

Description of Overall Test Plan

Our project is an amalgamation of several machine learning algorithms that integrate together to construct our application's final output. Therefore, we have decided to begin our testing process by testing each of those components individually with either open source or simulated data. Next, we will move onto testing the combined outputs of our modules. We will test for both expected and unexpected values. In addition, we will be testing the behavior of our output controller as well to ensure that it sends an alert to the car system when an anomaly is detected and otherwise no alerts are sent and the car runs as usual.

Test Case Descriptions

TM 1.1 **Traffic Sign Module Test 1**

TM 1.2 This test will ensure the traffic sign detection supervised model's output is correctly classifying traffic signs.

TM 1.3 This test will use the supervised model to check a set of known signs, which is generated by taking a subset of our unused training data, and compare its results to true/known classification for each sign.

TM 1.4 Inputs: A set of known but unique images of signs.

TM 1.5 Outputs: The model will output the category of sign it thinks it was fed, or an anomalous result if it believes the TMage is an anomaly.

TM 1.6 Normal

TM 1.7 Whitebox

TM 1.8 Performance

TM 1.9 Unit

TM 2.1 **Traffic Sign Module Test 2**

TM 2.2 This test will ensure the traffic sign detection semi-supervised model's output is Correctly classifying traffic signs.

TM 2.3 This test will use the semi-supervised model to check a set of known signs, which is generated by taking a subset of our unused training data, and compare its results to the true/known classification for each sign.

TM 2.4 Inputs: A set of known but unique images of signs.

TM 2.5 Outputs: The model will output the category of sign it thinks it was fed, or an anomalous result if it believes the TMage is an anomaly.

TM 2.6 Normal

TM 2.7 Whitebox

TM 2.8 Performance

TM 2.9 Unit

TM 3.1 **Traffic Sign Module Test 3**

TM 3.2 This test will ensure the traffic sign detection unsupervised model's output is correctly classifying traffic signs.

TM 3.3 This test will use the supervised model to check a set of known signs, which

is generated by taking a subset of our unused training data, and compare its results to the true/known classification for each sign.

- TM 3.4 Inputs: A set of known but unique images of signs.
- TM 3.5 Outputs: The model will output the category of sign it thinks it was fed, or an anomalous result if it believes the TMage is an anomaly.
- TM 3.6 Normal
- TM 3.7 Whitebox
- TM 3.8 Performance
- TM 3.9 Unit

OM 1.1 **Object Detection Module Test 1**

- OM 1.2 This test will ensure the object detection supervised model's output is correctly classifying cars.
- OM 1.3 This test will use the supervised model to check a set of known images of cars, which is generated by taking a subset of our unused training data, and compare its output, including the existence and location of the car, to the known and true classifications for each TMage.
- OM 1.4 Inputs: A set of images of a road containing a car.
- OM 1.5 Outputs: The model will output the identified existence/location of the car.
- OM 1.6 Normal
- OM 1.7 Whitebox
- OM 1.8 Performance
- OM 1.9 Unit

OM 2.1 **Object Detection Module Test 2**

- OM 2.2 This test will ensure the object detection semi-supervised model's output is correctly classifying cars.
- OM 2.3 This test will use the semi-supervised model to check a set of known images of cars, which is generated by taking a subset of our unused training data, and compare its output, including the existence and location of the car, to the known and true classifications for each TMage.
- OM 2.4 Inputs: A set of images of a road containing a car.
- OM 2.5 Outputs: The model will output the identified existence/location of the car.
- OM 2.6 Normal
- OM 2.7 Whitebox
- OM 2.8 Performance
- OM 2.9 Unit

OM 3.1 **Object Detection Module Test 3**

- OM 3.2 This test will ensure the object detection unsupervised model's output is correctly classifying cars.
- OM 3.3 This test will use the unsupervised model to check a set of known images of cars, which is generated by taking a subset of our unused training data, and

compare its output, including the existence and location of the car, to the known and true classifications for each TMage.

- OM 3.4 Inputs: A set of images of a road containing a car.
- OM 3.5 Outputs: The model will output the identified existence/location of the car.
- OM 3.6 Normal
- OM 3.7 Whitebox
- OM 3.8 Performance
- OM 3.9 Unit

GM 1.1 **GPS Module Test 1**

- GM 1.2 This test will ensure the object detection supervised model's output is correctly classifying GPS data as anomalous or non-anomalous.
- GM 1.3 This test will use the supervised model to check a set of known CSV files of GPS data, which is generated by taking a subset of our unused training data and false data, and compare whether it classified an anomaly correctly.
- GM 1.4 Inputs: A set of CSV files containing true and false data.
- GM 1.5 Outputs: The model will output whether the data is anomalous.
- GM 1.6 Normal
- GM 1.7 Whitebox
- GM 1.8 Performance
- GM 1.9 Unit

GM 2.1 **GPS Module Test 2**

- GM 2.2 This test will ensure the object detection unsupervised model's output is correctly classifying GPS data as anomalous or non-anomalous.
- GM 2.3 This test will use the supervised model to check a set of known CSV files of GPS data, which is generated by taking a subset of our unused training data and false data, and compare whether it classified an anomaly correctly.
- GM 2.4 Inputs: A set of CSV files containing true and false data.
- GM 2.5 Outputs: The model will output whether the data is anomalous.
- GM 2.6 Normal
- GM 2.7 Whitebox
- GM 2.8 Performance
- GM 2.9 Unit

FC 1.1 **Module Failure Output Controller Test 1**

- FC 1.2 This test will identify performance of the output controller when a module is failing to provide results.
- FC 1.3 In this test no output will be provided by the traffic sign module, so the output controller will have to make a determination on the data stream based on only two modules.
- FC 1.4 Inputs: The outputs of two modules: object detection and GPS.

