CLAIMS

1. A method, comprising:

receiving, at a processor and for a plurality of subjects, image data associated with colorimetric or luminescence signal profiles of a plurality of arrays each including a plurality of array spots (1) contacted with one or more samples associated with that subject and (2) heated at a predetermined temperature for a predetermined period of time, each of the plurality of array spots including a different hydrogel composition with a photoinitiator that was previously exposed to ultraviolet (UV) light, each of the subjects associated with a known diagnostic class from a plurality of diagnostic classes;

extracting from the image data for each of the plurality of subjects color intensity data for each of the plurality of array spots;

splitting the color intensity data into a plurality of color channels each associated with a different color and having color intensity values of that color for each of the plurality of array spots; and

training a neural network to classify a subject based on color intensity data by, for each of the plurality of subjects:

excluding the color intensity values for that subject from a subset of subjects being analyzed;

analyzing the color intensity values for each of the plurality of color channels of each of the subject of subjects using a neural network to identify relationships between the color intensity values and the known diagnostic classes of the subset of subjects;

predicting a diagnostic class for that subject using the neural network; and

validating the neural network by comparing the diagnostic class predicted for that subject against the known class associated with that subject.

2. The method of claim 1, wherein the splitting the color intensity data includes separately summing red, green, and blue pixel intensities for each of the plurality of array spots.

3. The method of claim 1, wherein the neural network is a multilayer perceptron.

4. The method of claim 3, wherein the multilayer perceptron includes an input layer having about 210 nodes and a hidden layer having between about 30 nodes to 250 nodes.

5. The method of claim 1, wherein the neural network uses a rectifier as an activation function and performs logistic regression using a limited-memory Broyden–Fletcher–Goldfarb–Shanno (L-BFGS) algorithm.

6. The method of claim 1, wherein the diagnostic class is selected from a plurality of diagnostic classes including a healthy class and at least one cancer class.

7. The method of claim 1, wherein the diagnostic class is selected from a plurality of diagnostic classes including a healthy class, a plurality of cancer classes, and a Hepatitis B virus-infected class.

8. The method of claim 1, further comprising processing the image data before extracting the color intensity data from the image data, the processing including at least one of: cropping the image data, or inverting the image data.

9. The method of claim 1, further comprising organizing the color intensity values of each of the plurality of color channels into vectors representative of each of the plurality of array spots,

the analyzing the color intensity values for each of the plurality of color channels using the neural network including providing the vectors as inputs into the neural network.

10. The method of claim 1, wherein the plurality of arrays is a first plurality of a first type of array, and the neural network is a first neural network, the method further comprising:

receiving image data associated with colorimetric or luminescence signal profiles of a second plurality of arrays of a second type of array, each of the second plurality of arrays including a plurality of array spots contacted with one or more samples associated with one or more subjects; and

training a second neural network to classify a subject based on color intensity data associated with the second plurality of arrays, the second neural network being different from the first neural network.

11. The method of claim 10, wherein the plurality of array spots of the first type of array includes different hydrogel compositions from the plurality of array spots of the second type of array.

12. A method, comprising:

receiving, at a processor, image data associated with a colorimetric or luminescence signal profile of an array that was previously (1) contacted with one or more analytes from the subject and (2) heated at a predetermined temperature for a predetermined period of time, the array including a plurality of array spots each including a different hydrogel composition with a photoinitiator that was previously exposed to ultraviolet (UV) light;

extracting from the image data color intensity data for each of the plurality of array spots;

splitting the color intensity data into a plurality of color channels each associated with a different color and having color intensity values for that color for each of the plurality of array spots; and

applying a trained neural network to the color intensity data split into the plurality of color channels to classify the subject into a diagnostic class of a plurality of diagnostic classes.

13. The method of claim 12, wherein the neural network is a multilayer perceptron.

14. The method of claim 13, wherein the multilayer perceptron includes an input layer having about 210 nodes and a hidden layer having between about 30 nodes to 250 nodes.

15. The method of claim 12, wherein the neural network uses a rectifier as an activation function and performs logistic regression using a limited-memory Broyden–Fletcher–Goldfarb–Shanno (L-BFGS) algorithm.

16. The method of claim 12, wherein splitting the image data into a plurality of color channels includes splitting the image data into a red channel including red pixel intensities of the plurality of array spots, a green channel including green pixel intensities of the plurality of array spots, and a blue channel including blue pixel intensities of the plurality of array spots.

17. The method of claim 12, wherein the plurality of diagnostic classes includes a healthy class and at least one cancer class.

18. The method of claim 12, wherein the plurality of diagnostic classes includes a healthy class, a plurality of cancer classes, and a Hepatitis B virus-infected class.

19. The method of claim 12, further comprising processing the image data before extracting the color intensity data from the image data, the processing including at least one of: cropping the image data, or inverting the image data.

20. An apparatus, comprising:

a memory; and

a processor operatively coupled to the memory, the processor configured to:

receive image data associated with a colorimetric or luminescence signal profile of an array that was previously (1) contacted with one or more analytes from the subject and (2) heated at a predetermined temperature for a predetermined period of time, the array including a plurality of array spots each including a different hydrogel composition with a photoinitiator that was previously exposed to ultraviolet (UV) light;

extract from the image data color intensity data for each of the plurality of array spots;

split the color intensity data into a plurality of color channels each associated with a different color and having color intensity values for that color for each of the plurality of array spots; and

apply a trained neural network to the color intensity data split into the plurality of color channels to classify the subject into a diagnostic class of a plurality of diagnostic classes.