



INTERNATIONAL TELEMATICS

INVESTIGATION OF LOCATION BASED SERVICES AND ANALYTICS

NIZAM SHAIK - 5695040

BTECH 451

MID-YEAR PRESENTATION

INTERNATIONAL TELEMATICS LTD.

- Specialises in designing and manufacturing of Telematic solutions for companies with remote assets such as road vehicles
- Ibright – Telematic Computer for Fleet Managers
 - GPS
 - Engine Management Interface
 - Driver Behaviour Monitoring (Swerving, Braking, etc.)

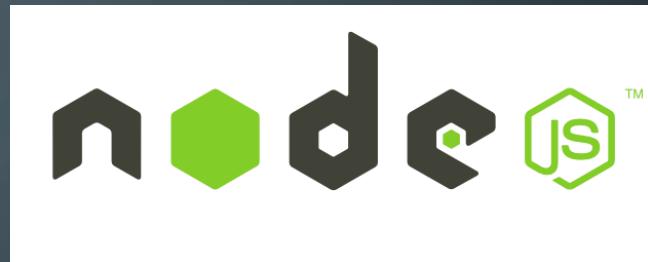


THE PROJECT

- To develop an application to predict truck stop durations at pickup/delivery sites
- Use of previously recorded sample data
 - Truck details
 - Pickup/delivery site details
 - Currently recorded known stop duration of a truck at a site
 - Day and time of the service

NODE.JS AND MONGODB

- What is Node.js?
 - Platform built on Chrome's JavaScript runtime
 - Event-driven and non-blocking I/O model
- What is MongoDB?
 - Open source NoSQL database
 - Document database
 - High performance and easy scalability

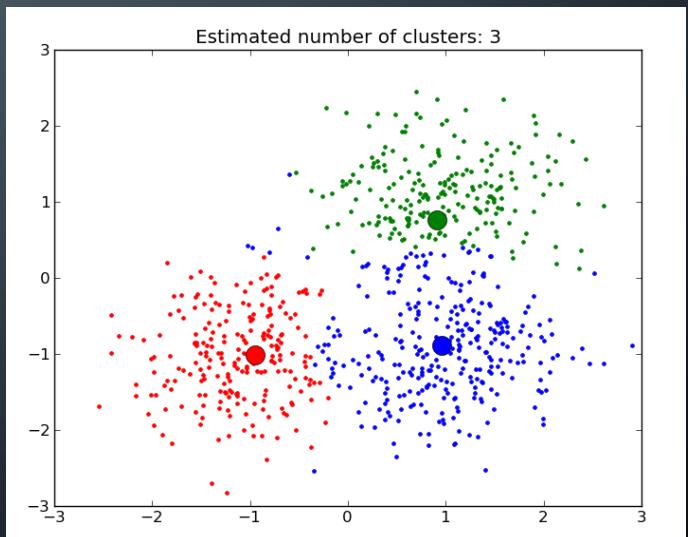


PREDICTION TECHNIQUES

- Data Mining Techniques
 - Supervised Learning
 - Unsupervised Learning
- Cluster Analysis (Unsupervised)
 - Unsure about the data structure
 - Possibility of no error/reward signals to evaluate a solution.
 - Adaptable to changes

CLUSTER ANALYSIS

- Divides data into groups based on relational information in the data
- K-Means Clustering Algorithm
 - Initially choose K number of total clusters/centroids
 - Assign each data object to its nearest cluster/centroid



IMPLEMENTATION METHOD

- Partition the data based on the different Geofences (locations of stops) recorded in the sample data
- Randomly select 5 points in each Geofence Partition – Centroids
- Assign the data objects in each partition to its nearest centroid to form clusters around the centroid
 - Nearest centroids found using Euclidean Distance

IMPLEMENTATION TECHNIQUES

- Euclidean Distance
 - Measure the distance of similarity of two data entries.
 - Each attribute of a data entry has a specific weight of importance
 - Boolean used to measure similarity of non numerical data
- Internal Cluster Validation
 - Silhouette Measure (Average inter-cluster distance measure)
- Final Prediction Evaluation
 - 10-Fold Cross Validation

EUCLIDEAN DISTANCE

- $d(A, B) = \sqrt{w_1(A_1 - B_1)^2 + w_2(A_2 - B_2)^2 \dots + w_n(A_n - B_n)^2}$

Example - Data attributes are VehicleID, Month, and Duration (500s max)

