Packet Loss Recovery in Media Specific FEC Audio Transmission by Least Square Method

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Abstract - This paper proposes a packet loss recovery technique in audio stream at a sender side. The adaptive error control in the Internet telephony system uses this packet recovery scheme based on the media specific Forward Error Correction (FEC). By adapting with the least square method used recovery algorithm with the best fitting curve of a reward value. This technique can estimate the trend of outcomes, and improve the adjustment of redundant packets of the recovery algorithm. The results of experiments show that the adaptive error control algorithm can decrease the packet loss rate.

Keywords: Internet telephony, packet loss recovery, least square method

1 Introduction

The current internet normally uses the best-effort service model. This cannot guarantee the quality of service (QoS). As a result the transmission of audio traffic over the internet is always affected by the packet loss problem. The FEC (Forward Error Correction) is one of the error recovery mechanisms that can reduce the effect of packet loss with the low latency [2]. FEC technique adds some redundancy that increases the usage bandwidth. The adaptive FEC-based algorithm which can set the quantity of audio redundancy based on the number of packet lost, therefore, is required. [4]

There are several proposed algorithms that can do this task. Some algorithms have to use a loss report forecast or estimate the reward parameters for the next interval time [2]. The least square method is very popular technique employed in computing estimation parameters and data curve fitting. This method can be used in part of increase or decrease combination number (pattern of redundant data in packet) for the adaptive FEC-based algorithm. In addition, the better forecasting can be performed because the result of this forecasting will be used in the optimization of the recovery mechanism.

The SES (single exponential smoothing) technique is a simple and pragmatic approach to forecasting, whereby the forecast is constructed from the exponentially weighted average of past observation [6]. If the packet loss prediction use bounded adaptive smoothing constant from the forecast loss rate in the next interval.

This paper studies the performance of the media specific FEC-based algorithm by increasing the number of combination data and comparing the performances. The adaptive FEC control algorithm developed in [5] is CNR (Centre for Network Research) algorithm is studied and the reward value of this algorithm is forecasted using the least square and exponential method. Process of quantitatively is estimated and the trend of the outcomes known as regression or curve fitting becomes necessary [1]. The develop mechanism attempts to eliminate or to minimize the impact of packet loss and end-to-end delay on the quality of the delivered audio to the destinations. The effect of the variability parameters that use in process of each algorithm for improve audio transmission in the future is employed.

2 Packet Recovery Algorithm by Least Square Method

2.1 CNR Algorithm

CNR algorithm [6] is a media specific FEC-based algorithm. This algorithm improved from Bolot [4] algorithm by increase the combination number of audio redundancy in each period. G.723.1 codec is the most widely-use in IP telephony system because it has low bit rate enough (6.3 kbps), this can reduce waste time from Bolot algorithm.

CNR algorithm requires RTP (Real-time Transport Protocol) for send audio data from the sender side and RTCP (Real-time Transport Control Protocol) use for report the loss rate (packet loss rate before and after the reconstruction) of the received data packet to the sender [3]. The redundant packet used for recovery the lost packets and the better combination of codec for higher the recovery rate. By used Bolot formulation to calculate a reward value of each combination data as equation.

\[
\text{reward} = \frac{\text{packet recovery rate before reconstruction}}{\text{packet recovery rate after reconstruction}}
\]  

(1)

RTCP packet is received in sender side, the reward value \( \frac{L_b}{L_d} \) of current combination \( R_c \) to calculate the loss information as follow.