

# Traffic Light Optimisation with Machine Learning

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# Chapter 1

## Hierarchical Index

### 1.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

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com.aegis.aegis.AegisApplication . . . . .	5
Util.AesUtil . . . . .	6
dto.completeDto . . . . .	7
com.aegis.aegis.modal.Generation . . . . .	7
com.aegis.aegis.modal.Intersection . . . . .	8
com.aegis.aegis.dao.IntersectionDAO . . . . .	8
com.aegis.aegis.dao.IntersectionDAOImplemented . . . . .	8
dto.intersectionDto . . . . .	9
dto.intersectionDto2 . . . . .	9
dto.intersectionsDto . . . . .	10
com.aegis.aegis.service.IntersectionService . . . . .	10
com.aegis.aegis.service.IntersetionServiceImplemented . . . . .	10
dto.loginDto . . . . .	11
machineLearning.NeuralNetwork . . . . .	11
machineLearning.NeuralNetworkUtilities . . . . .	15
machineLearning.Neuron . . . . .	16
machineLearning.ReinforcementLearning . . . . .	17
machineLearning.ReplayBuffer . . . . .	18
com.aegis.aegis.modal.Role . . . . .	20
RuntimeException	
exception.BadGatewayException . . . . .	6
exception.BadRequestException . . . . .	7
exception.RecordNotFoundException . . . . .	17
exception.UnauthorizedException . . . . .	25
com.aegis.aegis.controller.SimulationController . . . . .	20
com.aegis.aegis.modal.Statistic2 . . . . .	23
dto.statisticDto . . . . .	24
dto.statisticsDto . . . . .	24
machineLearning.Transition . . . . .	24
com.aegis.aegis.modal.User . . . . .	26
com.aegis.aegis.controller.UserController . . . . .	26
com.aegis.aegis.dao.UserDAO . . . . .	28
com.aegis.aegis.dao.UserDAOImplemented . . . . .	28

dto.userDto . . . . .	29
com.aegis.aegis.service.UserService . . . . .	29
com.aegis.aegis.service.UserServiceImplemented . . . . .	30
Serializable	
com.aegis.aegis.modal.Statistic . . . . .	22
WebSocketServer	
WebSocketEndpoint.WebsocketServer . . . . .	30



## Chapter 2

# Class Index

### 2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

<b>dto.adminDto</b>	5
<b>com.aegis.aegis.AegisApplication</b>	5
<b>Util.AesUtil</b>	6
<b>exception.BadGatewayException</b>	6
<b>exception.BadRequestException</b>	7
<b>dto.completeDto</b>	7
<b>com.aegis.aegis.modal.Generation</b>	7
<b>com.aegis.aegis.modal.Intersection</b>	8
<b>com.aegis.aegis.dao.IntersectionDAO</b>	8
<b>com.aegis.aegis.dao.IntersectionDAOImplemented</b>	8
<b>dto.intersectionDto</b>	9
<b>dto.intersectionDto2</b>	9
<b>dto.intersectionsDto</b>	10
<b>com.aegis.aegis.service.IntersectionService</b>	10
<b>com.aegis.aegis.service.IntersectionServiceImplemented</b>	10
<b>dto.loginDto</b>	11
<b>machineLearning.NeuralNetwork</b>	11
<b>machineLearning.NeuralNetworkUtilities</b>	15
<b>machineLearning.Neuron</b>	16
<b>exception.RecordNotFoundException</b>	17
<b>machineLearning.ReinforcementLearning</b>	17
<b>machineLearning.ReplayBuffer</b>	18
<b>com.aegis.aegis.modal.Role</b>	20
<b>com.aegis.aegis.controller.SimulationController</b>	20
<b>com.aegis.aegis.modal.Statistic</b>	22
<b>com.aegis.aegis.modal.Statistic2</b>	23
<b>dto.statisticDto</b>	24
<b>dto.statisticsDto</b>	24
<b>machineLearning.Transition</b>	24
<b>exception.UnauthorizedException</b>	25
<b>com.aegis.aegis.modal.User</b>	26
<b>com.aegis.aegis.controller.UserController</b>	26
<b>com.aegis.aegis.dao.UserDAO</b>	28
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<b>dto.userDto</b>	29
<b>com.aegis.aegis.service.UserService</b>	29
<b>com.aegis.aegis.service.UserServiceImplemented</b>	30
<b>WebSocketEndpoint.WebsocketServer</b>	30



## Chapter 3

# Class Documentation

### 3.1 dto.adminDto Class Reference

#### Public Member Functions

- void **setRole\_Id** (Integer id)
- Integer **getRole\_Id** ()
- Integer **getId** ()
- void **setId** (Integer id)
- String **getUsername** ()
- void **setUsername** (String username)
- String **getPassword** ()
- void **setPassword** (String password)

