CLAIMS

1. A non-transitory computer-readable storage medium storing instructions which, when executed, cause a processing device to perform operations comprising:

receiving an input comprising a template image and a test image, wherein the template image comprises labels for a first location and a second location associated with a first measurement of the template image;

providing the template image and the test image as input to a trained machine learning model, wherein the trained machine learning model outputs a deformation field based on non-rigid registration of the template image to the test image; and

determining, based on application of the deformation field to the template image, a third location and a fourth location on the test image that correspond to the first location and the second location, respectively, on the template image, wherein the third location and the fourth location are usable to determine the first measurement of the test image;

the operations further comprising:

extracting a template signal along a first line intersecting the first location and the second location on the template image;

extracting a test signal along a second line intersecting the third location and the fourth location on the test image; and

adjusting at least one of the third location or the fourth location using a dynamic time warping (DTW) transformation of the test signal to the template signal.

2 The non-transitory computer-readable storage medium of claim 1, wherein the template signal and the test signal each comprise an average of pixel values of pixels along the first line and the second line, respectively.

3. The non-transitory computer-readable storage medium of claim 1, the operations further comprising:

identifying a template signal local maximum, wherein the template signal local maximum is a closest local maximum to a point on the template signal corresponding to the first location on the template image;

identifying a template signal local minimum, wherein the template signal local minimum is a closest local minimum to a point on the template signal corresponding to the first location on the template image;

identifying a test signal local maximum, wherein the test signal local maximum is a closest local maximum to a point on the test signal corresponding to the third location on the test image;

identifying a test signal local minimum, wherein the test signal local minimum is a closest local minimum to a point on the test signal corresponding to the third location on the test image;

calculating a first ratio representing a relationship between a proximity of the point on the template signal to the template signal maximum and a proximity of the point on the template signal to the template signal minimum; and

adjusting the third location so that a second ratio representing a relationship between a proximity of the point on the test signal to the test signal maximum and a proximity of the point on the test signal to the test signal minimum is approximately equal to the first ratio.

4. The non-transitory computer-readable storage medium of claim 1, wherein the third location of the test image corresponds to the first location of the template image after non-rigid registration of the test image to the template image.

5. The non-transitory computer-readable storage medium of claim 1, wherein the first location and the second location of the template image are positioned at a vertical distance from a first reference point, and the third location and the fourth location of the test image are positioned at the vertical distance from a second reference point.

6. The non-transitory computer-readable storage medium of claim 1, wherein the machine learning model comprises at least one of a convolutional neural network (CNN) or an encoder-decoder network.

7. A system comprising:

a memory; and

a processing device coupled to the memory, the processing device to:

receive an input comprising a template image and a test image, wherein the template image comprises labels for a first location and a second location associated with a first measurement of the template image;

provide the template image and the test image as input to a trained machine learning model, wherein the trained machine learning model outputs

a deformation field based on non-rigid registration of the template image to the test image; and

determine, based on application of the deformation field to the template image, a third location and a fourth location on the test image that correspond to the first location and the second location, respectively, on the template image, wherein the third location and the fourth location are usable to determine the first measurement of the test image;

the processing device further to:

extract a template signal along a first line intersecting the first location and the second location on the template image;

extract a test signal along a second line intersecting the third location and the fourth location on the test image; and

adjust at least one of the third location or the fourth location using a dynamic time warping (DTW) transformation of the test signal to the template signal.

8. The system of claim 7, wherein the template signal and the test signal each comprise an average of pixel values of pixels along the first line and the second line, respectively.

9. The system of claim 7, the processing device further to:

identify a template signal local maximum, wherein the template signal local maximum is a closest local maximum to a point on the template signal corresponding to the first location on the template image;

identify a template signal local minimum, wherein the template signal local minimum is a closest local minimum to a point on the template signal corresponding to the first location on the template image;

identify a test signal local maximum, wherein the test signal local maximum is a closest local maximum to a point on the test signal corresponding to the third location on the test image;

identify a test signal local minimum, wherein the test signal local minimum is a closest local minimum to a point on the test signal corresponding to the third location on the test image;

calculate a first ratio representing a relationship between a proximity of the point on the template signal to the template signal maximum and a proximity of the point on the template signal to the template signal minimum; and

adjust the third location so that a second ratio representing a relationship between a proximity of the point on the test signal to the test signal maximum and a proximity of the point on the test signal to the test signal minimum is approximately equal to the first ratio.

10. The system of claim 7, wherein the third location of the test image corresponds to the first location of the template image after non-rigid registration of the test image to the template image.

11. The system of claim 7, wherein the first location and the second location of the template image are positioned at a vertical distance from a first reference point, and the third location and the fourth location of the test image are positioned at the vertical distance from a second reference point.

12. The system of claim 7, wherein the machine learning model comprises at least one of a convolutional neural network (CNN) or an encoder-decoder network.