CLAIM

1. A system for detecting information about a road relating to digital geographical map data for an area including a plurality of road segments, the system comprising:

an input device configured to obtain remotely captured geographical image data for the area; and

a processor configured to generate ground truth image data from the digital geographical map data, and generate binary image data of the road segments from the remotely captured geographical image data using a semantic segmentation task,

wherein the processor is further configured to:

skeletonize the binary image data to generate skeletonized binary image data including a center line of each road segment of the road segments,

detect a first road segment missing from the digital geographical map data by converting the skeletonized binary image data to a graph structure of the road segments and comparing the graph structure of the road segments with the ground truth image data,

detect a road width of each road segment of the road segments from the binary image data and the center line of each road segment of the road segments; and

detect number of lanes of each road segment of the road segments from the detected road width,

wherein the processor is configured to determine whether a line segment in the graph structure of the road segments is the first road segment missing from the digital geographical map data using a voting algorithm, and

wherein the processor is configured to count number of pixels of the line segment that has a predetermined value, check whether the counted number is greater than a predetermined threshold value, decide that the line segment is the first road segment missing from the digital

geographical map data if the counted number is greater than the predetermined threshold value, and decide that the line segment is not the first road segment missing from the digital geographical map data if the counted number is equal to or less than the predetermined threshold value.

2. The system according to claim 1, wherein the processor is configured to use a polygonal approximation based on the binary image data and the center line of each road segment of the road segments, to detect the road width.

3. The system according to claim 1 or claim 2, wherein the processor is configured to train a deep neural network model using the remotely captured geographical image data as an input.

4. The system according to claim 3, wherein the processor is configured to train the deep neural network model on the ground truth image data generated from the digital geographical map data, and tune the trained deep neural network model with annotated image data.

5. The system according to claim 3 or claim 4, wherein the processor is configured to obtain the trained deep neural network model, and use the trained deep neural network model on the semantic segmentation task.

6. The system according to any one of claims 1 to 5, wherein the road segments include a second road segment which is overlapped by at least one object, and the system further comprises a context module configured to receive additional information, and decide which pixel belongs to the second road segment based on the additional information, to generate the binary image data of the road segments.

7. The system according to any one of claims 1 to 6, wherein the remotely captured geographical image data includes a satellite image collected by an imaging satellite, and the digital geographical map data includes a crowd-sourced map.

8. A method of detecting information about a road relating to digital geographical map data for an area including a plurality of road segments, the method comprising:

obtaining remotely captured geographical image data for the area;

generating ground truth image data from the digital geographical map data;

generating binary image data of the road segments from the remotely captured geographical image data using a semantic segmentation task;

skeletonizing the binary image data to generate skeletonized binary image data including a center line of each road segment of the road segments;

detecting a first road segment missing from the digital geographical map data by converting the skeletonized binary image data to a graph structure of the road segments and comparing the graph structure of the road segments with the ground truth image data;

detecting a road width of each road segment of the road segments from the binary image data and the center line of each road segment of the road segments; and

detecting number of lanes of each road segment of the road segments from the detected road width,

wherein comparing the graph structure of the road segments with the ground truth image data comprises: determining whether a line segment in the graph structure of the road segments is the first road segment missing from the digital geographical map data using a voting algorithm, and

wherein determining whether a line segment in the graph structure of the road segments is the first road segment missing from the digital geographical map data using the voting algorithm comprises:

counting number of pixels of the line segment that has a predetermined value;

checking whether the counted number is greater than a predetermined threshold value;

deciding that the line segment is the first road segment missing from the digital geographical map data if the counted number is greater than the predetermined threshold value; and

deciding that the line segment is not the first road segment missing from the digital geographical map data if the counted number is equal to or less than the predetermined threshold value.

9. The method according to claim 8, wherein detecting a road width of each road segment of the road segments further comprises: using a polygonal approximation based on the binary image data and the center line of each road segment of the road segments.

10. The method according to claim 8 or claim 9 further comprising: training a deep neural network model using the remotely captured geographical image data as an input.

11. The method according to claim 10, wherein training a deep neural network model comprises:

training the deep neural network model on the ground truth image data generated from the digital geographical map data; and

tuning the trained deep neural network model with annotated image data.

12. The method according to claim 10 or claim 11, wherein generating binary image data of the road segments from the remotely captured geographical image data comprises:

obtaining the trained deep neural network model; and

using the trained deep neural network model on the semantic segmentation task.

13. The method according to any one of claims 8 to 12, wherein the road segments include a second road segment which is overlapped by at least one object, and generating binary image data of the road segments from the remotely captured geographical image data comprises:

receiving additional information; and

deciding which pixel belongs to the second road segment based on the additional information.

14. The method according to any one of claims 8 to 13, wherein the remotely captured geographical image data includes a satellite image collected by an imaging satellite, and the digital geographical map data includes a crowd-sourced map.

15. A data processing apparatus configured to perform the method of any one of claims 8 to 14.

16. A computer program element comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 8 to 14.