#### 3.1.1 Detailed Description

Author

rudo5

The documentation for this class was generated from the following file:

- dto/adminDto.java

### 3.2 com.aegis.aegis.AegisApplication Class Reference

#### Public Member Functions

- String **testCall** ()

## Static Public Member Functions

- static void **main** (String[] args)

The documentation for this class was generated from the following file:

- com/aegis/aegis/AegisApplication.java

## 3.3 Util.AesUtil Class Reference

### Public Member Functions

- **AesUtil** (int keySize, int iterationCount)
- String **decrypt** (String salt, String iv, String passphrase, String ciphertext)

### Static Public Member Functions

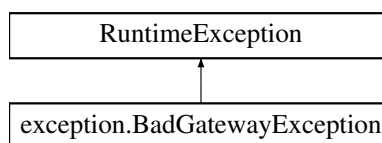
- static byte[] **base64** (String str)
- static byte[] **hex** (String str)

The documentation for this class was generated from the following file:

- Util/AesUtil.java

## 3.4 exception.BadGatewayException Class Reference

Inheritance diagram for exception.BadGatewayException:



### Public Member Functions

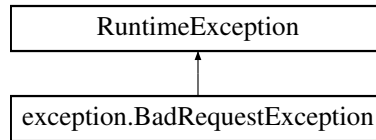
- **BadGatewayException** (String exceptionDetail, String fieldValue)
- String **getExceptionDetail** ()
- Object **getFieldValue** ()

The documentation for this class was generated from the following file:

- exception/BadGatewayException.java

## 3.5 exception.BadRequestException Class Reference

Inheritance diagram for exception.BadRequestException:



### Public Member Functions

- **BadRequestException** (String exceptionDetail, String fieldValue)
- String **getExceptionDetail** ()
- Object **getFieldValue** ()

The documentation for this class was generated from the following file:

- exception/BadRequestException.java

## 3.6 dto.completeDto Class Reference

### Public Member Functions

- int **getNumStationaryCars** ()
- void **setNumStationaryCars** (int cars)
- **statisticDto[]** **getStatistics** ()
- void **setStatistics** ( **statisticDto[]** stats)

The documentation for this class was generated from the following file:

- dto/completeDto.java

## 3.7 com.aegis.aegis.modal.Generation Class Reference

The documentation for this class was generated from the following file:

- com/aegis/aegis/modal/Generation.java

### 3.8 com.aegis.aegis.modal.Intersection Class Reference

#### Public Member Functions

- Integer **getId** ()
- void **setId** (Integer id)
- String **getName** ()
- void **setName** (String name)

The documentation for this class was generated from the following file:

- com/aegis/aegis/modal/Intersection.java

### 3.9 com.aegis.aegis.dao.IntersectionDAO Interface Reference

Inheritance diagram for com.aegis.aegis.dao.IntersectionDAO:



#### Public Member Functions

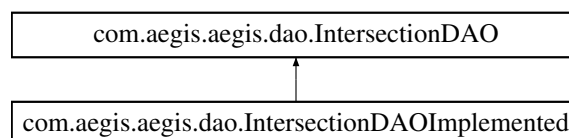
- List< **intersectionDto** > **get** ()
- **intersectionsDto** **get2** ()
- void **addIntersection** ( **intersectionDto** intersection)
- void **addStatistic** ( **statisticDto** statistic)
- void **addStatistic2** ( **statisticDto** statistic)
- **Intersection** **findbyName** (String name)
- void **addGeneration** ()

The documentation for this interface was generated from the following file:

- com/aegis/aegis/dao/IntersectionDAO.java

### 3.10 com.aegis.aegis.dao.IntersectionDAOImplemented Class Reference

Inheritance diagram for com.aegis.aegis.dao.IntersectionDAOImplemented:



## Public Member Functions

- List< **intersectionDto** > **get** ()
- **intersectionsDto** **get2** ()
- void **addIntersection** ( **intersectionDto** i)
- void **addStatistic** ( **statisticDto** s)
- void **addStatistic2** ( **statisticDto** s)
- **Intersection** **findbyName** (String name)
- void **addGeneration** ()

The documentation for this class was generated from the following file:

- com/aegis/aegis/dao/IntersectionDAOImplemented.java

## 3.11 dto.intersectionDto Class Reference

### Public Member Functions

- List< **Statistic** > **getStatistics** ()
- void **setStatistics** (List< **Statistic** > statistics)
- Integer **getTI\_Id** ()
- void **setTI\_Id** (Integer id)
- String **getName** ()
- void **setName** (String name)

