CLAIMS

1. A method of vehicle classification, comprising:

generating a signal waveform from a signal in a single inductive loop generated by a passing vehicle;

comparing the signal waveform to a first plurality of model waveforms, wherein each model waveform is associated with a respective class of vehicle;

determining a first model waveform of the first plurality of model waveforms that matches the signal waveform;

outputting data indicating the respective class of vehicle associated with the first model waveform;

comparing the signal waveform to a second plurality of model waveforms, wherein one or more of the classes has two or more subclasses of vehicles, and each of the subclasses has an associated model waveform of the second plurality of model waveforms;

determining a second model waveform of the second plurality of model waveforms that matches the signal waveform; and

outputting data indicating the respective subclass of vehicle associated with the second model waveform.

2. The method of claim 1, wherein each respective class of vehicle has an associated vehicle length value and the method further comprising outputting the vehicle length value associated with the first model waveform.

3. The method of claim 2, further comprising:

determining a duration of the signal waveform;

determining a speed of the vehicle as a function of the duration and the vehicle length value associated with the first model waveform; and

outputting data indicative of the speed of the vehicle.

4. The method of claim 1, further comprising:

determining a duration of the signal waveform;

determining a speed of the vehicle as a function of the duration and a vehicle length value associated with the subclass of vehicle that is associated with the second model waveform; and

outputting data indicative of the speed of the vehicle.

5. The method of claim 1, wherein the determining the first model waveform of the first plurality of model waveforms that matches the signal waveform includes:

comparing a number of negative peaks in the signal waveform to respective numbers of negative peaks in model waveforms of the first plurality of model waveforms; and

determining the first model waveform to be a model waveform of the first plurality of model waveforms having a respective number of negative peaks closest to the number of negative peaks in the signal waveform.

6. The method of claim 5, wherein the determining the second model waveform of the second plurality of model waveforms that matches the signal waveform includes:

comparing the signal waveform to respective limit masks corresponding to the model waveforms of the second plurality of model waveforms;

determining whether or not any of the limit masks cover all points of the signal waveform; and

determining the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask that covers all points of the signal waveform.

7. A system for classifying a vehicle passing a single inductive loop, comprising:

an oscillator coupled to the single inductive loop;

a pulse comparator coupled to the oscillator, the pulse comparator configured to generate a pulse train in response to an output signal from the oscillator;

a processor coupled to the pulse comparator; and

a memory coupled to the processor, wherein the memory is configured with a plurality of model wave forms and with instructions that when executed by the processor cause the processor to perform the method of claim 1.

8. The system of claim 7, wherein each respective class of vehicle has an associated vehicle length value, and the memory is further configured with instructions that when executed by the processor cause the processor to output the vehicle length value associated with the first model waveform.

9. The system of claim 8, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

determine a duration of the signal waveform;

determine a speed of the vehicle as a function of the duration and the vehicle length value associated with the first model waveform; and

output data indicative of the speed of the vehicle.

10. The system of claim 7, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

determine a duration of the signal waveform;

determine a speed of the vehicle as a function of the duration and a vehicle length value associated with the subclass of vehicle that is associated with the second model waveform; and

output data indicative of the speed of the vehicle.

11. The system of claim 7, wherein the instructions that cause the processor to determine the first model waveform of the first plurality of model waveforms that matches the signal waveform include instructions that cause the processor to:

compare a number of negative peaks in the signal waveform to respective numbers of negative peaks in model waveforms of the first plurality of model waveforms; and

determine the first model waveform to be a model waveform of the first plurality of model waveforms having a respective number of negative peaks closest to the number of negative peaks in the signal waveform.

12. The system of claim 11, wherein the instructions that cause the processor to determine the second model waveform of the second plurality of model waveforms that matches the signal waveform include instructions that cause the processor to:

compare the signal waveform to respective limit masks corresponding to the model waveforms of the second plurality of model waveforms;

determine whether or not any of the limit masks cover all points of the signal waveform; and

determine the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask that covers all points of the signal waveform.

13. The system of claim 12, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

determine, in response to determining that none of the limit masks cover all points of the signal waveform, the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask for which a least number of points of the signal waveform fall outside the limit mask.

CLAIMS

What is claimed is:

1. A method of vehicle classification, comprising:

generating a signal waveform from a signal in a single inductive loop generated by a passing vehicle;

comparing the signal waveform to a first plurality of model waveforms, wherein each model waveform is associated with a respective class of vehicle;

determining a first model waveform of the first plurality of model waveforms that matches the signal waveform; and

outputting data indicating the respective class of vehicle associated with the first model waveform.

2. The method of claim 1, wherein each respective class of vehicle has an associated vehicle length value and the method further comprising outputting the vehicle length value associated with the first model waveform.

3. The method of claim 2, further comprising:

determining a duration of the signal waveform;

determining a speed of the vehicle as a function of the duration and the vehicle length value associated with the first model waveform; and

outputting data indicative of the speed of the vehicle.

4. The method of claim 1, wherein the determining the first model waveform of the first plurality of model waveforms that matches the signal waveform includes:

comparing a number of negative peaks in the signal waveform to respective numbers of negative peaks in model waveforms of the first plurality of model waveforms; and

determining the first model waveform to be a model waveform of the first plurality of model waveforms having a respective number of negative peaks closest to the number of negative peaks in the signal waveform.

