CLAIMS

1. A method for generating an image of a subsurface region, the method comprising:
   (a) obtaining a set of seismic data and/or data derived therefrom for the subsurface region;
   (b) resampling the set of seismic data and/or data derived therefrom to generate a resampled data set, wherein a sampling rate of the resampled data set is at least twice the sampling rate of the set of seismic data and/or data derived therefrom;
   (c) inverting the resampled data set with an initial prior model of the subsurface region to generate a new model of the subsurface region;
   (d) updating the new model based on learned information to generate an updated prior model of the subsurface region; and
   (e) iterating steps (c) and (d) until a pre-determined end point is reached, thereby obtaining a final updated model of the subsurface, by substituting the initial prior model in each iteration with the updated prior model from an immediately-preceding iteration.

2. The method of claim 1, wherein the inverting the resampled data set comprises a one-stage petrophysical inversion.

3. The method of claim 1, wherein the inverting the resampled data set comprises Full Wavefield Inversion.

4. The method of any one of the foregoing claims, wherein the end point is determined to be when the prior model of the n^{th} iteration deviates less than 10% from the prior model of the n+1 iteration.

5. The method of any one of the foregoing claims, wherein the resampling consists of subsampling.

6. The method of any one of the foregoing claims, wherein the set of seismic data and/or data derived therefrom is selected from the group consisting of:
   seismic data for the subsurface region,
   seismic data and a velocity model for the subsurface region,

seismic data and elastic parameters for the subsurface region,
elastic parameters for the subsurface region, and
any combination of two or more of the foregoing.

7. The method of any one of the foregoing claims, wherein one or more additional geophysical data types selected from resistivity data and electromagnetic data are obtained in addition to said set of seismic data and/or data derived therefrom; and further wherein the inverting in step (c) to further includes inverting the one or more additional geophysical data types.

8. The method of any one of the foregoing claims, wherein the set of seismic data and/or data derived therefrom comprises elastic parameters generated by Full Waveform Inversion of seismic data for the subsurface region.

9. The method of claim 1, further comprising, after the end point is reached, imaging a final model of the subsurface region based on an immediately-preceding new model.

10. The method of claim 1, further comprising: training a learned information subsystem with information about the subsurface region; and obtaining the learned information for updating the new model from the learned information subsystem.

11. The method of claim 10, wherein the learned information subsystem comprises at least one of a 1D Hidden Markov Model and a 3D concepts model.

12. The method of claim 10, wherein the learned information subsystem is trained using at least one of: well logs, synthetic traces, 3D concepts model, 3D physical simulations, 3D analogues, and any combination thereof.

13. The method of claim 1, wherein the inverting the resampled data set comprises an optimization step, and the updating the new model based on the learned information comprises a learning step.

14. The method of any one of the foregoing claims, wherein the updated prior model comprises high frequency information.

15. The method of any one of the foregoing claims, further comprising:
applying a first weighting to the resampled data set and the initial prior model during the inverting of a first iteration; and
applying a second weighting to the resampled data set and the initial prior model during the inverting of a second iteration, wherein the first weighting is different from the second weighting, and the second iteration is subsequent to the first iteration.

16. The method of any one of the foregoing claims, wherein the resampling is high fidelity.

17. The method of any one of the foregoing claims, wherein, for each iteration, the initial prior model comprises values for porosity and volume of clay throughout the subsurface region.

18. The method of any one of the foregoing claims, wherein the set of seismic data and/or data derived therefrom comprises data with frequency below 50 Hz, and the resampled data set comprises data with frequency above 50 Hz.

19. The method of claim 1, wherein:
for the first one or more iterations, the inverting the resampled data set is carried out using linear or log-linear physics, and for all iterations subsequent to said first one or more iterations, the inverting the resampled data set is carried out using nonlinear physics.

20. The method of claim 1, wherein the resampling, inverting, and updating are each carried out on one or more seismic data analysis systems.

21. The method of the foregoing claims, further comprising managing hydrocarbons based at least in part upon the final updated model of the subsurface.

22. A method comprising:
(a) obtaining a set of seismic data and/or data derived therefrom for a subsurface region;

(b) resampling the set of seismic data and/or data derived therefrom to generate a resampled data set, wherein a sampling rate of the resampled data set is at least twice a sampling rate of the set of seismic data and/or data derived therefrom;

(c) utilizing linear inversion to invert the resampled data set with an initial prior model of the subsurface region to generate a new model of the subsurface region;

(d) updating the new model based on learned information to generate an updated prior model of the subsurface region;

(e) iterating steps (c) and (d) to generate a linear base model from the updated prior model from an immediately-preceding iteration;

(f) defining a second initial prior model to be the linear base model;

(g) utilizing nonlinear inversion to invert the resampled data set with the second initial prior model to generate a second new model of the subsurface region;

(h) updating the second new model based on learned information to generate a second updated prior model of the subsurface region; and

(i) iterating steps (g) and (h) until a pre-determined end point is reached, thereby obtaining a final updated model of the subsurface, by substituting the second initial prior model in each iteration with the second updated prior model from an immediately-preceding iteration;

wherein the resampling and steps (c), (d), (g), and (h) are carried out using one or more seismic data analysis systems.

23. A method for generating an image of a subsurface region, the method comprising:

(a) obtaining a seismic data set for the subsurface region;

(b) resampling the seismic data set to generate a resampled seismic data set, wherein a sampling rate of the resampled data set is at least twice a sampling rate of the set of seismic data;

(c) inverting the resampled seismic data set with an initial prior model of the subsurface region to generate a new model of the subsurface region; and

(d) imaging a final model of the subsurface region based on the new model;

wherein the resampling, inverting, and imaging are carried out using one or more seismic data analysis systems.

24. The method of claim 23, further comprising, using at least one of the one or more seismic data analysis systems:

(c2) updating the new model based on learned information to generate an updated prior model of the subsurface region; and

(c3) iterating steps (c) and (c2) until a pre-determined end point is reached, substituting the initial prior model in each iteration with the updated prior model from an immediately-preceding iteration.