The documentation for this class was generated from the following file:

- dto/intersectionDto.java

## 3.12 dto.intersectionDto2 Class Reference

### Public Member Functions

- List< **Statistic2** > **getStatistics** ()
- void **setStatistics** (List< **Statistic2** > statistics)
- Integer **getTI\_Id** ()
- void **setTI\_Id** (Integer id)
- String **getName** ()
- void **setName** (String name)

The documentation for this class was generated from the following file:

- dto/intersectionDto2.java

### 3.13 dto.intersectionsDto Class Reference

#### Public Member Functions

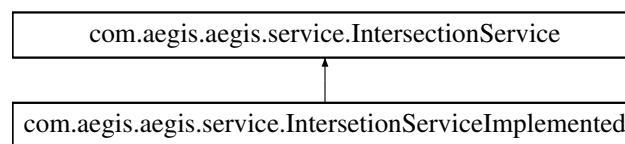
- List< **intersectionDto** > **getAi** ()
- void **setAi** (List< **intersectionDto** > ai)
- List< **intersectionDto2** > **getNormal** ()
- void **setNormal** (List< **intersectionDto2** > normal)

The documentation for this class was generated from the following file:

- dto/intersectionsDto.java

### 3.14 com.aegis.aegis.service.IntersectionService Interface Reference

Inheritance diagram for com.aegis.aegis.service.IntersectionService:



#### Public Member Functions

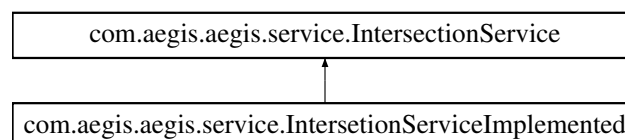
- List< **intersectionDto** > **getIntersections** ()
- **intersectionsDto** **getIntersections2** ()
- void **addIntersection** ( **intersectionDto** i)
- void **addStatistic** ( **statisticDto** statistic)
- void **addStatistic2** ( **statisticDto** statistic)
- void **addGeneration** ()

The documentation for this interface was generated from the following file:

- com/aegis/aegis/service/IntersectionService.java

### 3.15 com.aegis.aegis.service.IntersetionServiceImplented Class Reference

Inheritance diagram for com.aegis.aegis.service.IntersetionServiceImplented:





## Public Member Functions

- List< **intersectionDto** > **getIntersections** ()
- **intersectionsDto** **getIntersections2** ()
- void **addIntersection** ( **intersectionDto** i)
- void **addStatistic** ( **statisticDto** statistic)
- void **addStatistic2** ( **statisticDto** statistic)
- void **addGeneration** ()

The documentation for this class was generated from the following file:

- com/aegis/aegis/service/IntersetionServiceImplemented.java

## 3.16 dto.loginDto Class Reference

### Public Member Functions

- String **getUsername** ()
- void **setUsername** (String username)
- String **getPassword** ()
- void **setPassword** (String password)

#### 3.16.1 Detailed Description

Author

rudo5

The documentation for this class was generated from the following file:

- dto/loginDto.java

## 3.17 machineLearning.NeuralNetwork Class Reference

### Public Member Functions

- **NeuralNetwork** (int numInput, int numOutput, int[] numNodesHiddenLayer)
- void **setBiases** (ArrayList< Double >[] biases)
- ArrayList< Double >[] **getBiases** ()
- void **setWeights** (ArrayList< Double >[] weights)
- ArrayList< Double >[] **getWeights** ()
- int **getNumInput** ()
- int **maxA** (double[] s)
- double **Q** (double[] s, int a)
- double **maxQ** (double[] s)
- void **Backpropagate** (double Q, int action, double loss)
- void **incrementEpoch** ()
- void **Print** ()
- int **getNumberLayers** ()
- String **toString** ()

### 3.17.1 Constructor & Destructor Documentation

#### 3.17.1.1 NeuralNetwork()

```
machineLearning.NeuralNetwork.NeuralNetwork (
    int numInput,
    int numOutput,
    int[] numNodesHiddenLayer )
```

**NeuralNetwork()** (p. 12) - instantiates the neural network.

##### Parameters

<i>numInput</i>	- the number of inputs.
<i>numOutput</i>	- the number of outputs, corresponding to the number of actions.
<i>numNodesHiddenLayer</i>	- an array holding the number of nodes in each hidden layer.
<i>learningRate</i>	- the learning rate.
<i>epsilon</i>	- a threshold for whether the neural network should explore or exploit.

