CLAIMS

What is claimed is:

1. A method of encoding a time-domain audio signal, the method comprising:

at an electronic device, receiving the time-domain audio signal comprising at least one audio channel;

transforming the time-domain audio signal into a frequency-domain signal comprising a sequence of sample blocks for each of the at least one audio channel, wherein each sample block comprises a coefficient for each of a plurality of frequencies;

grouping the coefficients of each sample block into frequency bands;

for each frequency band of each sample block, determining a scale factor for the frequency band;

for each frequency band of each sample block, determining an energy of the frequency band;

for each frequency band of each sample block, comparing the energy of the frequency band for the sample block with the energy of the frequency band of an adjacent sample block;

for each frequency band of each sample block, increasing the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a predetermined value;

for each frequency band of each sample block, quantizing the coefficients of the frequency band based on the scale factor for the frequency band; and

generating an encoded audio signal based on the quantized coefficients and the scale factors.

2. The method of claim 1, wherein:

generating the encoded signal comprises encoding the quantized coefficients, wherein the encoded audio signal is based on the encoded coefficients and the scale factors.

3. The method of claim 1, wherein:

transforming the time-domain audio signal into the frequency-domain signal comprises performing a modified discrete cosine transform function on the time-domain audio signal.

4. The method of claim 1, wherein determining the energy of the frequency band comprises:

calculating an absolute sum of each of the coefficients of the frequency band of the sample block.

5. The method of claim 1, wherein:

the adjacent sample block of a first sample block comprises the sample block of the same audio channel as the first sample block that immediately precedes the first sample block in time.

6. The method of claim 5, wherein:

a time period represented by the adjacent sample block overlaps a time period represented by the first sample block.

7. The method of claim 1, wherein:

the adjacent sample block of a first sample block comprises a sample block of a different audio channel identified with the same time period associated with the first sample block.

8. The method of claim 7, further comprising:

for each frequency band of each sample block, comparing the energy of the frequency band for the sample block with the energy of the frequency band of a second adjacent sample block; and

for each frequency band of each sample block, increasing the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the second adjacent sample block is less than the predetermined value;

wherein the second adjacent sample block of a first sample block comprises a sample block of a second different audio channel identified with the same time period associated with the first sample block.

9. The method of claim 1, further comprising:

for each frequency band of each sample block, increasing the scale factor for the frequency band for the sample block if the ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a second predetermined value, wherein the second predetermined value is less than the first predetermined value, and wherein the increase in the scale factor involved with the second predetermined value is greater than the increase in the scale factor involved with the first predetermined value.

10. A method of adjusting a scale factor for a frequency band of a frequency-domain audio signal for producing a quantized output signal, the frequency-domain signal comprising a sequence of sample blocks for each of at least one audio channel, each sample block comprising a coefficient for each of multiple frequencies within the frequency band, the method comprising:

for each sample block, determining an energy of the frequency band;

for each sample block, comparing the energy of the frequency band of the sample block with the energy of the frequency band of an adjacent sample block; and

for each sample block, increasing the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a predetermined value;

wherein quantization of the frequency coefficients is based on the scale factor.

11. The method of claim 10, wherein:

the coefficients comprise coefficients of a modified discrete cosine transform.

12. The method of claim 10, wherein determining the energy of the frequency band comprises:

calculating an absolute sum of the coefficients of the frequency band of the sample block.

13. The method of claim 10, wherein:

the adjacent sample block of a first sample block comprises the immediately-preceding sample block of the same audio channel as the first sample block.

14. The method of claim 10, wherein:

the adjacent sample block of a first sample block comprises a sample block of a different audio channel identified with the same time period as the first sample block.

15. An electronic device, comprising:

data storage configured to store a time-domain audio signal; and

control circuitry configured to:

retrieve the time-domain audio signal from the data storage, wherein the time-domain audio signal comprises at least one audio channel;

transform the time-domain audio signal into a frequency-domain signal comprising a sequence of sample blocks for each of at least one audio channel, wherein each sample block comprises a coefficient for each of multiple frequencies;

organize the coefficients of each sample block into frequency bands;

for each frequency band of each sample block, estimate a scale factor for the frequency band;

for each frequency band of each sample block, determine an energy of the frequency band;

for each frequency band of each sample block, compare the energy of the frequency band for the sample block with the energy of the frequency band of an adjacent sample block;

for each frequency band of each sample block, increase the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a predetermined value;

for each frequency band of each sample block, quantize the coefficients of the frequency band based on the scale factor for the frequency band; and

generate an encoded audio signal based on the quantized coefficients and the scale factors.

16. The electronic device of claim 15, wherein, to determine the energy of the frequency band, the control circuitry is configured to:

sum the absolute value of each of the coefficients of the frequency band of the sample block.

17. The electronic device of claim 15, wherein:

the adjacent sample block of a first sample block comprises the sample block of the same audio channel as the first sample block that immediately precedes the first sample block.

18. The electronic device of claim 15, wherein:

the adjacent sample block of a first sample block comprises a sample block of a different audio channel representing the same time period as the first sample block.

19. The electronic device of claim 15, wherein the control circuitry is configured to:

for each frequency band of each sample block, compare the energy of the frequency band for the sample block with the energy of the frequency band of a second adjacent sample block; and

for each frequency band of each sample block, increase the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the second adjacent sample block is less than the predetermined value;

wherein the second adjacent sample block of a first sample block comprises a sample block of a second different audio channel representing the same time period as the first sample block.

