

CLAIMS

1. A system comprising:
 - a PCR system;
 - a reaction array plate;
 - a convolutional neural network (CNN) configured to receive a sequence of images of the reaction array plate in the PCR system; and
 - an output of the CNN coupled to a control for the reaction array plate.
2. The system of claim 1, wherein the control is a stop control.
3. The system of claim 1, further comprising:
 - a mapping function between through hole centers of the reaction array plate and arrays in layers of the CNN.
4. The system of claim 1, the output of the CNN transforming the sequence of images into a ROX spotting prediction, a ROX stripping prediction, a bright ROX prediction, a spot point bridge prediction, and a reformatting error prediction.
5. The system of claim 1, wherein the CNN lacks a final fully connected output layer.
6. The system of claim 5, further comprising at least one recurrent neural network (RNN) coupled to receive feature indications from the CNN, and to transform the feature indications into failure mode predictions.
7. The system of claim 6, comprising multiple RNNs, wherein predictions of multiple RNNs are combined by a perceptron into a final prediction of at least one failure mode.
8. The system of claim 1, the CNN further comprising:
 - an input layer comprising a 54 x 54 array;
 - a first convolution layer comprising 32 54x54 arrays; and
 - a second convolution layer comprising 64 18 x 18 arrays.
9. The system of claim 8, the CNN further comprising:
 - a first fully connected layer comprising 192 nodes;
 - a second fully connected layer coupled to the first fully connected layer and comprising 48 nodes; and

an output layer coupled to the second fully connected layer and generating a binary pass or a fail output signal.

10. The system of claim 9, the output layer further generating a prediction of a failure mode for the reaction array plate.

11. A method comprising:

operating a PCR system on a reaction array plate;

applying a sequence of images from a plurality of subarrays of the reaction array plate to a plurality of convolutional neural networks (CNNs) during operation of the PCR system on the reaction plate array;

operating the CNNs to generate failure mode predictions for the reaction plate based on the sequence of images; and

coupling an output of the CNNs to one or more of a setting for manufacture of the reaction array plate or to control the PCR system.

12. The method of claim 11, wherein the control is a stop control.

13. The method of claim 11, further comprising:

mapping through hole centers of the reaction array plate to different ones of the CNNs.

14. The method of claim 11, the output of the CNNs transforming the sequence of images into a ROX spotting prediction, a ROX stripping prediction, a bright ROX prediction, a spot point bridge prediction, and a reformatting error prediction.

15. The method of claim 11, wherein one or more of the CNN lacks a final fully connected output layer.

16. The method of claim 15, further comprising coupling the output of the CNNs to at least one recurrent neural network (RNN) to receive feature indications from the CNNs, and to transform the feature indications into the failure mode predictions.

17. The method of claim 16, comprising multiple RNNs, wherein predictions of multiple RNNs are combined by a perceptron into a final prediction of at least one failure mode.