### 3.17.2 Member Function Documentation

#### 3.17.2.1 Backpropagate()

```
void machineLearning.NeuralNetwork.Backpropagate (
    double Q,
    int action,
    double loss )
```

**Backpropagate()** (p. 12) - adjusts the weights and biases of the neural network to reflect the reward.

##### Parameters

<i>Q</i>	- the last Q value
<i>action</i>	- the action that was taken
<i>loss</i>	- the amount to promote demote the action by

levels[numberLayers - 1].get(output).error levels[numberLayers - 1].get(output).output)

#### 3.17.2.2 getBiases()

```
ArrayList<Double> [] machineLearning.NeuralNetwork.getBiases ( )
```

**getBiases()** (p. 12) - gets the biases of the neural network

**Returns**

biases

**3.17.2.3 getNumberLayers()**

```
int machineLearning.NeuralNetwork.getNumberLayers ( )
```

**getNumberLayers()** (p. 13)

**Returns**

the number of layers

**3.17.2.4 getNumInput()**

```
int machineLearning.NeuralNetwork.getNumInput ( )
```

**getNumInput()** (p. 13)

**Returns**

the number of inputs

**3.17.2.5 getWeights()**

```
ArrayList<Double> [ ] machineLearning.NeuralNetwork.getWeights ( )
```

**getWeights()** (p. 13) - get the weights of the neural network.

**Returns**

the weights

**3.17.2.6 maxA()**

```
int machineLearning.NeuralNetwork.maxA (
    double[] s )
```

**maxA()** (p. 13) - performs feed-forward and determines the action with the greatest Q value

**Returns**

an int corresponding to which action should be taken

**3.17.2.7 maxQ()**

```
double machineLearning.NeuralNetwork.maxQ (
    double[] s )
```

**maxQ()** (p. 13) - calculate the maxQ

**Parameters**

<i>s</i>	- state
----------	---------

**Returns**

a double representing the maximum Q value for a state

**3.17.2.8 Print()**

```
void machineLearning.NeuralNetwork.Print ( )
```

**Print()** (p. 14) - Print the Neural Network, including weights and biases.

**3.17.2.9 setBiases()**

```
void machineLearning.NeuralNetwork.setBiases (
    ArrayList< Double >[] biases )
```

**setBiases()** (p. 14) - sets the biases of the neural network.

**Parameters**

<i>biases</i>	
---------------	--

**3.17.2.10 setWeights()**

```
void machineLearning.NeuralNetwork.setWeights (
    ArrayList< Double >[] weights )
```

**setWeights()** (p. 14) - sets the weights of the neural network.

**Parameters**

<i>weights</i>	
----------------	--

**3.17.2.11 toString()**

```
String machineLearning.NeuralNetwork.toString ( )
```

**toString()** (p. 14)

**Returns**

produces a string of the state of the neural network.

The documentation for this class was generated from the following file:

- machineLearning/NeuralNetwork.java

## 3.18 machineLearning.NeuralNetworkUtilities Class Reference

### Public Member Functions

- **NeuralNetworkUtilities** (int[] hl)

### Static Public Member Functions

- static void **saveModelState** ( **NeuralNetwork** nn)
- static **NeuralNetwork** **createNeuralNetwork** ()
- static **NeuralNetwork** **restoreNeuralNetwork** ()
- static void **deleteModel** ()

### Static Public Attributes

- static int **numNumbersData** = 6
- static int **numIntersections** = 6
- static int **numInput**
- static int **numOutput**
- static int[] **hiddenLayers**

### 3.18.1 Member Function Documentation

#### 3.18.1.1 createNeuralNetwork()

```
static NeuralNetwork machineLearning.NeuralNetworkUtilities.createNeuralNetwork ( ) [static]
```

**createNeuralNetwork()** (p. 15)

#### Parameters

<i>target</i>	- boolean indicating whether or not the neural network is the target neural network
---------------	---

**Returns**

the new Neural Network

**3.18.1.2 deleteModel()**

```
static void machineLearning.NeuralNetworkUtilities.deleteModel ( ) [static]
```

**deleteModel()** (p. 16) - Delete the model

**3.18.1.3 restoreNeuralNetwork()**

```
static NeuralNetwork machineLearning.NeuralNetworkUtilities.restoreNeuralNetwork ( ) [static]
```

**Parameters**

<i>target</i>	
---------------	--

**Returns**

a **NeuralNetwork** (p. 11) restored from a file

**3.18.1.4 saveModelState()**

```
static void machineLearning.NeuralNetworkUtilities.saveModelState (
    NeuralNetwork nn ) [static]
```

**saveModelState()** (p. 16) - Save the model state

**Parameters**

<i>nn</i>	- the neural network to save
-----------	------------------------------

The documentation for this class was generated from the following file:

- machineLearning/NeuralNetworkUtilities.java

**3.19 machineLearning.Neuron Class Reference****Public Member Functions**

- double **F** (double n)
- double **F\_Derivative** (double n)

## Public Attributes

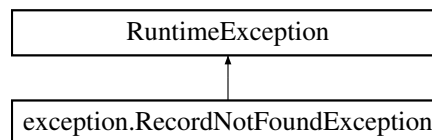
- double **output**

The documentation for this class was generated from the following file:

- machineLearning/Neuron.java

## 3.20 exception.RecordNotFoundException Class Reference

Inheritance diagram for exception.RecordNotFoundException:



## Public Member Functions

- **RecordNotFoundException** (String exceptionDetail, String fieldValue)
- String **getExceptionDetail** ()
- Object **getFieldValue** ()

The documentation for this class was generated from the following file:

- exception/RecordNotFoundException.java

## 3.21 machineLearning.ReinforcementLearning Class Reference

### Public Member Functions

- **ReinforcementLearning** (int[] hl)
- int **getAction** (double[] state, int numStationaryCars)
- void **storeTransitionAndLearn** ( Transition t)
- void **print** ()

## Public Attributes

- **NeuralNetwork** target

### 3.21.1 Member Function Documentation

#### 3.21.1.1 getAction()

```

int machineLearning.ReinforcementLearning.getAction (
    double[] state,
    int numStationaryCars )
  
```

**getAction()** (p. 17) - get the action to take given the state

**Parameters**

<i>state</i>	- the current state of the intersections
<i>numStationaryCars</i>	- the current global number of moving cars

**Returns**

the action

**3.21.1.2 print()**

```
void machineLearning.ReinforcementLearning.print ( )
```

**print()** (p. 18) - prints the neural network in it's current state.

**3.21.1.3 storeTransitionAndLearn()**

```
void machineLearning.ReinforcementLearning.storeTransitionAndLearn (
    Transition t )
```

storeTransition() - stores a transition and samples replay buffer

**Parameters**

<i>t</i>	- the transition to store
----------	---------------------------

The documentation for this class was generated from the following file:

- machineLearning/ReinforcementLearning.java

**3.22 machineLearning.ReplayBuffer Class Reference****Public Member Functions**

- **ReplayBuffer** ()
- **Transition** **getTransition** (int index)
- void **reset** ()
- void **enqueue** ( **Transition** t)
- void **dequeue** ()

**Public Attributes**

- int **occupancy**



### 3.22.1 Constructor & Destructor Documentation

#### 3.22.1.1 ReplayBuffer()

```
machineLearning.ReplayBuffer.ReplayBuffer ( )
```

`replayBuffer()` - instantiates the replay buffer.

### 3.22.2 Member Function Documentation

#### 3.22.2.1 dequeue()

```
void machineLearning.ReplayBuffer.dequeue ( )
```

**dequeue()** (p. 19) - removes a transition tuple from the buffer.

#### 3.22.2.2 enqueue()

```
void machineLearning.ReplayBuffer.enqueue (
    Transition t )
```

**enqueue()** (p. 19) - adds a transition tuple to the buffer.

Parameters

<b>Transition</b> (p. 24)	
---------------------------	--

#### 3.22.2.3 getTransition()

```
Transition machineLearning.ReplayBuffer.getTransition (
    int index )
```

**getTransition()** (p. 19) - gets a transition tuple.

Returns

buffer

### 3.22.2.4 reset()

```
void machineLearning.ReplayBuffer.reset ( )
```

reset - resets the replays buffer's matrix values to 0.

The documentation for this class was generated from the following file:

- machineLearning/ReplayBuffer.java

## 3.23 com.aegis.aegis.modal.Role Class Reference

### Public Member Functions

- String **toString** ()
- Integer **getId** ()
- void **setId** (Integer id)
- String **getName** ()
- void **setName** (String name)

The documentation for this class was generated from the following file:

- com/aegis/aegis/modal/Role.java

## 3.24 com.aegis.aegis.controller.SimulationController Class Reference

### Public Member Functions

- List< **intersectionDto** > **getIntersections** ()
- **intersectionsDto** **getIntersections2** ()
- List< **intersectionDto** > **addStatistic** (@RequestBody **statisticDto** statistic)
- void **addStat** ( **statisticDto** statistic)
- void **addStat2** ( **statisticDto** statistic)
- String **addstatistics** (@RequestBody **completeDto** complete)
- void **addstatistics2** (@RequestBody **completeDto** complete)

### 3.24.1 Member Function Documentation

#### 3.24.1.1 addStat()

```
void com.aegis.aegis.controller.SimulationController.addStat (
    statisticDto statistic )
```