FC 1.5 Outputs: The resulting validity of the data stream.
FC 1.6 Boundary
FC 1.7 Blackbox
FC 1.8 Functional
FC 1.9 Integration

FC 2.1 Module Failure Output Controller Test 2

FC 2.2 This test will identify performance of the output controller when a module is failing to provide results.
FC 2.3 In this test no output will be provided by the object detection module, so the output controller will have to make a determination on the data stream based on only two modules.
FC 2.4 Inputs: The outputs of two modules: traffic sign and GPS.
FC 2.5 Outputs: The resulting validity of the data stream.
FC 2.6 Boundary
FC 2.7 Blackbox
FC 2.8 Functional
FC 2.9 Integration

FC 3.1 Module Failure Output Controller Test 3

FC 3.2 This test will identify performance of the output controller when a module is failing to provide results.
FC 3.3 In this test no output will be provided by the GPS module, so the output controller will have to make a determination on the data stream based on only two modules.
FC 3.4 Inputs: The outputs of two modules: traffic sign and object detection.
FC 3.5 Outputs: The resulting validity of the data stream.
FC 3.6 Boundary
FC 3.7 Blackbox
FC 3.8 Functional
FC 3.9 Integration

CO 1.1 Combined Output Controller Test 1

CO 1.2 This test will ensure that the output of the combined output controller matches the ones coming from the modules
CO 1.3 In this test all outputs from the 3 different modules will be set to "true"
CO 1.4 Inputs: The outputs of 3 modules: traffic sign, object detection and gps set to "true"
CO 1.5 Outputs: "No anomaly found"
CO 1.6 Normal
CO 1.7 Whitebox
CO 1.8 Structural
CO 1.9 Integration

CO 2.1 **Combined Output Controller Test 2**

CO 2.2 This test will ensure that the output of the combined output controller matches the ones coming from the modules

CO 2.3 In this test all outputs from the 3 different modules will be set to “false”

CO 2.4 Inputs: The outputs of 3 modules: traffic sign, object detection and gps set to “false”

CO 2.5 Outputs: “Anomaly Detected. Suggest recommended action to the vehicle system”

CO 2.6 Abnormal

CO 2.7 Whitebox

CO 2.8 Structural

CO 2.9 Integration

CO 3.1 **Combined Output Controller Test 3**

CO 3.2 This test will ensure that the output of the combined output controller matches the ones coming from the modules

CO 3.3 In this test outputs from 2 modules will be set to “true” and output from 1 module will be set to “false”

CO 3.4 Inputs: The outputs of any 2 modules will be “true” and 1 module will be “false”

CO 3.5 Outputs: “No anomaly detected”

CO 3.6 Normal

CO 3.7 Whitebox

CO 3.8 Structural

CO 3.9 Integration

CO 4.1 **Combined Output Controller Test 4**

CO 4.2 This test will ensure that the output of the combined output controller matches the ones coming from the modules

CO 4.3 In this test outputs from 2 modules will be set to “false” and output from 1 module will be set to “true”

CO 4.4 Inputs: The outputs of any 2 modules will be “false” and 1 module will be “true”

CO 4.5 Outputs: “Anomaly Detected. Suggest recommended action to the vehicle system”

CO 4.6 Abnormal

CO 4.7 Whitebox

CO 4.8 Functional

CO 4.9 Integration

Test Case Matrix

	Normal/ Abnormal	Blackbox/ Whitebox	Functional/ Performance	Unit/ Integration
TM 1	Normal	Whitebox	Performance	Unit
TM 2	Normal	Whitebox	Performance	Unit
TM 3	Normal	Whitebox	Performance	Unit
OM 1	Normal	Whitebox	Performance	Unit
OM 2	Normal	Whitebox	Performance	Unit
OM 3	Normal	Whitebox	Performance	Unit
GM 1	Normal	Whitebox	Performance	Unit
GM 2	Normal	Whitebox	Performance	Unit
FC 1	Abnormal	Blackbox	Functional	Integration
FC 2	Abnormal	Blackbox	Functional	Integration
FC 3	Abnormal	Blackbox	Functional	Integration
CO 1	Normal	Whitebox	Functional	Integration
CO 2	Abnormal	Whitebox	Functional	Integration
CO 3	Normal	Whitebox	Functional	Integration
CO 4	Abnormal	Whitebox	Functional	Integration