20. The electronic device of claim 15, wherein the control circuitry is configured to:

for each frequency band of each sample block, increase the scale factor for the frequency band for the sample block if the ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a second predetermined value, wherein the second predetermined value is less than the first predetermined value, and wherein the increase in the scale factor involved with the second predetermined value is greater than the increase in the scale factor involved with the first predetermined value.

CLAIMS

1. A method of encoding a time-domain audio signal, the method comprising: at an electronic device, receiving the time-domain audio signal comprising at least one audio channel;

transforming (204) the time-domain audio signal into a frequency-domain signal comprising a sequence of sample blocks for each of the at least one audio channel, wherein each sample block comprises a coefficient for each of a plurality of frequencies;

grouping (206) the coefficients of each sample block into frequency bands;

for each frequency band of each sample block, determining (210) a scale factor for the frequency band;

for each frequency band of each sample block, determining (212) an energy of the frequency band;

for each frequency band of each sample block, comparing (214) the energy of the frequency band for the sample block with the energy of the frequency band of an adjacent sample block;

for each frequency band of each sample block, increasing (216) the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a predetermined value;

for each frequency band of each sample block, quantizing (218) the coefficients of the frequency band based on the scale factor for the frequency band; and

generating (220) an encoded audio signal based on the quantized coefficients and the scale factors.

2. The method of claim 1, wherein:

generating the encoded signal comprises encoding the quantized coefficients, wherein the encoded audio signal is based on the encoded coefficients and the scale factors.

3. The method of claim 1, wherein:

transforming the time-domain audio signal into the frequency-domain signal comprises performing a modified discrete cosine transform function on the time- domain audio signal.

4. The method of claim 1, wherein determining the energy of the frequency band comprises calculating an absolute sum of each of the coefficients of the frequency band of the sample block.

5. The method of claim 1, wherein the adjacent sample block of a first sample block comprises the sample block of the same audio channel as the first sample block that immediately precedes the first sample block in time.

6. The method of claim 5, wherein a time period represented by the adjacent sample block overlaps a time period represented by the first sample block.

7. The method of claim 1, wherein the adjacent sample block of a first sample block comprises a sample block of a different audio channel identified with the same time period associated with the first sample block.

8. The method of claim 7, comprising:

for each frequency band of each sample block, comparing the energy of the frequency band for the sample block with the energy of the frequency band of a second adjacent sample block; and

for each frequency band of each sample block, increasing the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the second adjacent sample block is less than the predetermined value;

wherein the second adjacent sample block of a first sample block comprises a sample block of a second different audio channel identified with the same time period associated with the first sample block.

9. The method of claim 1, further comprising:

for each frequency band of each sample block, increasing the scale factor for the frequency band for the sample block if the ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a second predetermined value, wherein the second predetermined value is less than the first predetermined value, and wherein the increase in the scale factor involved with the second predetermined value is greater than the increase in the scale factor involved with the first predetermined value.

10. An electronic device, comprising:

data storage (304) configured to store a time-domain audio signal (310); and

control circuitry (302) configured to:

retrieve the time-domain audio signal (310) from the data storage (304), wherein the time-domain audio signal comprises at least one audio channel;

transform the time-domain audio signal into a frequency-domain signal comprising a sequence of sample blocks for each of at least one audio channel, wherein each sample block comprises a coefficient for each of multiple frequencies;

organize the coefficients of each sample block into frequency bands; for each frequency band of each sample block, estimate a scale factor for the frequency band;

for each frequency band of each sample block, determine an energy of the frequency, band;

for each frequency band of each sample block, compare the energy of the frequency band for the sample block with the energy of the frequency band of an adjacent sample block;

for each frequency band of each sample block, increase the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a predetermined value;

for each frequency band of each sample block, quantize the coefficients of the frequency band based on the scale factor for the frequency band; and

generate an encoded audio signal based (320) on the quantized coefficients and the scale factors.

11. The electronic device of claim 10, wherein, to determine the energy of the frequency band, the control circuitry is configured to: sum the absolute value of each of the coefficients of the frequency band of the sample block.

12. The electronic device of claim 10, wherein:

the adjacent sample block of a first sample block comprises the sample block of the same audio channel as the first sample block that immediately precedes the first sample block.

13. The electronic device of claim 10, wherein:

the adjacent sample block of a first sample block comprises a sample block of a different audio channel representing the same time period as the first sample block.

14. The electronic device of claim 10, wherein the control circuitry is configured to:

for each frequency band of each sample block, compare the energy of the frequency band for the sample block with the energy of the frequency band of a second adjacent sample block; and

for each frequency band of each sample block, increase the scale factor for the frequency band for the sample block if a ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the second adjacent sample block is less than the predetermined value;

wherein the second adjacent sample block of a first sample block comprises a sample block of a second different audio channel representing the same time period as the first sample block.

15. The electronic device of claim 10, wherein the control circuitry is configured to:

for each frequency band of each sample block, increase the scale factor for the frequency band for the sample block if the ratio of the energy of the frequency band of the sample block to the energy of the frequency band of the adjacent sample block is less than a second predetermined value,

wherein the second predetermined value is less than the first predetermined value, and wherein the increase in the scale factor involved with the second predetermined value is greater than the increase in the scale factor involved with the first predetermined value.