CLAIMS:

1. A microscope system comprising:

an optical system for imaging a specimen, the optical system comprising an objective lens and a specimen stage configured to support the specimen during imaging; and

a focus detection system for automatically focusing the optical system, the focus detection system comprising a computing system that includes a processor and a memory, the memory has programming code stored thereon, which, when executed by the processor, causes the computing system to perform operations, comprising:

receiving, by the computing system from the optical system, only at least two images of the specimen positioned on the specimen stage, wherein the two images comprise a first image taken above or below a focal plane of the specimen and a second image taken above or below the focal plane;

providing, by the computing system, the at least two images to a deep learning model for detecting at least one distance to the focal plane of the specimen;

identifying, via the deep learning model, the at least one distance to the focal plane of the specimen by analyzing the first image and the second image; and

based on the identifying, automatically adjusting, by the computing system, a position of the specimen stage with respect to the objective lens of the microscope system.

2. The microscope system of claim 1, wherein receiving, by the computing system from the optical system, the at least two images of the specimen positioned on the specimen stage of the microscope system comprises:

receiving a first image of the at least two images at a first z-position; and

receiving a second image of the at least two images at a second z-position.

3. The microscope system of claim 2, wherein an x-position and a y-position of the specimen stage remains constant while the first z-position differs from the second z-position.

4. The microscope system of claim 1, wherein identifying, via the deep learning model, the at least one distance to the focal plane of the specimen comprises:

generating a range of distances to the focal plane, wherein the range of distances comprises an actual distance to the focal plane.

5. The microscope system of claim 1, wherein receiving, by the computing system from the optical system, the at least two images of the specimen positioned on the specimen stage of the microscope system comprises:

receiving at least one image at a first focal plane of the specimen; and

receiving at least one image at a second focal plane of the specimen.

6. The microscope system of claim 5, wherein identifying, via the deep learning model, the at least one distance to the focal plane of the specimen comprises:

identifying at least one first distance to the first focal plane of the specimen; and

identifying at least one second distance to the second focal plane of the specimen.

7. The microscope system of claim 1, wherein automatically adjusting, by the computing system, the position of the specimen stage with respect to the objective lens of the microscope system comprises:

causing a drive mechanism of the microscope system to adjust the distance between the specimen stage and the objective lens.

8. A method comprising:

receiving, by a computing system from an image sensor, only at least two images of a specimen positioned on a specimen stage of a microscope system, wherein the two images comprise a first image taken above or below a focal plane of the specimen and a second image taken above or below the focal plane;

providing, by the computing system, the at least two images to a deep learning model for detecting at least one distance to the focal plane of the specimen;

identifying, via the deep learning model, the at least one distance to the focal plane of the specimen; and

based on the identifying, automatically adjusting, by the computing system, a position of the specimen stage with respect to an objective lens of the microscope system.

9. The method of claim 8, wherein receiving, by the computing system from the image sensor, the at least two images of the specimen positioned on the specimen stage of the microscope system comprises:

receiving a first image of the at least two images at a first z-position; and

receiving a second image of the at least two images at a second z-position.

10. The method of claim 9, wherein an x-position and a y-position of the specimen stage remains constant while the first z-position differs from the second z-position.

11. The method of claim 8, wherein identifying, via the deep learning model, the at least one distance to the focal plane of the specimen comprises:

generating a range of distances to the focal plane, wherein the range of distances comprises an actual distance to the focal plane.

12. The method of claim 8, wherein receiving, by the computing system from the image sensor, the at least two images of the specimen positioned on the specimen stage of the microscope system comprises:

receiving at least one image at a first focal plane of the specimen; and

receiving at least one image at a second focal plane of the specimen.

13. The method of claim 12, wherein identifying, via the deep learning model, the at least one distance to the focal plane of the specimen comprises:

identifying at least one first distance to the first focal plane of the specimen; and

identifying at least one second distance to the second focal plane of the specimen.

14. The method of claim 8, wherein automatically adjusting, by the computing system, the position of the specimen stage with respect to the objective lens of the microscope system comprises:

causing a drive mechanism of the microscope system to adjust the distance between the specimen stage and the objective lens.

15. A non-transitory computer readable medium comprising one or more sequences of instructions, which, when executed by a processor, causes a computing system to perform operations comprising:

receiving, by the computing system from an image sensor, only at least two images of a specimen positioned on a specimen stage of a microscope system, wherein the two images

comprise a first image taken above or below a focal plane of the specimen and a second image taken above or below the focal plane;

providing, by the computing system, the at least two images to a deep learning model for detecting at least one distance to the focal plane of the specimen;

identifying, via the deep learning model, the at least one distance to the focal plane of the specimen; and

based on the identifying, automatically adjusting, by the computing system, a position of the specimen stage with respect to an objective lens of the microscope system.

16. The non-transitory computer readable medium of claim 15, wherein receiving, by the computing system from the image sensor, the at least two images of the specimen positioned on the specimen stage of the microscope system comprises:

receiving a first image of the at least two images at a first z-position; and

receiving a second image of the at least two images at a second z-position.

17. The non-transitory computer readable medium of claim 15, wherein identifying, via the deep learning model, the at least one distance to the focal plane of the specimen comprises:

generating a range of distances to the focal plane, wherein the range of distances comprises an actual distance to the focal plane.

18. The non-transitory computer readable medium of claim 15, wherein receiving, by the computing system from the image sensor, the at least two images of the specimen positioned on the specimen stage of the microscope system comprises:

receiving at least one image at a first focal plane of the specimen; and

receiving at least one image at a second focal plane of the specimen.

19. The non-transitory computer readable medium of claim 18, wherein identifying, via the deep learning model, the at least one distance to the focal plane of the specimen comprises:

identifying at least one first distance to the first focal plane of the specimen; and

identifying at least one second distance to the second focal plane of the specimen.

20. The non-transitory computer readable medium of claim 15, wherein automatically adjusting, by the computing system, the position of the specimen stage with respect to the objective lens of the microscope system comprises:

causing a drive mechanism of the microscope system to adjust the distance between the specimen stage and the objective lens.