CLAIMS:

1. A method for reconstructing an object model from a data set obtained from a physical process, wherein the data set contains noise, the method comprising:

receiving the data set defined in a data space;

constructing an object model in an object space wherein the object model comprises a plurality of object points;

devising a transformation of the object model from object space to data space resulting in a data model, wherein the transformation corresponds to the physical process by which the data set is obtained;

selecting a merit function for determining a fit of a data model to the data set;

determining an updating variable of the object model in object space based upon the merit function;

smoothing the updating variable to determine a smoothed updating variable by:

convolving the updating variable with each of a plurality of pixon kernels; and

selecting for each object point of the input object a pixon kernel having a largest size that meets a predetermined minimum criteria;

generating a pixon map by assigning indices at each object point corresponding to the selected pixon kernel; and

generating an output comprising a substantially denoised object model based on the indices within the pixon map.

2. The method of claim 1, further comprising smoothing the object model by convolving the object model at each object point with the selected pixon kernel according to the pixon map.

3. The method of claim 1, wherein the merit function is determined using a conjugate gradient method.

4. The method of claim 3, wherein the updating variable is a negradient.

5. The method of claim 3, further comprising adding a preconditioner.

6. The method of claim 1, further comprising:

iteratively smoothing the updating variable and updating the pixon map and the object model based upon the smoothed updating variable until the merit function is optimized.

7. The method of claim 1, further comprising, after the step of convolving the updating variable, subtracting the updating variable to determine an updating variable change.

8. The method of claim 7, wherein the predetermined minimum criteria is based on the ratio between the square of the updating variable change and a variance of the updating variable.

9. The method of claim 1, wherein the data set comprises interferometric data generated in conjunction with an analysis process selected from the group consisting of aperture synthesis, interferometric synthetic aperture radar (IfSAR or InSAR), synthetic aperture radar (SAR) and inverse synthetic aperture radar (ISAR), synthetic aperture sonar, beamforming, and synthetic aperture magnetometry.

10. The method of claim 1, wherein the data set comprises magnetic resonant imaging data.

11. The method of claim 1, wherein the data set comprises computed or emission tomography data.

12. The method of claim 1, wherein the data set comprises spectral analysis data.

13. The method of claim 1, wherein the data set comprises a plurality of input signals from different instruments, and the denoised object model comprises a single output corresponding to a mixture of the input signals.

14. A non-transitory computer readable medium having included software thereon, the software including instructions for reconstructing an object model from a data set obtained from a physical process, wherein the data set contains noise, the method comprising:

receiving the data set defined in a data space;

constructing an object model in an object space wherein the object model comprises a plurality of object points;

devising a transformation of the object model from object space to data space resulting in a data model, wherein the transformation corresponds to the physical process by which the data set is obtained;

selecting a merit function for determining a fit of a data model to the data set;

determining an updating variable of the object model in object space based upon the merit function;

smoothing the updating variable to determine a smoothed updating variable by:

convolving the updating variable with each of a plurality of pixon kernels; and

selecting for each object point of the input object a pixon kernel having a largest size that meets a predetermined minimum criteria; and

generating a pixon map by assigning indices at each object point of the input object corresponding to the selected pixon kernel.

15. The non-transitory computer readable medium of claim 14, further comprising smoothing the object model by convolving the object model at each object point with the selected pixon kernel according to the pixon map.

16. The non-transitory computer readable medium of claim 14, wherein the merit function is optimized using a conjugate gradient method.

17. The non-transitory computer readable medium of claim 16, wherein the updating variable is a negradient.

18. The non-transitory computer readable medium of claim 17, further comprising adding a preconditioner.

19. The non-transitory computer readable medium of claim 14, further comprising:

iteratively smoothing the updating variable and updating the pixon map and object model based upon the iteratively smoothed updating variable until the merit function is optimized.

20. The non-transitory computer readable medium of claim 19, further comprising, after the step of convolving the updating variable, subtracting the updating variable to determine an updating variable change.

21. The non-transitory computer readable medium of claim 20, wherein the predetermined minimum criteria is based on the ratio between the square of the updating variable change and a variance of the updating variable.