**addStat()** (p. 20) - adds statistics from the intersection data.

## Parameters

<i>statistic</i>	
------------------	--

**3.24.1.2 addStat2()**

```
void com.aegis.aegis.controller.SimulationController.addStat2 (
    statisticDto statistic )
```

**addStat2()** (p. 21) - adds statistics from the intersection data.

## Parameters

<i>statistic</i>	
------------------	--

**3.24.1.3 addStatistic()**

```
List< intersectionDto> com.aegis.aegis.controller.SimulationController.addStatistic (
    @RequestBody statisticDto statistic )
```

**addStatistic()** (p. 21) - adds statistics from the intersection data.

## Parameters

<i>statistic</i>	
------------------	--

**3.24.1.4 addstatistics()**

```
String com.aegis.aegis.controller.SimulationController.addstatistics (
    @RequestBody completeDto complete )
```

**addstatistics()** (p. 21) - adds statistics from the simulation AI.

## Parameters

<i>complete</i>	
-----------------	--

### 3.24.1.5 addstatistics2()

```
void com.aegis.aegis.controller.SimulationController.addstatistics2 (
    @RequestBody completeDto complete )
```

**addstatistics2()** (p. 21) - adds statistics from the simulation AI.

#### Parameters

<i>complete</i>	
-----------------	--

### 3.24.1.6 getIntersections()

```
List< intersectionDto> com.aegis.aegis.controller.SimulationController.getIntersections ( )
```

**getIntersections()** (p. 22) - returns data from the intersection (X direction).

### 3.24.1.7 getIntersections2()

```
intersectionsDto com.aegis.aegis.controller.SimulationController.getIntersections2 ( )
```

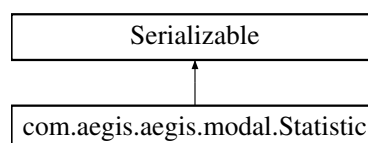
**getIntersections2()** (p. 22) - returns data from the intersection (Z direction).

The documentation for this class was generated from the following file:

- com/aegis/aegis/controller/SimulationController.java

## 3.25 com.aegis.aegis.modal.Statistic Class Reference

Inheritance diagram for com.aegis.aegis.modal.Statistic:



## Public Member Functions

- int **getPhase** ()
- void **setPhase** (int phase)
- Integer **getId** ()
- void **setId** (Integer id)
- Integer **getIntersection\_Id** ()
- void **setIntersection\_Id** (Integer tl\_id)
- java.sql.Timestamp **getTimestamp** ()
- void **setTimestamp** (java.sql.Timestamp timestamp)
- float **getStationaryX** ()
- void **setStationaryX** (float stationary\_vehicles\_X)
- float **getStationaryY** ()
- void **setStationaryY** (float stationary\_vehicles\_Y)
- float **getMovingX** ()
- void **setMovingX** (float moving\_vehicles\_X)
- float **getMovingY** ()
- void **setMovingY** (float moving\_vehicles\_Y)

The documentation for this class was generated from the following file:

- com/aegis/aegis/modal/Statistic.java

## 3.26 com.aegis.aegis.modal.Statistic2 Class Reference

### Public Member Functions

- int **getPhase** ()
- void **setPhase** (int phase)
- Integer **getId** ()
- void **setId** (Integer id)
- Integer **getIntersection\_Id** ()
- void **setIntersection\_Id** (Integer tl\_id)
- java.sql.Timestamp **getTimestamp** ()
- void **setTimestamp** (java.sql.Timestamp timestamp)
- float **getStationaryX** ()
- void **setStationaryX** (float stationary\_vehicles\_X)
- float **getStationaryY** ()
- void **setStationaryY** (float stationary\_vehicles\_Y)
- float **getMovingX** ()
- void **setMovingX** (float moving\_vehicles\_X)
- float **getMovingY** ()
- void **setMovingY** (float moving\_vehicles\_Y)

The documentation for this class was generated from the following file:

- com/aegis/aegis/modal/Statistic2.java

## 3.27 dto.statisticDto Class Reference

### Public Member Functions

- float **getPeriod** ()
- void **setPeriod** (float period)
- int **getPhase** ()
- void **setPhase** (int phase)
- String **getName** ()
- void **setName** (String name)
- float **getStationaryX** ()
- void **setStationaryX** (float stationary\_vehicles\_X)
- float **getStationaryY** ()
- void **setStationaryY** (float stationary\_vehicles\_Y)
- float **getMovingX** ()
- void **setMovingX** (float moving\_vehicles\_X)
- float **getMovingY** ()
- void **setMovingY** (float moving\_vehicles\_Y)

