WHAT IS CLAIMED IS:

1. A system for training a generative adversarial network using images including representations of a feature-of-interest, comprising:

at least one memory configured to store instructions; and

at least one processor configured to execute the instructions to perform operations comprising:

provide a first plurality of images that include representations of the feature-of-interest and indicators of the locations of the feature-of-interest in images of the first plurality of images;

using the first plurality of images and indicators of the feature-of-interest, train an object detection network to detect the feature-of-interest, optionally where the object detection network is a convolutional neural network;

provide a second plurality of images that include representations of the feature-of-interest, the second plurality of images comprising a larger number of images than that included in the first plurality of images;

apply the trained object detection network to the second plurality of images to produce a first plurality of detections of the feature-of-interest;

provide manually set verifications of true positives and false positives with respect to the first plurality of detections;

using the verifications of the true positives and false positives with respect to the first plurality of detections, train a generative adversarial network; and

retrain the generative adversarial network using at least one further set of images and detections of the feature-of-interest, together with further

manually set verifications of true positives and false positives with respect to the further detections of the feature-of-interest.

2. The system of claim 1, wherein the at least one processor is further configured to retrain the generative adversarial network by providing verifications of false negatives for missed detections of the feature-of-interest in two or more images.

3. The system of any preceding claim, wherein the number of images in the second plurality of images is at least 100 times larger than that included in the first plurality of images.

4. The system of any preceding claim, wherein the first plurality of images and the second plurality of images comprise medical images, and wherein the medical images optionally comprise images of a gastro-intestinal organ.

5. The system of any preceding claim, wherein at least one the first plurality of images and the second plurality of images comprise images from imaging device used during at least one of a gastroscopy, a colonoscopy, an enteroscopy, or an upper endoscopy, optionally including an endoscopy device.

6. The system of any preceding claim, wherein the feature-of-interest is an abnormality, and wherein the abnormality optionally comprises a change in human tissue from one type of cell to another type of cell, an absence of human tissue from

a location where the human tissue is expected, and/or a formation on or of human tissue.

7. The system of claim 6, wherein the abnormality comprises a lesion, optionally including a polypoid lesion or a non-polypoid lesion.

8. A method for training a neural network system to detect abnormalities in images of a human organ, the method comprising the following steps performed by at least one processor:

storing, in a database, a plurality of videos including representations of abnormalities;

selecting a first subset of the plurality of videos;

applying a perception branch of an object detection network to frames of the first subset of the plurality of videos to produce a first plurality of detections of abnormalities;

selecting a second subset of the plurality of videos;

using the first plurality of detections and frames from the second subset of the plurality of videos, training a generator network to generate a plurality of artificial representations of polyps, wherein the plurality of artificial representations are generated through residual learning, and wherein the generator network optionally comprises a generative adversarial network;

training an adversarial branch of a discriminator network to differentiate between the artificial representations of the abnormalities and true representations of abnormalities, wherein the discriminator network optionally comprises a convolutional neural network;

applying the adversarial branch of the discriminator network to the plurality of artificial representations to produce difference indicators between the artificial representations of abnormalities and true representations of abnormalities included in frames of the second subset of plurality of videos;

applying the perception branch of the discriminator network to the artificial representations to produce a second plurality of detections of the abnormalities; and

retraining the perception branch based on the difference indicators and the second plurality of detections.

9. The method of claim 8, wherein the abnormality comprises a change in human tissue from one type of cell to another type of cell, an absence of human tissue from a location where the human tissue is expected, and/or a formation on or of human tissue.

10. The method of claim 9, wherein the abnormality comprises a lesion, optionally including a polypoid lesion or a non-polypoid lesion.

11. The method of any of claims 8 to 10, wherein each artificial representation provides a false representation of an abnormality that is highly similar to a true representation of an abnormality.

12. A system for detecting an abnormality in images of a human organ, comprising:

at least one memory storing instructions; and

at least one processor configured to execute the instructions to perform operations comprising:

select frames from a video of a human organ;

apply a trained neural network system to the frames to produce at least one detection of the abnormality;

generate an indicator of a location of the at least one detection on one of the frames;

re-encode the frames into a video; and

output the re-encoded video with the indicator,

wherein the neural network system is trained according to the method of any of claims 8 to 11.