5. The method of claim 1, further comprising:

comparing the signal waveform to a second plurality of model waveforms, wherein one or more of the classes has two or more subclasses of vehicles, and each of the subclasses has an associated model waveform of the second plurality of model waveforms;

determining a second model waveform of the second plurality of model waveforms that matches the signal waveform; and

outputting data indicating the respective subclass of vehicle associated with the second model waveform.

6. The method of claim 5, wherein each respective subclass of vehicle has an associated vehicle length value and the method further comprising outputting the vehicle length value associated with the subclass of vehicle that is associated with the second model waveform.

7. The method of claim 6, further comprising:

determining a duration of the signal waveform;

determining a speed of the vehicle as a function of the duration and the vehicle length value associated with the subclass of vehicle that is associated with the second model waveform; and

outputting data indicative of the speed of the vehicle.

8. The method of claim 5, wherein the determining the first model waveform of the first plurality of model waveforms that matches the signal waveform includes:

comparing a number of negative peaks in the signal waveform to respective numbers of negative peaks in model waveforms of the first plurality of model waveforms; and

determining the first model waveform to be a model waveform of the first plurality of model waveforms having a respective number of negative peaks closest to the number of negative peaks in the signal waveform.

9. The method of claim 8, wherein the determining the second model waveform of the second plurality of model waveforms that matches the signal waveform includes:

comparing the signal waveform to respective limit masks corresponding to the model waveforms of the second plurality of model waveforms;

determining whether or not any of the limit masks cover all points of the signal waveform; and

determining the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask that covers all points of the signal waveform.

10. The method of claim 9, further comprising:

in response to determining that none of the limit masks cover all points of the signal waveform, determining the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask for which a least number of points of the signal waveform fall outside the limit mask.

11. A system for classifying a vehicle passing a single inductive loop, comprising:

an oscillator coupled to the single inductive loop;

a pulse comparator coupled to the oscillator, the pulse comparator configured to generate a pulse train in response to an output signal from the oscillator;

a processor coupled to the pulse comparator; and

a memory coupled to the processor, wherein the memory is configured with a plurality of model wave forms and with instructions that when executed by the processor cause the processor to:

generate a signal waveform from a signal in the single inductive loop generated by a passing vehicle;

compare the signal waveform to a first plurality of model waveforms, wherein each model waveform is associated with a respective class of vehicle;

determine a first model waveform of the first plurality of model waveforms that matches the signal waveform; and

output data indicating the respective class of vehicle associated with the first model waveform.

12. The system of claim 11, wherein each respective class of vehicle has an associated vehicle length value, and the memory is further configured with instructions that when executed by the processor cause the processor to output the vehicle length value associated with the first model waveform.

13. The system of claim 12, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

determine a duration of the signal waveform;

determine a speed of the vehicle as a function of the duration and the vehicle length value associated with the first model waveform; and

output data indicative of the speed of the vehicle.

14. The system of claim 11, wherein the instructions that cause the processor to determine the first model waveform of the first plurality of model waveforms that matches the signal waveform include instructions that cause the processor to:

compare a number of negative peaks in the signal waveform to respective numbers of negative peaks in model waveforms of the first plurality of model waveforms; and

determine the first model waveform to be a model waveform of the first plurality of model waveforms having a respective number of negative peaks closest to the number of negative peaks in the signal waveform.

15. The system of claim 11, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

compare the signal waveform to a second plurality of model waveforms, wherein one or more of the classes has two or more subclasses of vehicles, and each of the subclasses has an associated model waveform of the second plurality of model waveforms;

determine a second model waveform of the second plurality of model waveforms that matches the signal waveform; and

output data indicating the respective subclass of vehicle associated with the second model waveform.

16. The system of claim 15, wherein each respective subclass of vehicle has an associated vehicle length value, and the memory is further configured with instructions that when executed by the processor cause the processor to output the vehicle length value associated with the subclass of vehicle that is associated with the second model waveform.

17. The system of claim 16, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

determine a duration of the signal waveform;

determine a speed of the vehicle as a function of the duration and the vehicle length value associated with the subclass of vehicle that is associated with the second model waveform; and

output data indicative of the speed of the vehicle.

18. The system of claim 15, wherein the instructions that cause the processor to determine the first model waveform of the first plurality of model waveforms that matches the signal waveform include instructions that cause the processor to:

compare a number of negative peaks in the signal waveform to respective numbers of negative peaks in model waveforms of the first plurality of model waveforms; and

determine the first model waveform to be a model waveform of the first plurality of model waveforms having a respective number of negative peaks closest to the number of negative peaks in the signal waveform.

19. The system of claim 18, wherein the instructions that cause the processor to determine the second model waveform of the second plurality of model waveforms that matches the signal waveform include instructions that cause the processor to:

compare the signal waveform to respective limit masks corresponding to the model waveforms of the second plurality of model waveforms;

determine whether or not any of the limit masks cover all points of the signal waveform; and

determine the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask that covers all points of the signal waveform.

20. The system of claim 19, wherein the memory is further configured with instructions that when executed by the processor cause the processor to:

determine, in response to determining that none of the limit masks cover all points of the signal waveform, the second model waveform to be a model waveform of the second plurality of model waveforms having a corresponding limit mask for which a least number of points of the signal waveform fall outside the limit mask.