CLAIMS

1. A method to automatically interpret a subsurface feature within geophysical data, the method comprising: storing, in a computer memory, geophysical data obtained from a survey of a subsurface region; and extracting, with a computer, a feature probability volume by processing the geophysical data with one or more fully convolutional neural networks, which are trained to relate the geophysical data to at least one subsurface feature, wherein the extracting includes fusing together outputs of the one or more fully convolutional neural networks; wherein the feature probability volume is a 4D tensor that conveys a vector at each voxel within the volumes indicating the likelihood of that voxel belonging to a certain class.

2. The method of claim 1, wherein the geophysical data is a migrated or stacked seismic volume.

3. The method of claim 1, wherein the geophysical data includes attributes extracted from a migrated or stacked seismic volume.

4. The method of claim 1, further comprising: training the one or more fully convolutional neural networks with training data, wherein the training data includes synthetically generated subsurface physical models consistent with provided geological priors and computer simulated data based on governing equations of geophysics and the synthetically generated subsurface physical model.

5. The method of claim 4, wherein the training data includes migrated or stacked seismic data with manual interpretations.

6. The method of claim 4, wherein the training data is a blend of synthetic and real data.

7. The method of claim 4, wherein a plurality of neural networks are used and the plurality of neural networks have different architectures and the training includes training the plurality of neural networks with different datasets, wherein said plurality of neural networks comprises the one or more fully convolutional neural networks.

8. The method of claim 1, wherein the one or more fully convolutional neural networks are based on a U-net architecture.

9. The method of claim 1, wherein the one or more fully convolutional neural networks are based on augmentations to a U-net architecture.

10. The methods of claim 1, wherein the one or more fully convolutional neural networks use 3D convolution or filtering operations.

11. The method of claim 1, wherein the fusing is done using voxelwise operations.

12. The method of claim 11, wherein the voxelwise operations include averaging.

13. The method of claim 11, wherein the voxelwise operations include taking a maximum value.

14. The method of claim 1, wherein the fusing is done by feeding multiple prediction volumes, and the original data, into another artificial neural network.

15. The method of claim 1, wherein the at least one subsurface feature is one or more of faults, channels, or environments of deposition.

16. The method of claim 1, wherein the at least one subsurface feature is a fault.

17. The method of claim 1, wherein the extracting includes performing seismic feature interpretation via voxelwise labeling.

18. The method of claim 1, wherein the extracting includes running a learned 2D or 3D model on an entirety of a seismic volume to obtain a fault interpretation of the seismic Volume all at once.

19. The method of claim 1, wherein the extracting includes generating an output label map that is related to a size of an input image.