

CLAIMS

1. A computer implemented method (900) for detecting a disease, the method comprising:
 - obtaining (s902) an immunofluorescence assay (IFA) image associated with a sample;
 - processing (s904) the IFA image to produce a processed IFA image;
 - detecting (s906) cells in the processed IFA image;
 - determining (s908) numCells, where numCells is the total number of detected cells;
 - for each detected cell, classifying (s910) the cell as either a first type of cell (EA+ cell) or a second type of cell (EA- cell);
 - calculating (s912) an index value (EA+ Index) based on numCells and numCellsEA+, where numCellsEA+ is the total number of detected cells that are classified as an EA+ cell;
 - calculating (s914) a score value (EBV score);
 - using (s916) a first set of membership functions, mapping numCells to a first set of fuzzy values;
 - using (s918) a second set of membership functions, mapping EA+ Index to a second set of fuzzy values;
 - using (s920) a third set of membership functions, mapping EBV score to a third set of fuzzy values; and
 - using (s922) the first set of fuzzy values, the second set of fuzzy values, the third set of fuzzy values, and fuzzy rules to classify the sample.
2. The method of claim 1, wherein the step of classifying the cells is performed by a convolutional neural network (CNN).
3. The method of claim 2, wherein, for each detected cell, the CNN determines a probability index (PI) value for the cell and uses the PI value and a predetermined threshold to determine whether or not the cell should be classified as a EA+ cell.

4. The method of claim 3, wherein the CNN classifies a particular cell as an EA+ cell as a result of determining that the PI value for the particular cell exceeds the threshold.

5. The method of claim 1, wherein classifying the cell as either a first type of cell (EA+ cell) or a second type of cell (EA- cell) comprises:

obtaining pixel information for the cell;

using the pixel information to calculate a probability index (PI) value for the cell; and

uses the PI value and a predetermined threshold to determine whether or not the cell should be classified as a EA+ cell.

6. The method of claim 5, wherein the pixel information for the cell comprises a set of pixel intensity values, wherein each pixel intensity value in the set of pixel intensity values indicates the intensity of a pixel corresponding to the cell.

7. The method of claim 6, wherein using the pixel information to calculate the PI value for the cell comprises calculating:

$PI = \sigma/\mu$, where

μ is the mean of the pixel intensity values, and

σ is standard deviation of the pixel intensity values.

8. The method of any one of claims 3-7, wherein

the EBV score is the average of the PI values that are greater than or equal to the predetermined threshold, or

the EBV score is the average of the PI values that are greater than the predetermined threshold.

9. A computer program (1043) comprising instructions (1044) which when executed by processing circuitry (1002) of a disease detection system causes the disease detection system (200) to perform the method of any one of claims 1-8.

10. A carrier containing the computer program of claim 9, wherein the carrier is one of an electronic signal, an optical signal, a radio signal, and a computer readable storage medium (1042).

11. A disease detection system (200), the disease detection system (200) being configured to:

- obtain (s902) an immunofluorescence assay (IFA) image associated with a sample;
- process (s904) the IFA image to produce a processed IFA image;
- detect (s906) cells in the processed IFA image;
- determine (s908) numCells, where numCells is the total number of detected cells;
- for each detected cell, classify (s910) the cell as either a first type of cell (EA+ cell) or a second type of cell (EA- cell);
- calculate (s912) an index value (EA+ Index) based on numCells and numCellsEA+, where numCellsEA+ is the total number of detected cells that are classified as an EA+ cell;
- calculate (s914) a score value (EBV score);
- use (s916) a first set of membership functions, mapping numCells to a first set of fuzzy values;
- use (s918) a second set of membership functions, mapping EA+ Index to a second set of fuzzy values;
- use (s920) a third set of membership functions, mapping EBV score to a third set of fuzzy values; and
- use (s922) the first set of fuzzy values, the second set of fuzzy values, the third set of fuzzy values, and fuzzy rules to classify the sample.

12. The disease detection system of claim 11, wherein the disease detection system is further configured to perform the method of any one of claims 2-8.

13. A disease detection system (200), the disease detection system (200) comprising:
processing circuitry (1002); and

a memory (1042), the memory (1042) containing instructions (1044) executable by the processing circuitry, whereby the disease detection system (200) is configured to perform the method of any one of claims 1-8.