CLAIMS

1. A method (100) of predicting one or more road attributes (20) corresponding to a road segment (12) in a geographical area (10), the method (100) comprising:

providing (110) trajectory data (30) and a satellite image (40) of the geographical area (10);

calculating (120) two or more image channels (32) based on the trajectory data (30);

using at least one processor, classifying (130) the road segment (12) based on the two or more image channels (32) and the satellite image (40) using a trained classifier (61) into prediction probabilities of the road attributes (20);

concatenating (118) the two or more image channels (32) into a concatenated trajectory image (34) before classifying (130) the road segment (12); and

using the trained classifier (61) to fuse (140) the satellite image (40) and the concatenated trajectory image (34) into a fused image and input the fused image in a neural network stream of the trained classifier (61).

2. The method (100) of claim 1, wherein calculating (120) two or more image channels (32) based on the trajectory data (30) comprises at least two of:

i) calculating a trajectory image channel (111), as part of the two or more image channels (32), based on the trajectory data (30);

ii) calculating a bearing image channel (113), as part of the two or more image channels (32), based on the trajectory data (30);

iii) calculating a speed image channel (116), as part of the two or more image channels (32), based on the trajectory data (30).

3. The method (100) of claim 2, comprising i), ii), and iii).

4. The method (100) of claim 3, wherein calculating the trajectory image channel (111) comprises assigning a count of a number of trajectory points of the trajectory data (30) that are projected onto each pixel of a matrix of pixels onto that pixel.

5. The method (100) of claim 3 or claim 4, wherein calculating the bearing image channel (113) comprises providing a multichannel bearing image comprising multichannel pixels, wherein a number of channels represents a number of bearing bins, and quantizing bearing values into the bearing bins forming a bearing histogram for each of the multichannel pixels.

6. The method (100) of claim 3 or claim 4, wherein calculating the speed image channel (116) comprises providing a multichannel speed image comprising multichannel pixels, wherein a number of channels represents a number of speed bins, and quantizing speed values into the speed bins forming a speed histogram for each of the multichannel pixels.

7. The method (100) of any one of claims 3 to 6, comprising concatenating (118) the trajectory image channel, the bearing image channel, and the speed image channel into the concatenated trajectory image (34) before classifying (130) the road segment (12).

8. The method (100) of claim 7, further comprising applying a smoothing filter (131) on the concatenated trajectory image (34) before classifying (130) the road segment (12).

9. The method (100) of claim 7 or claim 8, further comprising applying image rotation (133) until the road segment (12) in the concatenated trajectory image (34) is aligned with the road segment (12) in the satellite image (40) before classifying (130) the road segment (12).

10. The method (100) of any one of claims 7 to 9, wherein the trained classifier (61) comprises:

a trajectory neural network stream (S1);

a satellite image neural network stream (S2); and

a fully connected layer (FC1) for receiving input from the trajectory neural network stream (S1) and the satellite image neural network stream (S2) and outputting a fused stream (FS1),

wherein the classifying comprises inputting the concatenated trajectory image (34) into the trajectory neural network stream (S1), and

inputting the satellite image (40) in the satellite image neural network stream (S2).

11. The method (100) of claim 10, wherein the trajectory neural network stream (S1) is configured to process a multiple trajectory images of a same geographical area (10) comprising different times, wherein the multiple trajectory images include the concatenated trajectory image (34).

12. The method (100) of any one of the previous claims, wherein the trained classifier (61) comprises a Convolutional Neural Network.

13. The method (100) of claim 12 wherein the trained classifier (61) comprises:

a first group comprising 2 first convolutional layers, followed by

a second group comprising 3 second convolutional layers, followed by

a max pooling layer, followed by

a third group comprising 2 fully connected layers, followed by

an output layer;

wherein each convolutional layer of the first group and the second group is followed by an activation unit, and

wherein each fully connected layer of the third group is followed by a respective activation unit.

14. A data processing system (60) for predicting one or more road attributes (20) corresponding to a road segment (12) in a geographical area (10), the data processing system (60) comprising:

a first memory configured to store trajectory data (30) of the geographical area (10);

a second memory configured to store a satellite image (40) of the geographical area (10);

a processor configured to calculate two or more image channels (32) based on the trajectory data (30); and

a trained classifier (61) comprising: a neural network configured to predict the road attributes (20) based on the two or more image channels (32) and the satellite image (40), and

an output layer configured to classify an output of the neural network into prediction probabilities of the road attributes (20),

wherein the system (60) is configured to concatenate the two or more image channels (32) into a concatenated trajectory image (34) before classifying the road segment (12), and

wherein the trained classifier (61) is configured to fuse the satellite image (40) and the concatenated trajectory image (34) into a fused image and input the fused image in a neural network stream of the trained classifier (61).

15. The data processing system (60) of claim 14, wherein the trained classifier (61) comprises:

a trajectory neural network stream (S1);

a satellite image neural network stream (S2); and

a fully connected layer (FC1) for receiving input from the trajectory neural network stream (S1) and the satellite image neural network stream (S2) and outputting a fused stream (FS1),

wherein the trained classifier (61) is configured to classify when the concatenated trajectory image (34) is input into the trajectory neural network stream (S1), and

the satellite image (40) is input in the satellite image neural network stream (S2).

16. The data processing system (60) of claim 15, wherein the trajectory neural network stream (S1) is configured to process multiple trajectory images of a same geographical area (10) comprising different times, wherein the multiple trajectory images include the concatenated trajectory image (34).

17. The data processing system (60) of any one of claims 14 to 16, wherein the trained classifier (61) comprises a Convolutional Neural Network.

18. A non-transitory computer-readable medium storing computer executable code comprising instructions for predicting one or more road attributes according to the method of any one of claims 1 to 13.

19. A computer executable code comprising instructions for predicting one or more road attributes according to the method of any one of claims 1 to 13.