

What is claimed is:

1.——A computer-implemented method for processing electronic images, the method comprising:

~~receiving a generalized machine learning model generated by processing a plurality of first training images to predict at least one cancer characteristic;~~

~~receiving a plurality of second training images, wherein the first training images and the second training images comprise images of tissue specimens and/or images algorithmically generated to replicate tissue specimens;~~

~~receiving a plurality of target specialized attributes each related to a respective second training image of the plurality of second training images;~~

~~generating a specialized machine learning model by modifying the generalized machine learning model based on the plurality of second training images and respective target specialized attributes;~~

~~receiving a target image corresponding to a target specimen;~~

~~applying the specialized machine learning model to the target image to determine at least one characteristic of the target image; and~~

~~outputting the at least one characteristic of the target image.~~

2.——The computer-implemented method of claim 1, further comprising:

~~determining a prediction of a specimen type of the target specimen based on the at least one characteristic of the target image; and~~

~~outputting the prediction of the specimen type of the target specimen.~~

~~3. The computer implemented method of claim 1, wherein the plurality of target specialized attributes are one or more biomarkers present within each respective second training image.~~

~~4. The computer implemented method of claim 1, wherein the generalized machine learning model comprises a plurality of layers and modifying the generalized machine learning model comprises modifying one or more outer layers of the generalized machine learning model.~~

~~5. The computer implemented method of claim 1, wherein modifying the generalized machine learning model comprises removing an output layer of the generalized machine learning model.~~

~~6. The computer implemented method of claim 1, wherein the plurality of target specialized attributes are one or more biomarkers present within each respective second training image.~~

~~7. The computer implemented method of claim 1, wherein the plurality of target specialized attributes are based on at least one of drug response information, cancer recurrence prediction information, or toxicity assessment information.~~

~~8. The computer implemented method of claim 1, wherein each of second training images are generated based on a same category of pathology specimens.~~

~~9.—The computer implemented method of claim 8, wherein a category of pathology specimens is selected from histology, cytology, immunohistochemistry, or a combination thereof.~~

~~10.—The computer implemented method of claim 1, wherein modifying a generalized machine learning model further comprises adjusting the generalized machine learning model to have outputs based on the target specialized attributes.~~

~~11.—The computer implemented method of claim 1, wherein the plurality of first training images comprise images corresponding to a plurality of cancer types.~~

~~12.—The computer implemented method of claim 1, wherein the at least one cancer characteristic is one of a cancer diagnosis, a tumor characterization, or biomarker detection.~~

~~13.—A system for processing electronic images, the system comprising:
at least one memory storing instructions; and
at least one processor executing the instructions to perform operations
comprising:~~

~~receiving a generalized machine learning model generated by
processing a plurality of first training images to predict at least one cancer
characteristic;~~

~~receiving a plurality of second training images, wherein the first training
images and the second training images comprise images of tissue specimens
and/or images algorithmically generated to replicate tissue specimens;~~

~~receiving a plurality of target specialized attributes each related to a respective second training image of the plurality of second training images;~~

~~generating a specialized machine learning model by modifying the generalized machine learning model based on the plurality of second training images and the respective target specialized attributes;~~

~~receiving a target image corresponding to a target specimen;~~

~~applying the specialized machine learning model to the target image to determine at least one characteristic of the target image; and outputting the at least one characteristic of the target image.~~

~~14.—The system of claim 13, the operations further comprising:~~

~~determining a prediction of a specimen type of the target specimen based on the at least one characteristic of the target image; and outputting the prediction of the specimen type of the target specimen.~~

~~15.—The system of claim 13, wherein the plurality of target specialized attributes are one or more biomarkers present within each respective second training image.~~

~~16.—The system of claim 13, wherein the generalized machine learning model comprises a plurality of layers and modifying the generalized machine learning model comprises modifying one or more outer layers of the generalized machine learning model.~~

~~17.—The system of claim 13, wherein modifying the generalized machine learning model comprises removing an output layer of the generalized machine learning model.~~

~~18.—A non-transitory computer-readable medium storing instructions that, when executed by processor, cause the processor to perform operations for processing electronic images, the operations comprising:~~

~~receiving a generalized machine learning model generated by processing a plurality of first training images to predict at least one cancer characteristic;~~

~~receiving a plurality of second training images, wherein the first training images and the second training images comprise images of tissue specimens and/or images algorithmically generated to replicate tissue specimens;~~

~~receiving a plurality of target specialized attributes each related to a respective second training image of the plurality of second training images;~~

~~generating a specialized machine learning model by modifying the generalized machine learning model based on the plurality of second training images and the respective target specialized attributes;~~

~~receiving a target image corresponding to a target specimen;~~

~~applying the specialized machine learning model to the target image to determine at least one characteristic of the target image; and outputting the at least one characteristic of the target image.~~

~~19.—The non-transitory computer-readable medium of claim 18, the operations further comprising:~~

~~determining a prediction of a specimen type of the target specimen based on the at least one characteristic of the target image; and
outputting the prediction of the specimen type of the target specimen.~~

20 ~~The non-transitory computer-readable medium of claim 18, wherein the plurality of target specialized attributes are one or more biomarkers present within each respective second training image.~~

1. A computer-implemented method for processing electronic images,
the method comprising:

receiving a generalized machine learning model generated by processing a
plurality of first training images to predict at least one cancer characteristic;

receiving a plurality of second training images, wherein the first training
images and the second training images comprise images of tissue specimens and/or
images algorithmically generated to replicate tissue specimens, a quantity of second
training images being insufficient to generate a machine learning model that meets a
threshold for outputting one or more characteristics of target images for a specialized
task;

receiving a plurality of target specialized attributes each related to a
respective second training image of the plurality of second training images;

generating a specialized machine learning model by modifying the
generalized machine learning model based on the plurality of second training images
and respective target specialized attributes, the specialized machine learning model
meeting the threshold for outputting the one or more characteristics of target images
for the specialized task, the specialized machine learning model being generated in
accordance with a feature extraction scheme by generating additional layers to an
existing set of layers of the generalized machine learning model and generating
weights for the additional layers based on the plurality of second training images and
the target specialized attributes;

receiving a target image corresponding to a target specimen;

applying the specialized machine learning model to the target image to
determine at least one characteristic of the target image; and

outputting the at least one characteristic of the target image.