- A = ("1001", June, 400) and B = ("1001", July, 150)

$$\rightarrow \sqrt{0.25(1001 == 1001)^2 + 0.25(June == July)^2 + 0.5(0.8 - 0.3)^2}$$

$$\rightarrow \sqrt{0.25(0)^2 + 0.25(1)^2 + 0.5(0.5)^2}$$

$$\rightarrow \sqrt{0 + 0.25 + 0.125}$$

$$\rightarrow d(A, B) = 0.61 = \text{Distance between data entry A and data entry B}$$

INTERNAL CLUSTER VALIDATION

- **Silhouette Measure**

- $$s(i) = \frac{b(i) - a(i)}{\max\{a(i), b(i)\}}, -1 \leq s(i) \leq 1$$

- $a(i)$ = The average distance of i to all other data entries in its cluster

- $b(i)$ = The distance between i and closest neighbouring cluster

- A positive value of $s(i)$ means that the data entry is appropriately clustered, where a negative values means it is not

MY APPLICATION

BTECH 451

Stop Duration Prediction

STOP DURATION	
Vehicle ID:	
Geofence ID:	
Month:	
Time Period:	
Stop Duration Prediction:	---
<input type="button" value="Generate"/>	

Stop Information

Data Entry	Vehicle ID	Geofence ID	Geogence Category	Arrival Time (NZT)	Departure Time (NZT)	Duration	
1	A91E0C96-5298-480A-ADDC-6EDFA346661F	983055C6-F559-DD11-AF49-001D091BD8DE	Load/Unload	1/06/2013 7:50	1/06/2013 8:01	689	Delete
2	A91E0C96-5298-480A-ADDC-6EDFA346661F	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload	1/06/2013 7:50	1/06/2013 8:01	681	Delete
3	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	1/06/2013 7:51	1/06/2013 8:01	596	Delete
4	A91E0C96-5298-480A-ADDC-6EDFA346661F	983055C6-F559-DD11-AF49-001D091BD8DE	Load/Unload	1/06/2013 8:34	1/06/2013 8:51	1022	Delete
5	A91E0C96-5298-480A-ADDC-6EDFA346661F	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload	1/06/2013 8:34	1/06/2013 8:50	976	Delete
6	A91E0C96-5298-480A-ADDC-6EDFA346661F	BF862EE0-A6D4-DE11-9922-001D091BD8DE	Load/Unload	1/06/2013 8:34	1/06/2013 8:42	514	Delete
7	A91E0C96-5298-480A-ADDC-6EDFA346661F	4A36C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	1/06/2013 8:34	1/06/2013 8:44	582	Delete
8	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	1/06/2013 8:44	1/06/2013 8:50	371	Delete
9	A91E0C96-5298-480A-ADDC-6EDFA346661F	16683F4A-7325-DF11-94E2-001D091BD8DE	Service Centre	1/06/2013 9:05	1/06/2013 9:17	724	Delete
10	D5445322-CCF5-499C-B9E1-0E09A3AC695F	798A01BE-E76F-DE11-9922-001D091BD8DE	Load/Unload	4/06/2013 5:07	4/06/2013 6:46	5952	Delete
11	545B1611-7C38-E011-A912-00505681613D	9E839BCD-DDB5-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 5:47	4/06/2013 6:12	1490	Delete
12	D5445322-CCF5-499C-B9E1-0E09A3AC695F	8D1CF87C-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 6:46	4/06/2013 7:00	853	Delete
13	1CE8212F-4701-48AD-A344-951AF1019535	16683F4A-7325-DF11-94E2-001D091BD8DE	Service Centre	4/06/2013 7:28	4/06/2013 7:31	196	Delete
14	A91E0C96-5298-480A-ADDC-6EDFA346661F	8D1CF87C-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 8:02	4/06/2013 8:30	1647	Delete
15	B7A70A11-2A45-E011-B112-00505681613D	8D1CF87C-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 8:38	4/06/2013 11:59	12068	Delete
16	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	8D1CF87C-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 8:40	4/06/2013 9:07	1670	Delete
17	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	1E135C1D-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 9:07	4/06/2013 9:16	497	Delete
18	A91E0C96-5298-480A-ADDC-6EDFA346661F	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload	4/06/2013 9:10	4/06/2013 9:26	1004	Delete
19	A91E0C96-5298-480A-ADDC-6EDFA346661F	A136C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:11	4/06/2013 9:24	806	Delete
20	A91E0C96-5298-480A-ADDC-6EDFA346661F	983055C6-F559-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2627	Delete
21	A91E0C96-5298-480A-ADDC-6EDFA346661F	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2621	Delete
22	A91E0C96-5298-480A-ADDC-6EDFA346661F	4A36C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:31	4/06/2013 9:40	559	Delete
23	A91E0C96-5298-480A-ADDC-6EDFA346661F	BF862EE0-A6D4-DE11-9922-001D091BD8DE	Load/Unload	4/06/2013 9:31	4/06/2013 9:40	507	Delete
24	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload	4/06/2013 9:39	4/06/2013 10:17	2303	Delete
25	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:40	4/06/2013 10:12	1899	Delete
26	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	A136C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:41	4/06/2013 10:17	2171	Delete
27	D5445322-CCF5-499C-B9E1-0E09A3AC695F	798A01BE-E76F-DE11-9922-001D091BD8DE	Load/Unload	4/06/2013 9:43	4/06/2013 10:04	1273	Delete
28	D5445322-CCF5-499C-B9E1-0E09A3AC695F	1E135C1D-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 10:05	4/06/2013 10:11	384	Delete
29	D5445322-CCF5-499C-B9E1-0E09A3AC695F	A3B5ED67-AE00-DF11-9CEB-001D091BD8DE	Load/Unload	4/06/2013 10:13	4/06/2013 10:28	942	Delete