CLAIMS

1. A system for training a generative adversarial network using images including representations of a feature-of-interest, comprising:

at least one memory configured to store instructions; and

at least one processor configured to execute the instructions to perform operations comprising:

provide a first plurality of images that include representations of the feature-of-interest and indicators of the locations of the feature-of-interest in images of the first plurality of images;

using the first plurality of images and indicators of the locations of the feature-of-interest, train an object detection network to detect the feature-of-interest;

provide a second plurality of images that include representations of the feature-of-interest, the second plurality of images comprising a larger number of images than that included in the first plurality of images;

apply the trained object detection network to the second plurality of images to produce a first plurality of detections of the feature-of-interest;

provide manually set verifications of true positives and false positives with respect to the first plurality of detections;

using the verifications of the true positives and false positives with respect to the first plurality of detections, train a generative adversarial network; and

retrain the generative adversarial network using at least one further set of images and detections of the feature-of-interest, together with further manually set verifications of true positives and false positives with respect to the further detections of the feature-of-interest.

2. The system of claim 1, wherein the at least one processor is further configured to retrain the generative adversarial network by providing verifications of false negatives for missed detections of the feature-of-interest in two or more images.

3. The system of claim 1, wherein the object detection network is a convolutional neural network.

4. The system of claim 1, wherein the number of images in the second plurality of images is at least 100 times larger than that included in the first plurality of images.

5. The system of claim 1, wherein the first plurality of images and the second plurality of images comprise medical images.

6. The system of claim 5, wherein the medical images comprise images of a gastro-intestinal organ.

7. The system of claim 1, wherein at least one the first plurality of images and the second plurality of images comprise images from an endoscopy device.

8. The system of claim 1, wherein at least one the first plurality of images and the second plurality of images comprise images from imaging device used during at least one of a gastroscopy, a colonoscopy, or an enteroscopy.

9. The system of claim 1, wherein the feature-of-interest is an abnormality.

10. The system of claim 9, wherein the abnormality comprises a change in human tissue from one type of cell to another type of cell.

11. The system of claim 9, wherein the abnormality comprises an absence of human tissue from a location where the human tissue is expected.

12. The system of claim 9, wherein the abnormality comprises a formation on or of human tissue.

13. The system of claim 12, wherein the abnormality comprises a lesion.

14. The system of claim 13, wherein the lesion comprises a polypoid lesion.

15. The system of claim 13, wherein the lesion comprises a non-polypoid lesion.

16. The system of claim 1, wherein the first plurality of detections comprises a location indicator when a feature-of-interest is present or a null indicator when no feature-of-interest is present.

17. The system of claim 1, wherein the at least one processor is further configured to provide verifications of a false negative for images that had no feature-of-interest detected but include the feature-of-interest.

18. The system of claim 1, wherein the indicators of the locations of the feature-of-interest comprise at least one of points, regions, or manual annotations.

19. The system of claim 1, wherein the verifications of true positives and false positives are received from at least one of one or more databases or one or more inputs.

20. A method for training a generative adversarial network using images including representations of a feature-of-interest, the method comprising the following steps performed by at least one processor:

providing a first plurality of images that include representations of the feature-of-interest and indicators of the locations of the feature-of-interest in images of the first plurality of images;

using the first plurality of images and indicators of the locations of the feature-of-interest to train an object detection network to detect the feature-of-interest;

providing a second plurality of images that include representations of the feature-of-interest, the second plurality of images comprising a larger number of images than that included in the first plurality of images;

applying the trained object detection network to the second plurality of images to produce a first plurality of detections of the feature-of-interest;

providing manually set verifications of true positives and false positives with respect to the first plurality of detections;

using the verifications of the true positives and false positives with respect to the first plurality of detections to train a generative adversarial network; and

retraining the generative adversarial network using at least one further set of images and detections of the feature-of-interest, together with further manually set verifications of true positives and false positives with respect to the further detections of the feature-of-interest.

21. The method of claim 20, wherein the method further comprises retraining the generative adversarial network by providing verifications of false negatives for missed detections of the feature-of-interest in two or more images.

22. The method of claim 20, wherein the object detection network is a convolutional neural network.

23. The method of claim 20, wherein the number of images in the second plurality of images is at least 100 times larger than that included in the first plurality of images.

24. The method of claim 20, wherein the first plurality of images and the second plurality of images comprise medical images.

25. The method of claim 20, wherein at least one the first plurality of images and the second plurality of images comprise images from imaging device used during at least one of a gastroscopy, a colonoscopy, or an enteroscopy.

26. The method of claim 20, wherein the first plurality of detections comprises a location indicator when a feature-of-interest is present or a null indicator when no feature-of-interest is present.