The documentation for this class was generated from the following file:

- dto/statisticDto.java

## 3.28 dto.statisticsDto Class Reference

### Public Member Functions

- List< **statisticDto** > **getAi** ()
- void **setAi** (List< **statisticDto** > ai)
- List< **statisticDto** > **getNormal** ()
- void **setNormal** (List< **statisticDto** > normal)

The documentation for this class was generated from the following file:

- dto/statisticsDto.java

## 3.29 machineLearning.Transition Class Reference

### Public Member Functions

- **Transition** (double[] s\_before, int a, double r, double[] s\_after, double difference)

### Public Attributes

- int **action**
- double[] **state\_before**
- double[] **state\_after**
- double **reward**
- long **id**
- double **difference**

### 3.29.1 Constructor & Destructor Documentation

#### 3.29.1.1 Transition()

```
machineLearning.Transition.Transition (
    double[] s_before,
    int a,
    double r,
    double[] s_after,
    double difference )
```

**Transition()** (p. 25) - instantiates an object containing the transition tuple.

##### Parameters

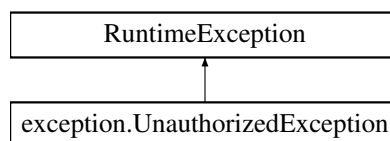
<i>s_before</i>	- state before an action.
<i>a</i>	- action taken.
<i>s_after</i>	- state after an action.
<i>difference</i>	- temporal error difference.

The documentation for this class was generated from the following file:

- machineLearning/Transition.java

## 3.30 exception.UnauthorizedException Class Reference

Inheritance diagram for exception.UnauthorizedException:



### Public Member Functions

- **UnauthorizedException** (String exceptionDetail, String fieldValue)
- String **getExceptionDetail** ()
- Object **getFieldValue** ()

The documentation for this class was generated from the following file:

- exception/UnauthorizedException.java

### 3.31 com.aegis.aegis.modal.User Class Reference

#### Public Member Functions

- **Role** **getRole** ()
- void **setRole** ( **Role** role)
- String **toString** ()
- Integer **getId** ()
- void **setRole\_Id** (Integer id)
- Integer **getRole\_Id** ()
- void **setId** (Integer id)
- String **getUsername** ()
- void **setUsername** (String username)
- String **getPassword** ()
- void **setPassword** (String password)

The documentation for this class was generated from the following file:

- com/aegis/aegis/modal/User.java

### 3.32 com.aegis.aegis.controller.UserController Class Reference

#### Public Member Functions

- List< **User** > **get** ()
- String **changeRole** (@RequestBody **adminDto** admin)
- **User** **get** (@PathVariable int id)
- String **delete** (@PathVariable int id)
- **User** **FindByUsername** (@RequestBody **userDto** username)
- **User** **Login** (@RequestBody **loginDto** login)
- String **Register** (@RequestBody **loginDto** regUser)
- String **RegisterEncrypted** (@RequestBody **loginDto** regUser)

#### 3.32.1 Member Function Documentation

##### 3.32.1.1 changeRole()

```
String com.aegis.aegis.controller.UserController.changeRole (
    @RequestBody adminDto admin )
```

**changeRole()** (p. 26) - changes the role of a user.

#### Parameters

<i>admin</i>	
--------------	--



### 3.32.1.2 delete()

```
String com.aegis.aegis.controller.UserController.delete (
    @PathVariable int id )
```

**delete()** (p. 27) - deletes a specific user based on their id.

#### Parameters

<i>id</i>	
-----------	--

### 3.32.1.3 FindByUsername()

```
User com.aegis.aegis.controller.UserController.FindByUsername (
    @RequestBody userDto username )
```

**findByUsername()** - finds a user based on their username instead of their id.

#### Parameters

<i>username</i>	
-----------------	--

### 3.32.1.4 get()

```
User com.aegis.aegis.controller.UserController.get (
    @PathVariable int id )
```

**getUser()** - returns a specific user.

### 3.32.1.5 Register()

```
String com.aegis.aegis.controller.UserController.Register (
    @RequestBody loginDto regUser )
```

**Register()** (p. 27) - registers a user - not used anymore - replaced by RegisterEncrypted.

#### Parameters

<i>regUser</i>	
----------------	--

### 3.32.1.6 RegisterEncrypted()

```
String com.aegis.aegis.controller.UserController.RegisterEncrypted (
    @RequestBody loginDto regUser )
```

**RegisterEncrypted()** (p. 27) - registers a user - replaces Register method.

Parameters

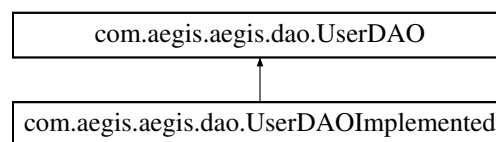
<i>regUser</i>	
----------------	--

The documentation for this class was generated from the following file:

