CLAIMS

1. An overhead contact line fitting abnormality detection device comprising:

a learning processing unit that performs learning using image data generated by capturing an image of an overhead contact line fitting; and

a data processing unit that performs abnormality determination using the image data, wherein

the learning processing unit comprises an equipment learning unit that learns to detect equipment, and a component learning unit that learns to detect a component of the equipment,

the data processing unit detects the equipment by using an equipment detection model learned by the equipment learning unit, detects the component from the detected equipment by using a component detection model learned by the component learning unit, and determines whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

2. The overhead contact line fitting abnormality detection device according to claim 1, wherein the data processing unit detects the equipment based on the equipment detection model, travel position information for a vehicle, and equipment information.

3. The overhead contact line fitting abnormality detection device according to claim 1 or 2, wherein the data processing unit determines whether there is an abnormality in the equipment and/or the component based on reconstruction error in the abnormality detection model.

4. The overhead contact line fitting abnormality detection device according to claim 1 or 2, further comprising an input/output unit, wherein a detection result of the equipment and/or the component detected by the data processing unit is displayed on the input/output unit, and a worker checks and edits the detection result from the input/output unit.

5. An overhead contact line fitting abnormality detection method comprising:

performing learning using image data generated by capturing an image of an overhead contact line fitting; and

performing abnormality determination using the image data, wherein

performing the learning comprises learning to detect equipment, and learning to detect a component of the equipment,

performing the abnormality determination comprises detecting the equipment by using an equipment detection model learned by learning to detect the equipment, detecting the component from the detected equipment by using a component detection model learned by learning to detect the component of the equipment, and determining whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

6. The overhead contact line fitting abnormality detection method according to claim 5, wherein performing the abnormality determination comprises detecting the equipment based on the equipment detection model, travel position information for a vehicle, and equipment information.

7. The overhead contact line fitting abnormality detection method according to claim 5 or 6, wherein performing the abnormality determination comprises determining whether there is an abnormality in the equipment and/or the component based on reconstruction error in the abnormality detection model.

8. The overhead contact line fitting abnormality detection method according to claim 5 or 6, comprising displaying, on an input/output unit, a detection result of the equipment and/or the component detected by performing the abnormality determination, and a worker checking and editing the detection result from the input/output unit.

9. An overhead contact line fitting abnormality detection device comprising:

a learning processing unit that performs learning using image data generated by capturing an image of an overhead contact line fitting; and

a data processing unit that performs abnormality determination using the image data, wherein

the learning processing unit comprises an equipment learning unit that learns to detect equipment, and a component learning unit that learns to detect a component of the equipment,

the data processing unit

detects the equipment by using an equipment detection model learned by the equipment learning unit,

detects the component from the detected equipment by using a component detection model learned by the component learning unit,

retouches the image data in which the equipment or the component was detected, and

determines whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

10. An overhead contact line fitting abnormality detection device comprising:

a learning processing unit that performs learning using image data generated by capturing an image of an overhead contact line fitting; and

a data processing unit that performs abnormality determination using the image data, wherein

the learning processing unit comprises an equipment learning unit that learns to detect equipment, and a component learning unit that learns to detect a component of the equipment,

the data processing unit

retouches the image data,

detects the equipment by using an equipment detection model learned by the equipment learning unit,

detects the component from the detected equipment by using a component detection model learned by the component learning unit, and

determines whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model

is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

11. An overhead contact line fitting abnormality detection device comprising:

a learning processing unit that performs learning using image data generated by capturing an image of an overhead contact line fitting; and

a data processing unit that performs abnormality determination using the image data, wherein

the learning processing unit comprises an equipment learning unit that learns to detect equipment, and a component learning unit that learns to detect a component of the equipment,

the data processing unit

detects the equipment by using an equipment detection model learned by the equipment learning unit,

detects the component from the detected equipment by using a component detection model learned by the component learning unit,

retouches the image data in which the equipment or the component is detected, based on an image capture time and travel position information for a vehicle, and

determines whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

12. An overhead contact line fitting abnormality detection device comprising:

a learning processing unit that performs learning using image data generated by capturing an image of an overhead contact line fitting; and

a data processing unit that performs abnormality determination using the image data, wherein

the learning processing unit comprises an equipment learning unit that learns to detect equipment, and a component learning unit that learns to detect a component of the equipment,

the data processing unit

detects the equipment by using an equipment detection model learned by the equipment learning unit,

detects the component from the detected equipment by using a component detection model learned by the component learning unit,

retouches the image data in which the equipment or the component is detected, based on brightness information in the image data or on discriminative AI, and

determines whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

13. The overhead contact line fitting abnormality detection device according to any one of claims 9 to 12, wherein

the data processing unit,

before determining whether there is an abnormality in the equipment and/or the component by using the abnormality detection model learned in advance, performs a flipping process on the image data based on a position of a detection target in the image data.

14. An overhead contact line fitting abnormality detection method comprising:

performing learning using image data generated by capturing an image of an overhead contact line fitting; and

performing abnormality determination using the image data, wherein

performing the learning comprises learning to detect equipment, and learning to detect a component of the equipment,

performing the abnormality determination comprises

detecting the equipment by using an equipment detection model learned by learning to detect the equipment,

detecting the component from the detected equipment by using a component detection model learned by learning to detect the component of the equipment,

retouching the image data in which the equipment or the component

is detected, and

determining whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

15. An overhead contact line fitting abnormality detection method comprising:

performing learning using image data generated by capturing an image of an overhead contact line fitting; and

performing abnormality determination using the image data, wherein

performing the learning comprises learning to detect equipment, and learning to detect a component of the equipment,

performing the abnormality determination comprises

retouching the image data,

detecting the equipment by using an equipment detection model learned by learning to detect the equipment,

detecting the component from the detected equipment by using a component detection model learned by learning to detect the component of the equipment, and

determining whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

16. An overhead contact line fitting abnormality detection method comprising:

performing learning using image data generated by capturing an image of an overhead contact line fitting; and

performing abnormality determination using the image data, wherein

performing the learning comprises learning to detect equipment, and learning to detect a component of the equipment,

performing the abnormality determination comprises

detecting the equipment by using an equipment detection model learned by learning to detect the equipment,

detecting the component from the detected equipment by using a component detection model learned by learning to detect the component of the equipment,

retouching the image data in which the equipment or the component is detected, based on an image capture time and travel position information for a vehicle, and

determining whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are not using semantic segmentation.

17. An overhead contact line fitting abnormality detection method comprising:

performing learning using image data generated by capturing an image of an overhead contact line fitting; and

performing abnormality determination using the image data, wherein

performing the learning comprises learning to detect equipment, and learning to detect a component of the equipment,

performing the abnormality determination comprises

detecting the equipment by using an equipment detection model learned by learning to detect the equipment,

detecting the component from the detected equipment by using a component detection model learned by learning to detect the component of the equipment,

retouching the image data in which the equipment or the component is detected, based on brightness information in the image data or on discriminative AI, and

determining whether there is an abnormality in the equipment and/or the component by using an abnormality detection model learned in advance, and

each of the equipment detection model and the component detection model is selected from models, including Single-Shot Multibox Detector (SSD), which are

not using semantic segmentation.

18. The overhead contact line fitting abnormality detection method according to any one of claims 14 to 17, wherein

performing the abnormality determination comprises,

before determining whether there is an abnormality in the equipment and/or the component by using the abnormality detection model learned in advance, performing a flipping process on the image data based on a position of a detection target in the image data.