2. The computer-implemented method of claim 1, further comprising:
determining a prediction of a specimen type of the target specimen based on
the at least one characteristic of the target image; and
outputting the prediction of the specimen type of the target specimen.

3. The computer-implemented method of claim 1, wherein the plurality of
target specialized attributes are one or more biomarkers present within each
respective second training image.

4. The computer-implemented method of claim 1, wherein the
generalized machine learning model comprises a plurality of layers and modifying
the generalized machine learning model further comprises modifying one or more
outer layers of the generalized machine learning model.

5. The computer-implemented method of claim 1, wherein modifying the
generalized machine learning model further comprises removing an output layer of
the generalized machine learning model.

6. The computer-implemented method of claim 1, wherein the plurality of
target specialized attributes are one or more indications of characteristic outputs
selected from a disease presence, staging variable presence, drug response,
toxicity, or cancer classification.

7. The computer-implemented method of claim 1, wherein the plurality of
target specialized attributes are based on at least one of drug response information,
cancer recurrence prediction information, or toxicity assessment information.

8. The computer-implemented method of claim 1, wherein each of
second training images are generated based on a same category of pathology
specimens.

9. The computer-implemented method of claim 8, wherein a category of pathology specimens is selected from histology, cytology, immunohistochemistry, or a combination thereof.

10. The computer-implemented method of claim 1, wherein modifying a generalized machine learning model further comprises adjusting the generalized machine learning model to have outputs based on the target specialized attributes.

11. The computer-implemented method of claim 1, wherein the plurality of first training images comprise images corresponding to a plurality of cancer types.

12. The computer-implemented method of claim 1, wherein the at least one cancer characteristic is one of a cancer diagnosis, a tumor characterization, or biomarker detection.

13. A system for processing electronic images, the system comprising:
at least one memory storing instructions; and
at least one processor executing the instructions to perform operations
comprising:

receiving a generalized machine learning model generated by processing a plurality of first training images to predict at least one cancer characteristic;

receiving a plurality of second training images, wherein the first training images and the second training images comprise images of tissue specimens and/or images algorithmically generated to replicate tissue specimens a quantity of second training images being insufficient to generate a machine learning model that meets a threshold for outputting one or more characteristics of target images for a specialized task;

receiving a plurality of target specialized attributes each related to a respective second training image of the plurality of second training images;

generating a specialized machine learning model by modifying the generalized machine learning model based on the plurality of second training images and the respective target specialized attributes, the specialized machine learning model meeting the threshold for outputting the one or more characteristics of target images for the specialized task, the specialized machine learning model being generated in accordance with a feature extraction scheme by generating additional layers to an existing set of layers of the generalized machine learning model and generating weights for the additional layers based on the plurality of second training images and the target specialized attributes;

receiving a target image corresponding to a target specimen;

applying the specialized machine learning model to the target image to determine at least one characteristic of the target image; and

outputting the at least one characteristic of the target image.

14. The system of claim 13, the operations further comprising:

determining a prediction of a specimen type of the target specimen based on the at least one characteristic of the target image; and

outputting the prediction of the specimen type of the target specimen.

15. The system of claim 13, wherein the plurality of target specialized attributes are one or more biomarkers present within each respective second training image.

16. The system of claim 13, wherein the generalized machine learning model comprises a plurality of layers and modifying the generalized machine learning model further comprises modifying one or more outer layers of the generalized machine learning model.

17. The system of claim 13, wherein modifying the generalized machine learning model further comprises removing an output layer of the generalized machine learning model.

18. A non-transitory computer-readable medium storing instructions that, when executed by processor, cause the processor to perform operations for processing electronic images, the operations comprising:

receiving a generalized machine learning model generated by processing a plurality of first training images to predict at least one cancer characteristic;

receiving a plurality of second training images, wherein the first training images and the second training images comprise images of tissue specimens and/or images algorithmically generated to replicate tissue specimens a quantity of second training images being insufficient to generate a machine learning model that meets a threshold for outputting one or more characteristics of target images for a specialized task;

receiving a plurality of target specialized attributes each related to a respective second training image of the plurality of second training images;

generating a specialized machine learning model by modifying the generalized machine learning model based on the plurality of second training images and the respective target specialized attributes, the specialized machine learning model meeting the threshold for outputting the one or more characteristics of target images for the specialized task, the specialized machine learning model being generated in accordance with a feature extraction scheme by generating additional layers to an existing set of layers of the generalized machine learning model and generating weights for the additional layers based on the plurality of second training images and the target specialized attributes;

receiving a target image corresponding to a target specimen;
applying the specialized machine learning model to the target image to
determine at least one characteristic of the target image; and
outputting the at least one characteristic of the target image.

19. The non-transitory computer-readable medium of claim 18, the
operations further comprising:

determining a prediction of a specimen type of the target specimen based on
the at least one characteristic of the target image; and
outputting the prediction of the specimen type of the target specimen.

20. The non-transitory computer-readable medium of claim 18, wherein
the plurality of target specialized attributes are one or more biomarkers present
within each respective second training image.