

CLAIMS

What is claimed is:

1. A method comprising:

receiving, by at least one processor, a tissue image comprising a digital representation of a plurality of cells of a tissue;

utilizing, by the at least one processor, a histopathological scoring model to predict at least one mask delineating areas of interest in the tissue image according to cell types or biomarkers based on learned histopathological scoring parameters;

wherein each mask of the at least one mask comprises:

- i) at least one polygon formed by labelled pixels representing a delineation of each area of interest of the areas of interest, and
- ii) at least one label associated with the labelled pixels representing a cell type or biomarker of the cell types in each area of interest of the areas of interest;

determining, by the at least one processor, a sum of values associated with each mask across all pixels;

wherein the sum of the values represents a measure of an area of each area of interest of the areas of interest based at least in part on the image band of each area of interest;

determining, by the at least one processor, a histopathological score based at least in part on the measure of the area of each area of interest; and

causing to display, by the at least one processor, the histopathological score on at least one screen of at least one computing device associated with at least one user.

2. The method as recited in claim 1, wherein the histopathological scoring model comprises a generative adversarial network (GAN).

3. The method as recited in claim 1, wherein the labelled pixels comprises a set of image bands representing a set of classifications of cell types or biomarkers, wherein the at least one label

of each mask comprises an image band of the set of image bands representing a classification by cell type or biomarker of a set of classifications by cell type or biomarker.

4. The method as recited in claim 3, wherein the set of image bands comprises a plurality of grayscale bands.

5. The method as recited in claim 1, further comprising normalizing, by the at least one processor, each mask to produce a pixel value for each pixel that is equivalent for every pixel in each mask.

6. The method as recited in claim 5, wherein the pixel value comprises a value of one.

7. The method as recited in claim 1, further comprising determining, by the at least one processor, a cell-type-specific histopathological score for a particular cell type or biomarker of the cell types or biomarkers based at least in part on a ratio of an area of a mask associated with the particular cell type or biomarker to a total area of the at least one mask.

8. A system comprising:

at least one processor in communication with at least one memory and configured to access instructions stored in the memory, wherein the instructions cause the at least one processor to perform steps to:

receive a tissue image comprising a digital representation of a plurality of cells of a tissue;

utilize a histopathological scoring model to predict at least one mask delineating areas of interest in the tissue image according to cell staining based on learned histopathological scoring parameters;

wherein each mask of the at least one mask comprises:

i) at least one polygon formed by labelled pixels representing a delineation of each area of interest of the areas of interest, and

ii) at least one label associated with the labelled pixels representing an image band of each area of interest of the areas of interest;

determine a sum of values associated with each image band across all pixels;

wherein the sum of the values represents a measure of an area of each area of interest of the areas of interest based at least in part on the image band of each area of interest;

determine a histopathological score based at least in part on the measure of the area of each area of interest; and

cause to display the histopathological score on at least one screen of at least one computing device associated with at least one user.

9. The system as recited in claim 8, wherein the histopathological scoring model comprises a generative adversarial network (GAN).

10. The system as recited in claim 8, wherein the labelled pixels comprises a set of image bands representing a set of classifications of cell types or biomarkers, wherein the at least one label of each mask comprises an image band of the set of image bands representing a classification by cell type or biomarker of a set of classifications by cell type or biomarker.

11. The system as recited in claim 10, wherein the set of image bands comprises a plurality of grayscale bands.

12. The system as recited in claim 8, wherein the instructions further cause the at least one processor to perform steps to: normalize each mask to produce a pixel value for each pixel that is equivalent for every pixel in each mask.

13. The system as recited in claim 12, wherein the pixel value comprises a value of one.

14. The system as recited in claim 8, wherein the instructions further cause the at least one processor to perform steps to: determine a cell-type-specific histopathological score for a particular cell type or biomarker of the cell types based at least in part on a ratio of an area of a mask associated with the particular cell type or biomarker to a total area of the at least one mask.

15. A non-transitory computer readable medium having software instructions stored thereon, the software instructions configured to cause at least one processor to perform steps comprising:

receiving a tissue image comprising a digital representation of a plurality of cells of a tissue;

utilizing a histopathological scoring model to predict at least one mask delineating areas of interest in the tissue image according to cell types or biomarkers based on learned histopathological scoring parameters;

wherein each mask of the at least one mask comprises:

- i) at least one polygon formed by labelled pixels representing a delineation of each area of interest of the areas of interest, and
- ii) at least one label associated with the labelled pixels representing a cell type or biomarker of the cell types in each area of interest of the areas of interest;

determining a sum of values associated with each mask across all pixels;

wherein the sum of the values represents a measure of an area of each area of interest of the areas of interest based at least in part on the image band of each area of interest;

determining a histopathological score based at least in part on the measure of the area of each area of interest; and

causing to display the histopathological score on at least one screen of at least one computing device associated with at least one user.

16. The non-transitory computer readable medium as recited in claim 15, wherein the histopathological scoring model comprises a generative adversarial network (GAN).

17. The non-transitory computer readable medium as recited in claim 15, wherein the labelled pixels comprises a set of image bands representing a set of classifications of cell types or biomarkers, wherein the at least one label of each mask comprises an image band of the set of image bands representing a classification by cell type or biomarker of a set of classifications by cell type or biomarker.

18. The non-transitory computer readable medium as recited in claim 17, wherein the set of image bands comprises a plurality of grayscale bands.

19. The non-transitory computer readable medium as recited in claim 15, wherein the software instructions are further configured to cause at least one processor to perform steps comprising normalizing each mask to produce a pixel value for each pixel that is equivalent for every pixel in each mask.

20. The non-transitory computer readable medium as recited in claim 15, wherein the software instructions are further configured to cause the at least one processor to perform steps comprising determining a cell-type-specific histopathological score for a particular cell type or biomarker of the cell types based at least in part on a ratio of an area of a mask associated with the particular cell type or biomarker to a total area of the at least one mask.