

METHOD AND APPARATUS FOR ALLOCATING BITS OF AUDIO SIGNAL

[0001] This application claims priority to Chinese Patent Application No. 201210415253.6, filed with the Chinese Patent Office on October 26, 2012 and entitled
5 "METHOD AND APPARATUS FOR ALLOCATING BITS OF AUDIO SIGNAL", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of the present invention relate to the field of audio technologies, and more specifically, to a method and an apparatus for allocating bits of an audio signal.

BACKGROUND

10 [0003] At present, increasing attention is paid to quality of audio in communication transmission, so it is required that, during coding and decoding, music quality be improved as far as possible on a premise of ensured quality of voice. Because information of a music signal is abundant, a code-excited linear prediction (CELP) coding mode for conventional
15 voice cannot be used, and a transform coding method is usually used to process the music signal in a frequency domain, to improve coding quality of the music signal. However, it has now become a main subject of research on audio coding how to effectively use limited coding bits to encode information efficiently.

[0004] In current audio coding technologies, usually fast Fourier transform (FFT) or
20 modified discrete cosine transform (MDCT) is used to transform a time domain signal to a frequency domain signal, and then the frequency domain signal is encoded. Usually, in transform coding, band division is performed on frequency domain coefficients, a normalized energy of each band is obtained,

allocation is random and also relatively scattered, which causes a phenomenon of discontinuous quantization in a time domain.

SUMMARY

[0007] Embodiments of the present invention provide a method and an apparatus for allocating bits of an audio signal, which can resolve a problem of random and scattered allocation and discontinuous quantization in a time domain caused by an existing bit allocation method in a case of low and medium bit rates.

[0008] According to a first aspect, a method for allocating bits of an audio signal is provided and includes: dividing a frequency band of an audio signal into multiple sub-bands, and quantizing a sub-band normalization factor of each sub-band; classifying the multiple sub-bands into multiple groups, and acquiring a sum of intra-group sub-band normalization factors of each group, where the sum of intra-group sub-band normalization factors is a sum of sub-band normalization factors of all sub-bands in the group; performing initial inter-group bit allocation according to the sum of intra-group sub-band normalization factors of each group, to determine the initial number of bits of each group; performing secondary inter-group bit allocation based on the initial number of bits of each group, to allocate coding bits of the audio signal to at least one group, where a sum of bits allocated to the at least one group is the number of the coding bits of the audio signal; and allocating the bits of the audio signal that are allocated to the group to sub-bands in the group.

[0009] With reference to the first aspect, in a first implementation manner of the first aspect, the performing secondary inter-group bit allocation includes: performing the secondary inter-group bit allocation by using a saturation algorithm for bit allocation.

[0010] With reference to the first implementation manner of the first aspect, in a second implementation manner of the first aspect, the performing the secondary inter-group bit allocation by using a saturation algorithm for bit allocation includes: determining the number of saturation bits of each group; determining a bit-saturated group and the number of surplus bits in the bit-saturated group according to the number of saturation bits of each group and the initial number of bits of each group, where the number of surplus bits in the bit-saturated

CLAIMS

1. A method for allocating bits of an audio signal, comprising:

dividing a frequency band of an audio signal into multiple sub-bands, and quantizing a sub-band normalization factor of each sub-band;

5 classifying the multiple sub-bands into multiple groups, and acquiring a sum of intra-group sub-band normalization factors of each group, wherein the sum of intra-group sub-band normalization factors is a sum of sub-band normalization factors of all sub-bands in the group;

performing initial inter-group bit allocation according to the sum of intra-group sub-band normalization factors of each group, to determine the initial number of bits of each group;

performing secondary inter-group bit allocation based on the initial number of bits of each group, to allocate coding bits of the audio signal to at least one group, wherein a sum of bits allocated to the at least one group is the number of the coding bits of the audio signal; and

15 allocating the bits of the audio signal that are allocated to the group to sub-bands in the group.

2. The method according to claim 1, wherein the performing secondary inter-group bit allocation comprises:

performing the secondary inter-group bit allocation by using a saturation algorithm for bit allocation.

20 3. The method according to claim 2, wherein the performing the secondary inter-group bit allocation by using a saturation algorithm for bit allocation comprises:

determining the number of saturation bits of each group;

determining a bit-saturated group and the number of surplus bits in the bit-saturated group according to the number of saturation bits of each group and the initial number of bits of each group, wherein the number of surplus bits in the bit-saturated group is the number of bits by which the initial number of bits in the bit-saturated group is greater than the number of saturation bits in the bit-saturated group;

allocating the number of surplus bits to a non-bit-saturated group; wherein

the bit-saturated group is a group in which the initial number of bits is greater than the number of saturation bits, and the non-bit-saturated group is a group in which the initial number of bits is less than the number of saturation bits.

4. The method according to claim 3, wherein the allocating the number of surplus bits to
5 a non-bit-saturated group comprises:

allocating the number of surplus bits evenly to the non-bit-saturated group.

5. The method according to claim 2, wherein after the initial inter-group bit allocation and before the secondary inter-group bit allocation, the method further comprises:

determining, according to a difference between average values of intra-group sub-band
10 normalization factors and/or a bit rate, whether a saturation algorithm for bit allocation is to be used, wherein an average value of intra-group sub-band normalization factors is an average value of sub-band normalization factors of all sub-bands in a group; and

if a saturation algorithm for bit allocation is to be used, determining that a saturation algorithm for bit allocation is to be used, and

15 if a saturation algorithm for bit allocation is not to be used, determining that a weighting algorithm is to be used.

