSTRACT

This paper gives an overlook of time scale algorithms used for packet loss concealment. The time scale modification (TSM) approach can be used to overcome the quality degradation at the packet loss regions. The Overlap and add (OLA) algorithm does not consider what are the content of the input signal rather it just overlap and add the signal. To avoid time discontinuities synchronous overlap and add (SOLA) algorithm is introduced. The disadvantage of SOLA is that it does not maintain maximum local similarity. To overcome this problem WSOLA technique is used. This technique good quality output sound than other time scale modification algorithms. Gain control into the standard WSOLA technique which could adjust the level of the audio segments for overlap and add in order to maintain the audio signal level consistent. GWSOLA algorithm can be applied in the packet loss concealment of real time voice communications

INTRODUCTION

The speech signal is the most essential medium of human communication. In speech communication system, the speech signal is transmitted, processed and stored in different ways. Now-a-days speech signal processing is the active field of research. But the major problem in this communication is loss of packet on network. Even a single loss of packet may generate an audible artifact in the decoded speech signal. There are many reasons for loss of packet such the excess of the transmission capacity and congestion and also may be caused by wireless channel such as noise, co-channel interference and fading [1]. At the receiver side there is a need of packet loss concealment algorithm so as to avoid the quality degradation.

The time scale modification (TSM) approach can be used to overcome the quality degradation at the packet loss regions. To conceal the lost packet, one or two packets before the

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lost packet are stretched such that the pitch frequency of speech signal is preserved. The Overlap and add (OLA) algorithm is the origin of all TSM algorithms. It does not consider the content of the input signal rather it just overlaps and add the signal. Hence the output of this method consists of an unpleasant [2]. The modification of OLA algorithm is synchronous overlap and add (SOLA) algorithm. The time discontinuities that were introduced in OLA method can be avoided using SOLA algorithm [2].The ideal time scaling algorithm should produce an output that maintains similarity to original signal. But SOLA does not maintain maximum local similarity. So to overcome all this problems the new algorithm is introduced named as WSOLA. It is the technique that ensures sufficient signal continuity at segment joins that existed in original signal [3]. Since WSOLA gives good quality output sound than other time scale modification algorithms [3][4]. Time-scale modification (TSM) of speech signal alters the duration of an audio signal while maintaining the local frequency of the original signal without affecting the perceived pitch or timbre of the original signal. The duration of the original signal is increased or decreased but basic parameters of the original signal remain unchanged.

WSOLA algorithm is time domain approach of time scale modification. Audio signal packet loss concealment is an important application of WSOLA algorithm. The principle of WSOLA is depends on wave similarity. It does operations in time domain [3]. WSOLA algorithm extends the packets before the missing packet to conceal the lost packet. Gain controlled Waveform Similarity Overlap and Add (GWSOLA) algorithm is the modified technique of WSOLA. The gain control mechanism is used in the GWSOLA technique which adjusts the level of audio segments to be overlap added to maintain audio signal level consistent [5].

LITERATURE REVIEW

Overlap and Add (OLA) and Synchronous Overlap and Add (SOLA) algorithms are presented by **Adam Kupryjanow and Andrzej Czyżewski**. They did this work in order to find the best algorithm. The algorithms were used to check the real time requirements. To check the quality of stretched signal they used the parameter named as Mean Opinion Score (MOS). They concluded that the results of SOLA algorithm are more acceptable than the results of OLA [2].

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W. Verhelst and M. Roelands proposed the waveform similarity overlap and add (WSOLA) algorithm. The purpose of proposing this algorithm is to avoid the problem occurring due to time-scale modification of speech signal, and is uses the STFT representations. The result of this algorithm can be found out by informal listening test can evaluate. WSOLA algorithm produces high quality speech output. Paper concludes that WSOLA performs better for TSM [3].

Alexander Stinger et al proposed use of WSOLA scheme for the application such as packet loss concealment. In his work he did extension of time scaling of previous signal packet so as to hide the gap of missing packets. The discontinuities problems are considered at the boundary. The proposed algorithm was compared with other methods like silence substitution (s), pattern recognition (PR) and pitch waveform replication (PWR) by subjective hearing tests. The mean opinion score (MOS) was taken and it shows that the quality of recovered signal by using proposed algorithm is enhanced as compared to other methods [4].

