CLAIMS

What is claimed is:

1. A system of motion detection and correction of a medical image, comprising:

a management platform providing a user interface to submit instructions for performing optimization processing on a medical image of a target organ, wherein said medical image corresponds to list mode data; and

an optimization device performing said optimization processing of said medical image in accordance with said instructions, wherein said optimization processing comprises:

segmenting said list mode data corresponding to said medical image into a plurality of frames having a fixed time dimension, and imaging each said frame as a multi-frame image;

labeling a volume of interest in each said frame image to encompass said target organ;

calculating a motion curve of said target organ based on said volume of interest of each said frame image;

reconstructing said medical image based on said motion curve; and

displaying said reconstructed medical image on said user interface,

wherein calculating the motion curve of said target organ based on said volume of interest of each said frame image comprises:

dividing said volume of interest into a first sub-volume of interest and a second sub-volume of interest;

extracting three-dimensional coordinates of a first center of mass of said first sub-volume of interest and a second center of mass of said second sub-volume of interest, respectively, to be used as descriptive values of said frame images;

down dimensionalizing said descriptive values of each said frame image by principal component analysis, and using a largest feature of said descriptive values after

down dimensionalizing as a movement and/or rotation signal of said target organ; and

grouping and filtering each said frame image based on each said movement and/or rotation signal to calculate said motion curve.

2. The system of claim 1, wherein said optimization device comprises a deep learning module, and labeling the volume of interest in each of said frame images comprises:

recognizing a binary segmented volume containing said target organ in each said frame image by said deep learning module;

blurring each said binary segmented volume by said deep learning module to generate a soft mask;

applying each said soft mask to each said frame image by said deep learning module;

fitting said target organ in each said frame image with an initial elliptical sphere based on each said soft mask by said deep learning module; and

expanding each said initial elliptical sphere by a predetermined distance outwardly from a radius thereof by said deep learning module to generate an elliptical sphere representing said volume of interest.

3. The system of claim 1, wherein said target organ is a heart, and said dividing said volume of interest into a first sub-volume of interest and a second sub-volume of interest is along a long axis of said heart in a short-axis direction.

4. The system of claim 1, wherein said motion curve is plotted relative to any one of a head-tail axis, a left-right axis, and a ventral-dorsal axis of a human body, and reconstructing said medical image based on said motion curve comprises:

selecting a reference object from each said frame image;

performing motion compensation of each said frame image using said motion curve as a reference, wherein said motion compensation comprises:

performing an adjustment operation of all pixels contained in each said frame image

other than said reference object in any one of said head-tail axis, said left-right axis, and said ventral-dorsal axis according to three-dimensional coordinates thereof with respect to said reference object; and

repeating said adjustment operation of each said frame image until correlation coefficient between integration of each said frame image after said adjustment operation and said reference object reaching a maximum value; and

integrating each said frame image after said motion compensation to reconstruct said medical image.

5. The system of claim 1, further comprising:

after calculating the motion curve of said target organ based on each said center of mass, and each said volume of interest of each said frame image does not accurately correspond to said motion curve, said optimization device performing said optimization processing alternatively comprising performing gating of each said frame image, wherein said gating is used to assemble a predetermined number of gated set images with similar time and/or positional relationships among said frame images, and said time and/or positional relationships are defined by cyclic phases of human respiration and/or heartbeat.

6. The system of claim 5, wherein said motion curve is plotted relative to any one of a head-tail axis, a left-right axis, and a ventral-dorsal axis of a human body, and reconstructing said medical image based on said motion curve comprises:

selecting a reference object from each said gated set image;

performing motion compensation of each said gated set image using said motion curve as a reference, wherein said motion compensation of each said gated set image comprises:

performing an adjustment operation of all pixels contained in each said gated set image other than said reference object in any one of said head-tail axis, said left-right axis, and said ventral-dorsal axis according to three-dimensional coordinates thereof with respect to said reference object; and

repeating said adjustment operation of each said gated set image until correlation coefficient between integration of each said gated set image after said adjustment operation and said reference object reaching a maximum value; and

integrating each said gated set image after said motion compensation to reconstruct said medical image.

7. The system of claim 1, wherein said fixed time dimension is measured in units of 100 milliseconds to 500 milliseconds.

8. The system of claim 1, further comprising:

a scanning device photographing said target organ to obtain said medical image, wherein said scanning device is selected from a group consisting of a single photon emission computed tomography device, a positron emission tomography device, a magnetic resonance imaging device, and a computed tomography device or a combination thereof;

a medical image storage and transmission system storing said medical image and said medical image as reconstructed; and

an in-office reporting computer accessing or displaying said medical image and said medical image as reconstructed.