- com/aegis/aegis/controller/UserController.java

## 3.33 com.aegis.aegis.dao.UserDAO Interface Reference

Inheritance diagram for com.aegis.aegis.dao.UserDAO:



### Public Member Functions

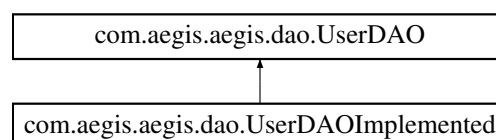
- List< **User** > **get** ()
- **User** **get** (int id)
- void **save** ( **loginDto** user)
- void **saveEncrypted** ( **loginDto** user)
- void **delete** (int id)
- void **changeRole** ( **adminDto** admin)
- **User** **checkLogin** (String username, String password)
- boolean **validate** ( **loginDto** user)
- **User** **findByUsername** (String username)

The documentation for this interface was generated from the following file:

- com/aegis/aegis/dao/UserDAO.java

## 3.34 com.aegis.aegis.dao.UserDAOImplemented Class Reference

Inheritance diagram for com.aegis.aegis.dao.UserDAOImplemented:



## Public Member Functions

- List< **User** > **get** ()
- **User** **get** (int id)
- void **delete** (int id)
- **User** **checkLogin** (String username, String password)
- void **save** ( **loginDto** user)
- void **saveEncrypted** ( **loginDto** encrypted)
- boolean **validate** ( **loginDto** user)
- **User** **findByUsername** (String username)
- void **changeRole** ( **adminDto** admin)

The documentation for this class was generated from the following file:

- com/aegis/aegis/dao/UserDAOImplemented.java

## 3.35 dto.userDto Class Reference

### Public Member Functions

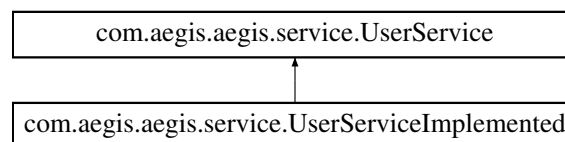
- String **getUsername** ()
- void **setUsername** (String username)

The documentation for this class was generated from the following file:

- dto/userDto.java

## 3.36 com.aegis.aegis.service.UserService Interface Reference

Inheritance diagram for com.aegis.aegis.service.UserService:



### Public Member Functions

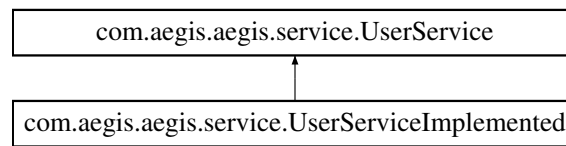
- List< **User** > **getUsers** ()
- **User** **getUser** (int id)
- void **save** ( **loginDto** user)
- void **changeRole** ( **adminDto** admin)
- void **saveEncrypted** ( **loginDto** user)
- void **delete** (int id)
- **User** **checkLogin** (String username, String password)
- **User** **findByUsername** (String username)

The documentation for this interface was generated from the following file:

- com/aegis/aegis/service/UserService.java

### 3.37 com.aegis.aegis.service.UserServiceImplemented Class Reference

Inheritance diagram for com.aegis.aegis.service.UserServiceImplemented:



#### Public Member Functions

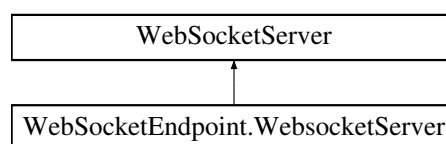
- `List< User > getUsers ()`
- `void changeRole ( adminDto admin)`
- `User getUser (int id)`
- `void save ( loginDto user)`
- `void saveEncrypted ( loginDto user)`
- `void delete (int id)`
- `User checkLogin (String username, String password)`
- `User findByUsername (String username)`

The documentation for this class was generated from the following file:

- `com/aegis/aegis/service/UserServiceImplemented.java`

### 3.38 WebSocketEndpoint.WebsocketServer Class Reference

Inheritance diagram for WebSocketEndpoint.WebsocketServer:



#### Public Member Functions

- `void onOpen (WebSocket ws, ClientHandshake handshake)`
- `void onClose (WebSocket conn, int code, String reason, boolean remote)`
- `void onMessage (WebSocket conn, String message)`
- `void onError (WebSocket conn, Exception ex)`
- `void onStart ()`

The documentation for this class was generated from the following file:

- `WebSocketEndpoint/WebsocketServer.java`

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