BTECH 451

Stop Duration Prediction

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Vehicle ID:
Geofence ID:
Month:
Time Period:
Stop Duration Prediction: ---
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22	A91E0C96-5298-480A-ADDC-6EDFA346661F	4A36C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:31	4/06/2013 9:40	559	Delete
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24	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload	4/06/2013 9:39	4/06/2013 10:17	2303	Delete
25	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:40	4/06/2013 10:12	1899	Delete
26	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	A136C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload	4/06/2013 9:41	4/06/2013 10:17	2171	Delete
27	D5445322-CCF5-499C-B9E1-0E09A3AC695F	798A01BE-E76F-DE11-9922-001D091BD8DE	Load/Unload	4/06/2013 9:43	4/06/2013 10:04	1273	Delete
28	D5445322-CCF5-499C-B9E1-0E09A3AC695F	1E135C1D-579D-E211-80E0-782BCB2814F2	Queue	4/06/2013 10:05	4/06/2013 10:11	384	Delete
29	D5445322-CCF5-499C-B9E1-0E09A3AC695F	A3B5ED67-AE00-DF11-9CEB-001D091BD8DE	Load/Unload	4/06/2013 10:13	4/06/2013 10:28	942	Delete

The page at localhost:3000 says

Generate stop predictions

09

Can

BTECH 451

Stop Duration Prediction

STOP DURATION

Vehicle ID:

Geofence ID:

Month:

Time Period:

Stop Duration Prediction:

Stop Information

Data Entry	Vehicle ID	Geofence ID	Month	Time Period	Stop Duration Prediction
1	A91E0C96-5298-480A-ADDC-6EDFA346661F	983055C6-F559-DD11-AF49-001D091BD8DE	2769		
2	A91E0C96-5298-480A-ADDC-6EDFA346661F	B064F76C-8177-E111-AAA3-782BCB2814F2	3564		
3	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE	2366		
4	A91E0C96-5298-480A-ADDC-6EDFA346661F	BF862EE0-A6D4-DE11-9922-001D091BD8DE	2366		
5	A91E0C96-5298-480A-ADDC-6EDFA346661F	4A36C7E9-C93C-DD11-AF49-001D091BD8DE	2338		
6	A91E0C96-5298-480A-ADDC-6EDFA346661F	16683F4A-7325-DF11-94E2-001D091BD8DE	368		
7	A91E0C96-5298-480A-ADDC-6EDFA346661F	798A01BE-E76F-DE11-9922-001D091BD8DE	550		
8	A91E0C96-5298-480A-ADDC-6EDFA346661F	9E839BCD-DDB5-DD11-AF49-001D091BD8DE	291		
9	A91E0C96-5298-480A-ADDC-6EDFA346661F	8D1CF87C-579D-E211-80E0-782BCB2814F2	2439		
10	A91E0C96-5298-480A-ADDC-6EDFA346661F	1E135C1D-579D-E211-80E0-782BCB2814F2	3316		
11	A91E0C96-5298-480A-ADDC-6EDFA346661F	A136C7E9-C93C-DD11-AF49-001D091BD8DE	731		
12	A91E0C96-5298-480A-ADDC-6EDFA346661F	A3B5ED67-AE00-DF11-9CEB-001D091BD8DE	132		
13	A91E0C96-5298-480A-ADDC-6EDFA346661F	14243A2F-9677-E011-8795-00505681613D	77		
14	A91E0C96-5298-480A-ADDC-6EDFA346661F	A5979B3E-008E-DF11-8C3C-001D091BD8DE	58		
15	A91E0C96-5298-480A-ADDC-6EDFA346661F	3BFBEB753-C3B9-DD11-AF49-001D091BD8DE	121		
16	A91E0C96-5298-480A-ADDC-6EDFA346661F	CD21BAF5-C93C-DD11-AF49-001D091BD8DE	178		
17	A91E0C96-5298-480A-ADDC-6EDFA346661F	9C3155C6-F559-DD11-AF49-001D091BD8DE	129		
18	A91E0C96-5298-480A-ADDC-6EDFA346661F	81B1EAAA-77D5-DF11-B4B3-00505681613D	268		
19	A91E0C96-5298-480A-ADDC-6EDFA346661F	42FA2788-24BA-E011-89FF-842B2B6943E3	38		
20	A91E0C96-5298-480A-ADDC-6EDFA346661F	54C0A20D-A20B-DF11-94E2-001D091BD8DE	38		
21	A91E0C96-5298-480A-ADDC-6EDFA346661F	F32ACDDD-C93C-DD11-AF49-001D091BD8DE	21		
22	A91E0C96-5298-480A-ADDC-6EDFA346661F	981BFABB-29E8-E211-926F-782BCB2814F2	6141		
23	A91E0C96-5298-480A-ADDC-6EDFA346661F	49A94DC4-A4D4-DE11-9922-001D091BD8DE	5		
24	A91E0C96-5298-480A-ADDC-6EDFA346661F				
25	A91E0C96-5298-480A-ADDC-6EDFA346661F				
26	A91E0C96-5298-480A-ADDC-6EDFA346661F				
27	A91E0C96-5298-480A-ADDC-6EDFA346661F				
28	A91E0C96-5298-480A-ADDC-6EDFA346661F				
29	A91E0C96-5298-480A-ADDC-6EDFA346661F				

The page at localhost:3000 says:

GEOFENCE PARTITIONS:

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983055C6-F559-DD11-AF49-001D091BD8DE = 2769
B064F76C-8177-E111-AAA3-782BCB2814F2 = 3564
4936C7E9-C93C-DD11-AF49-001D091BD8DE = 2366
BF862EE0-A6D4-DE11-9922-001D091BD8DE = 2366
4A36C7E9-C93C-DD11-AF49-001D091BD8DE = 2338
16683F4A-7325-DF11-94E2-001D091BD8DE = 368
798A01BE-E76F-DE11-9922-001D091BD8DE = 550
9E839BCD-DDB5-DD11-AF49-001D091BD8DE = 291
8D1CF87C-579D-E211-80E0-782BCB2814F2 = 2439
1E135C1D-579D-E211-80E0-782BCB2814F2 = 3316
A136C7E9-C93C-DD11-AF49-001D091BD8DE = 731
A3B5ED67-AE00-DF11-9CEB-001D091BD8DE = 132
14243A2F-9677-E011-8795-00505681613D = 77
A5979B3E-008E-DF11-8C3C-001D091BD8DE = 58
3BFBEB753-C3B9-DD11-AF49-001D091BD8DE = 121
CD21BAF5-C93C-DD11-AF49-001D091BD8DE = 178
9C3155C6-F559-DD11-AF49-001D091BD8DE = 129
81B1EAAA-77D5-DF11-B4B3-00505681613D = 268
42FA2788-24BA-E011-89FF-842B2B6943E3 = 38
54C0A20D-A20B-DF11-94E2-001D091BD8DE = 38
F32ACDDD-C93C-DD11-AF49-001D091BD8DE = 21
981BFABB-29E8-E211-926F-782BCB2814F2 = 6141
49A94DC4-A4D4-DE11-9922-001D091BD8DE = 5
```

 Prevent this page from creating additional dialogs.

Geofence Category	Arrival Time (NZT)	Departure Time (NZT)	Duration	
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	689	Delete
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	681	Delete
Load/Unload	1/06/2013 7:51	1/06/2013 8:01	596	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:51	1022	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:50	976	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:42	514	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:44	582	Delete
Load/Unload	1/06/2013 8:44	1/06/2013 8:50	371	Delete
Service Centre	1/06/2013 9:05	1/06/2013 9:17	724	Delete
Load/Unload	4/06/2013 5:07	4/06/2013 6:46	5952	Delete
Load/Unload	4/06/2013 5:47	4/06/2013 6:12	1490	Delete
Queue	4/06/2013 6:46	4/06/2013 7:00	853	Delete
Service Centre	4/06/2013 7:28	4/06/2013 7:31	196	Delete
Queue	4/06/2013 8:02	4/06/2013 8:30	1647	Delete
Queue	4/06/2013 8:38	4/06/2013 11:59	12068	Delete
Queue	4/06/2013 8:40	4/06/2013 9:07	1670	Delete
Queue	4/06/2013 9:07	4/06/2013 9:16	497	Delete
Load/Unload	4/06/2013 9:10	4/06/2013 9:26	1004	Delete
Load/Unload	4/06/2013 9:11	4/06/2013 9:24	806	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2627	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2621	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	559	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	507	Delete
Load/Unload	4/06/2013 9:39	4/06/2013 10:17	2303	Delete
Load/Unload	4/06/2013 9:40	4/06/2013 10:12	1899	Delete
Load/Unload	4/06/2013 9:41	4/06/2013 10:17	2171	Delete
Load/Unload	4/06/2013 9:43	4/06/2013 10:04	1273	Delete
Queue	4/06/2013 10:05	4/06/2013 10:11	384	Delete
Load/Unload	4/06/2013 10:13	4/06/2013 10:28	942	Delete

BTECH 451

Stop Duration Prediction

STOP DURATION	
Vehicle ID:	
Geofence ID:	
Month:	
Time Period:	
Stop Duration Prediction:	---
<input type="button" value="Generate"/>	

Stop Information

	Data Entry	Vehicle ID	
1	A91E0C96-5298-480A-ADDC-6EDFA346661F	983055C6-F559-DD11-AF49-001D091BD8DE: Centroids = 27373,26269,17116,11890,27915	
2	A91E0C96-5298-480A-ADDC-6EDFA346661F	B064F76C-8177-E111-AAA3-782BCB2814F2: Centroids = 12568,11727,26152,10769,26967	
3	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE: Centroids = 23894,1487,22776,9121,3703	
4	A91E0C96-5298-480A-ADDC-6EDFA346661F	BF862EE0-A6D4-DE11-9922-001D091BD8DE: Centroids = 11349,17220,2648,25561,1276	
5	A91E0C96-5298-480A-ADDC-6EDFA346661F	4A36C7E9-C93C-DD11-AF49-001D091BD8DE: Centroids = 24900,5448,16240,8506,23114	
6	A91E0C96-5298-480A-ADDC-6EDFA346661F	16683F4A-7325-DF11-94E2-001D091BD8DE: Centroids = 14853,14030,1103,9630,8277	
7	A91E0C96-5298-480A-ADDC-6EDFA346661F	798A01BE-E76F-DE11-9922-001D091BD8DE: Centroids = 10356,3450,20738,20506,7082	
8	A91E0C96-5298-480A-ADDC-6EDFA346661F	9E839BCD-DDB5-DD11-AF49-001D091BD8DE: Centroids = 16510,12662,3406,1182,11837	
9	A91E0C96-5298-480A-ADDC-6EDFA346661F	8D1CF87C-579D-E211-80E0-782BCB2814F2: Centroids = 18247,18127,14801,5732,16456	