CLAIMS:

1. A method for reconstructing an object model from a data set containing noise, the method comprising:

receiving within a processor the data set defined in a data space, wherein the processor is operable for:

constructing an object model in an object space wherein the object model comprises a plurality of object points;

devising a transformation of the object model from object space to data space resulting in a data model, such transformation corresponding to the physical process by which the data are actually obtained;

selecting a merit function for determining a fit of a data model to the data set;

determining an updating variable of the object model in object space based upon the merit function;

smoothing the updating variable to determine a smoothed updating variable by:

convolving the updating variable with each of a plurality of pixon kernels; and

selecting for each object point of the input object a pixon kernel having a largest size that meets a predetermined minimum criteria;

generating a pixon map by assigning indices at each object point of the input object corresponding to the selected pixon kernel; and

generating an output comprising a substantially denoised object model based on the indices within the pixon map.

2. The method of claim 1, wherein the processor is further operable for smoothing the object model by convolving the object model at each object point with the selected pixon kernel according to the pixon map.

3. The method of claim 1, wherein the merit function is determined using a conjugate gradient method.

4. The method of claim 3, wherein the updating variable is a negradient.

5. The method of claim 3, wherein the processor is further operable for adding a preconditioner.

6. The method of claim 1, wherein the processor is further operable for:

iteratively smoothing the updating variable and updating the pixon map based upon the iteratively smoothed updating variable until the merit function is optimized.

7. The method of claim 1, wherein the processor is further operable for, after the step of convolving the updating variable, subtracting the updating variable to determine an updating variable change.

8. The method of claim 7, wherein the predetermined minimum criteria is based on the ratio between the square of the updating variable change and a variance of the updating variable.

9. The method of claim 1, wherein the data set comprises interferometric data generated in conjunction with an analysis process selected from the group consisting of aperture synthesis, interferometric synthetic aperture radar (IfSAR or InSAR), synthetic aperture radar (SAR) and inverse synthetic aperture radar (ISAR), synthetic aperture sonar, beamforming, and synthetic aperture magnetometry.

10. The method of claim 1, wherein the data set comprises magnetic resonant imaging data.

11. The method of claim 1, wherein the data set comprises computed or emission tomography data.

12. The method of claim 1, wherein the data set comprises spectral analysis data.

13. The method of claim 1, wherein the data set comprises a plurality of input signals from different instruments, and the denoised object model comprises a single output corresponding to a mixture of the input signals.

14. A non-transitory computer readable medium having included software thereon, the software including instructions for reconstructing an input signal from a data set containing noise, the instructions comprising:

receiving the data set defined in a data space;

constructing an object model in an object space wherein the object model comprises a plurality of object points;

devising a transformation of the object model from object space to data space resulting in a data model, such transformation corresponding to the physical process by which the data are actually obtained;

selecting a merit function for determining a fit of a data model to the data set;

determining an updating variable of the object model in object space based upon the merit function;

smoothing the updating variable to determine a smoothed updating variable by:

convolving the updating variable with each of a plurality of pixon kernels; and

selecting for each object point of the input object a pixon kernel having a largest size that meets a predetermined minimum criteria; and

generating a pixon map by assigning indices at each object point of the input object corresponding to the selected pixon kernel.

15. The non-transitory computer readable medium of claim 14, further comprising smoothing the data set by convolving the data set at each location with the selected pixon kernel according to the pixon map.

16. The non-transitory computer readable medium of claim 14, wherein the merit function is determined using a conjugate gradient method.

17. The non-transitory computer readable medium of claim 16, wherein the updating variable is a negradient.

18. The non-transitory computer readable medium of claim 17, further comprising adding a preconditioner.

19. The non-transitory computer readable medium of claim 14, further comprising:
iteratively smoothing the updating variable and updating the pixon map based upon the iteratively smoothed updating variable until the merit function is optimized.

20. The non-transitory computer readable medium of claim 19, further comprising, after the step of convolving the updating variable, subtracting the updating variable to determine an updating variable change.

21. The non-transitory computer readable medium of claim 20, wherein the predetermined minimum criteria is based on the ratio between the square of the updating variable change and a variance of the updating variable.