L. Wang et al proposed waveform similarity overlap and add technique with gain control (GWSOLA), which is modified technique of WSOLA. The algorithm was proposed for packet loss concealment. In the proposed GWSOLA algorithm, they introduce the gain control into the standard WSOLA technique which could adjust the level of the audio segments for overlap and add in order to maintain the audio signal level consistent. They said that GWSOLA algorithm can be applied in the packet loss concealment of real time voice communications, especially for jitter buffer management of mobile VoIP in order to confront packet loss and packet delay as GWSOLA is transmitter independent and suitable for multicast. To get the quality of time recovered signal they had taken Mean Opinion Score (MOS).The results of work show that GWSOLA algorithm is more suitable for packet loss concealment than standard WSOLA algorithm [5].

J.F. Yeh and P.C. Lin said that WSOLA and GWSOLA techniques consider the packets before the missing packet for concealment of lost packet that leads to the misalignment between the original waveform and the recovered waveform. Packets before and after the missing packets are considered for concealment in BWSOLA technique. So BWSOLA technique maintains consistency in amplitude, frequency and phase between recovered signal and adjacent signal. Thus gives noticeable quality improvement in the recovered signal [6].

Jin Ah Kang and Hong Kook Kim proposed an adaptive packet loss recovery (APLR) method that improves the speech quality of a real-time speech streaming (RSS) system over IP

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networks. In the proposed APLR method first the packet loss rate (PLR) of network via a real-time speech quality assessment (RSQA) is estimated at the receiver side of the RSS system, and then requested the opposite RSS system to transmit redundant speech frame data (RSD). They said that APLR assists the speech decoder employed in the RSS system to reconstruct lost speech signals when the estimated PLR is high. According to the estimated PLR, the APLR method then controlled the bitrates of speech coding for the RSS system. The effectiveness of the proposed APLR method was finally demonstrated by using an adaptive multi rate-narrowband (AMR-NB) speech codec and ITU-T Recommendation P.563 as the scalable speech codec and RSQA, respectively. It is shown from results that an RSS system employing the proposed APLR method significantly improves the speech quality under packet loss conditions [7].

Speech signals having lost packets are considered as input. The packets before / after the missing packet are extracted from the speech signal. The proposed work then aims to conceal this lost packet by two different methods WSOLA, GWSOLA and compare the quality of the recovered speech signal obtained by these methods.

APPLICATION OF WSOLA FOR PACKET LOSS CONCEALMENT

As we know, the standard WSOLA algorithm is designed to deal with voice signals of long time duration, unfortunately, in real time voice communications, this requirement is not always satisfied. The typical human voice is composed of a lot of separate voice waves called talk spurt, and if a packet loss occurs at the bottom of a talk spurt, the standard WSOLA algorithm will straightly extends the waveform before the lost frame to cover the gap of it, and this might lead to a mismatch of amplitude between the original waveform and the restored one. Usually, the amplitude of the bottom of a talk spurt is small, whereas the amplitude of the middle of a talk spurt is big, and if we restore the frame of small amplitude by a segment of waveform of big amplitude straightly, mismatch occurs. In this way, the bottom of some talk spurts in the restored waveform would have inappropriate big amplitude and a sharp decrease of amplitude after the restored frame, all of which are impairments to the quality of the restored waveform. To avoid the case above, our new algorithm introduces again into the standard WSOLA algorithm.

Because of transmitter independent and suitable for multicast, the GWSOLA algorithm can be applied in the packet loss concealment of real time voice communications, especially for

jitter buffer management of mobile VoIP in order to confront packet loss and packet delay. When one voice frame of the received signal is lost, the GWSOLA technique can applied to extend the time duration of several voice frames before the lost voice frame, in order to make them span across the gap of the lost voice frame.

CONCLUSION

From the above discussion, we can see that the standard WSOLA algorithm is suitable for packet loss concealment in real time voice communications. It extends the successfully received signals across the gaps of the lost frames, so that substitutes the lost voice frames by the newly restored ones, while the pitch frequency and timbre of the voice transmitted are maintained unchanged. The disadvantages of the standard WSOLA algorithm is lack of efficient amplitude controls, which may lead to significant mismatch between the original voice signal and the restored signal, and decrease the effect of packet loss concealment. By introducing a gain into the standard WSOLA algorithm, the problem of amplitude controls is resolved. We can conclude that the GWSOLA algorithm is more suitable for packet loss concealment than standard WSOLA algorithm. It reconstruct the gap caused by lost frame by extends the successfully received voice frames. The pitch frequency, timbre and level of the voice transmitted are maintained consistent.

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