9. A method of motion detection and correction of a medical image, comprising:

obtaining a medical image of a target organ, wherein said medical image corresponds to list mode data;

segmenting said list mode data corresponding to said medical image into a plurality of frames having a fixed time dimension, and imaging each said frame as a multi-frame image;

labeling a volume of interest in each said frame image to encompass said target organ;

calculating a motion curve of said target organ based on said volume of interest of each said frame image; and

reconstructing said medical image based on said motion curve,

wherein calculating the motion curve of said target organ based on said volume of

interest of each said frame image comprises:

dividing said volume of interest into a first sub-volume of interest and a second sub-volume of interest;

extracting three-dimensional coordinates of a first center of mass of said first sub-volume of interest and a second center of mass of said second sub-volume of interest, respectively, to be used as descriptive values of said frame images;

down dimensionalizing said descriptive values of each said frame image by principal component analysis, and using a largest feature of said descriptive values after down dimensionalizing as a movement and/or rotation signal of said target organ; and

grouping and filtering each said frame image based on each said movement and/or rotation signal to calculate said motion curve.

10. The method of claim 9, wherein labeling said volume of interest in each said frame image to encompass said target organ comprises:

recognizing a binary segmented volume containing said target organ in each said frame image by a deep learning module;

blurring each said binary segmented volume by said deep learning module to generate a soft mask;

applying each said soft mask to each said frame image by said deep learning module;

fitting said target organ in each said frame image with an initial elliptical sphere based on each said soft mask by said deep learning module; and

expanding each said initial elliptical sphere by a predetermined distance outwardly from a radius thereof by said deep learning module to generate an elliptical sphere representing said volume of interest.

11. The method of claim 9, wherein said target organ is a heart, and said dividing said volume of interest into a first sub-volume of interest and a second sub-volume of interest is along a

long axis of said heart in a short-axis direction.

12. The method of claim 9, wherein said motion curve is plotted relative to any one of a head-tail axis, a left-right axis, and a ventral-dorsal axis of a human body, and reconstructing said medical image based on said motion curve comprises:

selecting a reference object from each said frame image;

performing motion compensation of each said frame image using said motion curve as a reference, wherein said motion compensation comprises:

performing an adjustment operation of all pixels contained in each said frame image other than said reference object in any one of said head-tail axis, said left-right axis, and said ventral-dorsal axis according to three-dimensional coordinates thereof with respect to said reference object; and

repeating said adjustment operation of each said frame image until correlation coefficient between integration of each said frame image after said adjustment operation and said reference object reaching a maximum value; and

integrating each said frame image after said motion compensation to reconstruct said medical image.

13. The method of claim 9, wherein after calculating the motion curve of said target organ based on each said center of mass, and each said volume of interest of each said frame image does not accurately correspond to said motion curve, gating of each said frame image is performed, wherein said gating is used to assemble a predetermined number of gated set images with similar time and/or positional relationships among said frame images, and said time and/or positional relationships are defined by cyclic phases of human respiration and/or heartbeat.

14. The method of claim 13, wherein said motion curve is plotted relative to any one of a head-tail axis, a left-right axis, and a ventral-dorsal axis of a human body, and reconstructing said medical image based on said motion curve comprises:

selecting a reference object from each said gated set image;

performing motion compensation of each said gated set image using said motion curve as a reference, wherein said motion compensation of each said gated set image comprises:

performing an adjustment operation of all pixels contained in each said gated set image other than said reference object in any one of said head-tail axis, said left-right axis, and said ventral-dorsal axis according to three-dimensional coordinates thereof with respect to said reference object; and

repeating said adjustment operation of each said gated set image until correlation coefficient between integration of each said gated set image after said adjustment operation and said reference object reaching a maximum value; and

integrating each said gated set image after said motion compensation to reconstruct said medical image.

15. The method of claim 9, wherein said medical image is obtained by photographing said target organ by a scanning device, and said scanning device is selected from a group consisting of a single photon emission computed tomography device, a positron emission tomography device, a magnetic resonance imaging device, and a computed tomography device or a combination thereof.

16. The method of claim 9, wherein said fixed time dimension is measured in units of 100 milliseconds to 500 milliseconds.

17. A computer-readable storage medium applied in a computer and having instructions to perform the method of motion detection and correction of said medical image as claimed in any one of claims 9 to 16.