6. The method according to claim 1, wherein the performing secondary inter-group bit allocation comprises:

performing the secondary inter-group bit allocation by using a weighting algorithm.

20 7. The method according to claim 6, wherein the performing the secondary inter-group bit allocation by using a weighting algorithm comprises:

weighting the sum of intra-group sub-band normalization factors of each group, to obtain a weighted sum of intra-group sub-band normalization factors of each group; and

25 performing the secondary inter-group bit allocation on the initial number of bits according to the weighted sum of intra-group sub-band normalization factors of each group.

8. The method according to claim 1, wherein the allocating the bits of the audio signal that are allocated to the group to sub-bands in the group comprises:

weighting the sub-band normalization factors to obtain weighted sub-band normalization factors; and

30 allocating the bits of the audio signal that are allocated to the group to some or all of the

sub-bands in the group according to the weighted sub-band normalization factors, wherein the some of the sub-bands are selected from all the sub-bands in the group in descending order according to the weighted sub-band normalization factors.

5 9. The method according to claim 1, wherein the classifying the multiple sub-bands into multiple groups comprises:

classifying sub-bands with a same bandwidth into one group, so that the multiple sub-bands are classified into multiple groups; or

classifying sub-bands with close sub-band normalization factors into one group, so that the multiple sub-bands are classified into multiple groups.

10 10. The method according to claim 9, wherein sub-bands in each group have a same bandwidth or specifically close sub-band normalization factors.

11. An apparatus for allocating bits of an audio signal, comprising:

a sub-band quantizing unit, configured to divide a frequency band of an audio signal into multiple sub-bands, and quantize a sub-band normalization factor of each sub-band;

15 a grouping unit, configured to classify the multiple sub-bands into multiple groups, and acquire a sum of intra-group sub-band normalization factors of each group, wherein the sum of intra-group sub-band normalization factors is a sum of sub-band normalization factors of all sub-bands in the group;

20 a first allocating unit, configured to perform initial inter-group bit allocation according to the sum of intra-group sub-band normalization factors of each group, to determine the initial number of bits of each group;

25 a second allocating unit, configured to perform secondary inter-group bit allocation based on the initial number of bits of each group, to allocate coding bits of the audio signal to at least one group, wherein a sum of bits allocated to the at least one group is the number of the coding bits of the audio signal; and

a third allocating unit, configured to allocate the bits of the audio signal that are allocated to the group to sub-bands in the group.

12. The apparatus according to claim 11, wherein the second allocating unit is specifically configured to:

30 perform the secondary inter-group bit allocation by using a saturation algorithm for bit

allocation.

13. The apparatus according to claim 12, wherein the second allocating unit comprises:

a first determining module, configured to determine the number of saturation bits of each group;

5 a second determining module, configured to determine a bit-saturated group and the number of surplus bits in the bit-saturated group according to the number of saturation bits of each group and the initial number of bits of each group, wherein the number of surplus bits in the bit-saturated group is the number of bits by which the initial number of bits in the bit-saturated group is greater than the number of saturation bits in the bit-saturated group; and

10 an allocating module, configured to allocate the number of surplus bits to a non-bit-saturated group; wherein

the bit-saturated group is a group in which the initial number of bits is greater than the number of saturation bits, and the non-bit-saturated group is a group in which the initial number of bits is less than the number of saturation bits.

15 14. The apparatus according to claim 13, wherein the allocating module is specifically configured to:

allocate the number of surplus bits evenly to the non-bit-saturated group.

15. The apparatus according to claim 12, further comprising: a determining unit, configured to: after the initial inter-group bit allocation and before the secondary inter-group
20 bit allocation, determine, according to a difference between average values of intra-group sub-band normalization factors and/or a bit rate, whether a saturation algorithm for bit allocation is to be used, wherein an average value of intra-group sub-band normalization factors is an average value of sub-band normalization factors of all sub-bands in a group; and

25 if a saturation algorithm for bit allocation is to be used, determine that a saturation algorithm for bit allocation is to be used, and

if a saturation algorithm for bit allocation is not to be used, determine that a weighting algorithm is to be used.

16. The apparatus according to claim 11, wherein the second allocating unit is further configured to:

30 perform the secondary inter-group bit allocation by using a weighting algorithm.

17. The apparatus according to claim 16, wherein the second allocating unit further comprises: a weighting module, configured to weight the sum of intra-group sub-band normalization factors of each group, to obtain a weighted sum of intra-group sub-band normalization factors of each group; and

5 the allocating module is configured to perform the secondary inter-group bit allocation on the initial number of bits according to the weighted sum of intra-group sub-band normalization factors of each group.

18. The apparatus according to claim 11, wherein the third allocating unit comprises:

10 a weighting module, configured to weight the sub-band normalization factors to obtain weighted sub-band normalization factors; and

 an allocating module, configured to allocate the bits of the audio signal that are allocated to the group to some or all of the sub-bands in the group according to the weighted sub-band normalization factors, wherein the some of the sub-bands are selected from all the sub-bands in the group in descending order according to the weighted sub-band normalization factors.

15 19. The apparatus according to claim 11, wherein the grouping unit is specifically configured to:

 classify sub-bands with a same bandwidth into one group, so that the multiple sub-bands are classified into multiple groups; or

20 classify sub-bands with close sub-band normalization factors into one group, so that the multiple sub-bands are classified into multiple groups.

20. The apparatus according to claim 19, wherein sub-bands in each group have a same bandwidth or specifically close sub-band normalization factors.