CLAIMS

1. An automatic volume adjustment method, comprising:

acquiring, in a case that a terminal does not output loudspeaker sound, a noise signal outside the terminal;

determining noise energy based on the noise signal; and

adjusting playback volume of audio or video on the terminal based on the noise energy;

wherein the determining the noise energy based on the noise signal comprises:

performing smoothing processing on signal energy of previous N frames of signal in the noise signal respectively, to obtain smoothed energy of the previous N frames of signal; wherein the previous N frames of signal are N frames of signal before the last acquired frame of signal in the noise signal, and N is a positive integer greater than or equal to 1;

performing smoothing processing on signal energy of the last acquired frame of signal based on the smoothed energy of the previous N frames of signal and the signal energy of the last acquired frame of signal, to obtain smoothed energy of the last acquired frame of signal;

determining the smoothed energy of the last acquired frame of signal as the noise energy; or, comparing the smoothed energy of the last acquired frame of signal with previously updated noise energy, and updating the previously updated noise energy based on a comparison result to obtain updated noise energy.

2. The method according to claim 1, wherein the updating the previously updated noise energy based on the comparison result comprises:

in a case that the smoothed energy of the last acquired frame of signal is less than the previously updated noise energy, updating the previously updated noise energy by the following formula:

$$N_{\text{updated noise energy}} = (a * E_smoothed(t) + b * N_{\text{previously updated noise energy}}) * c$$

in a case that the smoothed energy of the last acquired frame of signal is greater than the previously updated noise energy, updating the previously updated noise energy by the following formula:

$$N_{\text{updated noise energy}} = N_{\text{previously updated noise energy}} * d$$

wherein $N_{\text{updated noise energy}}$ represents the updated noise energy; E_smoothed(t) represents the smoothed energy of the last acquired frame of signal; $N_{\text{previously updated noise energy}}$ represents the previously updated noise energy; a, b, c, and d are coefficients; and t represents time.

3. The method according to claim 1 or 2, wherein the adjusting the playback volume of the audio or the video on the terminal based on the noise energy comprises:

determining target volume corresponding to the noise energy by using a preset correspondence table; and

determining the playback volume of the audio or the video based on the target volume.

4. The method according to any one of claims 1-3, wherein the adjusting the playback volume of the audio or the video on the terminal based on the noise energy comprises:

calculating target volume corresponding to the noise energy by using a preset functional relationship, wherein the target volume and the noise energy satisfy the preset functional relationship; and

determining the playback volume of the audio or the video based on the target volume.

5. The method according to any one of claims 1-4, wherein the acquiring, in the case that the terminal does not output loudspeaker sound, the noise signal outside the terminal comprises:

acquiring the noise signal outside the terminal during an interval of switching the audio or the video.

6. An automatic volume adjustment apparatus, comprising:

a noise signal acquiring module, configured to acquire, in a case that a terminal does not output loudspeaker sound, a noise signal outside the terminal;

a noise energy determining module, configured to determine noise energy based on the noise signal; and

a volume adjusting module, configured to adjust playback volume of audio or video based on the noise energy;

wherein the noise energy determining module is configured to:

perform smoothing processing on signal energy of previous N frames of signal in the noise signal respectively, to obtain smoothed energy of the previous N frames of signal; wherein the previous N frames of signal are N frames of signal before the last acquired frame of signal in the noise signal, and N is a positive integer greater than or equal to 1;

perform smoothing processing on signal energy of the last acquired frame of signal based on the smoothed energy of the previous N frames of signal and the signal energy of the last acquired frame of signal, to obtain smoothed energy of the last acquired frame of signal;

determine the smoothed energy of the last acquired frame of signal as the noise energy; or, compare the smoothed energy of the last acquired frame of signal with previously updated noise energy, and update the previously updated noise energy based on a comparison result to obtain updated noise energy.

7. The automatic volume adjustment apparatus according to claim 6, wherein the noise energy determining module is further configured to:

in a case that the smoothed energy of the last acquired frame of signal is less than the previously updated noise energy, update the previously updated noise energy by the following formula:

$$N_{\text{updated noise energy}} = (a * E_smoothed(t) + b * N_{\text{previously updated noise energy}}) * c$$

in a case that the smoothed energy of the last acquired frame of signal is greater than the previously updated noise energy, update the previously updated noise energy by the following formula:

$$N_{\text{updated noise energy}} = N_{\text{previously updated noise energy}} * d$$

wherein $N_{\text{updated noise energy}}$ represents the updated noise energy; E_smoothed(t) represents the smoothed energy of the last acquired frame of signal; $N_{\text{previously updated noise energy}}$ represents the previously updated noise energy; a, b, c, and d are coefficients; and t represents time.

8. The automatic volume adjustment apparatus according to claim 6 or 7, wherein the volume adjusting module is configured to:

determine target volume corresponding to the noise energy by using a preset correspondence table; and

determine the playback volume of the audio or the video based on the target volume.

9. The automatic volume adjustment apparatus according to any one of claims 6-8, wherein the volume adjusting module is configured to:

calculate target volume corresponding to the noise energy by using a preset functional relationship, wherein the target volume and the noise energy satisfy the preset functional relationship; and

determine the playback volume of the audio or the video based on the target volume.

10. The automatic volume adjustment apparatus according to any one of claims 6-9, wherein the noise signal acquiring module is configured to:

acquire the noise signal outside the terminal during an interval of switching the audio or the video.

11. A computer-readable medium, on which a computer program is stored, wherein when the computer program is executed by a processing apparatus, the steps of the method according to any one of claims 1-5 are implemented.

12. An electronic device, comprising:

a storage apparatus, on which a computer program is stored;

a processing apparatus, configured to execute a computer program in the storage apparatus to implement the steps of the method according to any one of claims 1-5.

13. A computer program product, comprising a computer program carried on a computer-readable medium, wherein when the computer program is executed by a processor, the steps of the method according to any one of claims 1-5 is implemented.