10	D5445322-CCF5-499C-B9E1-0E09A3AC695F	1E135C1D-579D-E211-80E0-782BCB2814F2: Centroids = 15968,23850,21010,4967,5271	
11	545B1611-7C38-E011-A912-00505681613D		
12	D5445322-CCF5-499C-B9E1-0E09A3AC695F		
13	1CE8212F-4701-48AD-A344-951AF1019535		
14	A91E0C96-5298-480A-ADDC-6EDFA346661F		
15	B7A70A11-2A45-E011-B112-00505681613D		
16	EB756A4F-7D3B-4C0D-828B-B651B54EBA27		
17	EB756A4F-7D3B-4C0D-828B-B651B54EBA27		
18	A91E0C96-5298-480A-ADDC-6EDFA346661F		
19	A91E0C96-5298-480A-ADDC-6EDFA346661F		
20	A91E0C96-5298-480A-ADDC-6EDFA346661F		
21	A91E0C96-5298-480A-ADDC-6EDFA346661F		
22	A91E0C96-5298-480A-ADDC-6EDFA346661F		
23	A91E0C96-5298-480A-ADDC-6EDFA346661F	BF862EE0-A6D4-DE11-9922-001D091BD8DE	Load/Unload
24	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	B064F76C-8177-E111-AAA3-782BCB2814F2	Load/Unload
25	A91E0C96-5298-480A-ADDC-6EDFA346661F	4936C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload
26	EB756A4F-7D3B-4C0D-828B-B651B54EBA27	A136C7E9-C93C-DD11-AF49-001D091BD8DE	Load/Unload
27	D5445322-CCF5-499C-B9E1-0E09A3AC695F	798A01BE-E76F-DE11-9922-001D091BD8DE	Load/Unload
28	D5445322-CCF5-499C-B9E1-0E09A3AC695F	1E135C1D-579D-E211-80E0-782BCB2814F2	Queue
29	D5445322-CCF5-499C-B9E1-0E09A3AC695F	A3B5ED67-AE00-DF11-9CEB-001D091BD8DE	Load/Unload

The page at localhost:3000 says:

GEOFENCE PARTITION MICRO-CLUSTER CENTROIDS:

983055C6-F559-DD11-AF49-001D091BD8DE:

Centroids = 27373,26269,17116,11890,27915

B064F76C-8177-E111-AAA3-782BCB2814F2:

Centroids = 12568,11727,26152,10769,26967

4936C7E9-C93C-DD11-AF49-001D091BD8DE:

Centroids = 23894,1487,22776,9121,3703

BF862EE0-A6D4-DE11-9922-001D091BD8DE:

Centroids = 11349,17220,2648,25561,1276

4A36C7E9-C93C-DD11-AF49-001D091BD8DE:

Centroids = 24900,5448,16240,8506,23114

16683F4A-7325-DF11-94E2-001D091BD8DE:

Centroids = 14853,14030,1103,9630,8277

798A01BE-E76F-DE11-9922-001D091BD8DE:

Centroids = 10356,3450,20738,20506,7082

9E839BCD-DDB5-DD11-AF49-001D091BD8DE:

Centroids = 16510,12662,3406,1182,11837

8D1CF87C-579D-E211-80E0-782BCB2814F2:

Centroids = 18247,18127,14801,5732,16456

1E135C1D-579D-E211-80E0-782BCB2814F2:

Centroids = 15968,23850,21010,4967,5271

 Prevent this page from creating additional dialogs.

OK

Geofence Category	Arrival Time (NZT)	Departure Time (NZT)	Duration	
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	689	Delete
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	681	Delete
Load/Unload	1/06/2013 7:51	1/06/2013 8:01	596	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:51	1022	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:50	976	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:42	514	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:44	582	Delete
Load/Unload	1/06/2013 8:44	1/06/2013 8:50	371	Delete
Service Centre	1/06/2013 9:05	1/06/2013 9:17	724	Delete
Load/Unload	4/06/2013 5:07	4/06/2013 6:46	5952	Delete
Load/Unload	4/06/2013 5:47	4/06/2013 6:12	1490	Delete
Queue	4/06/2013 6:46	4/06/2013 7:00	853	Delete
Service Centre	4/06/2013 7:28	4/06/2013 7:31	196	Delete
Queue	4/06/2013 8:02	4/06/2013 8:30	1647	Delete
Queue	4/06/2013 8:38	4/06/2013 11:59	12068	Delete
Queue	4/06/2013 8:40	4/06/2013 9:07	1670	Delete
Queue	4/06/2013 9:07	4/06/2013 9:16	497	Delete
Load/Unload	4/06/2013 9:10	4/06/2013 9:26	1004	Delete
Load/Unload	4/06/2013 9:11	4/06/2013 9:24	806	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2627	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2621	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	559	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	507	Delete
Load/Unload	4/06/2013 9:39	4/06/2013 10:17	2303	Delete
Load/Unload	4/06/2013 9:40	4/06/2013 10:12	1899	Delete
Load/Unload	4/06/2013 9:41	4/06/2013 10:17	2171	Delete
Load/Unload	4/06/2013 9:43	4/06/2013 10:04	1273	Delete
Queue	4/06/2013 10:05	4/06/2013 10:11	384	Delete
Load/Unload	4/06/2013 10:13	4/06/2013 10:28	942	Delete

BTECH 451

Stop Duration Prediction

STOP DURATION	
Vehicle ID:	
Geofence ID:	
Month:	
Time Period:	
Stop Duration Prediction:	---
<input type="button" value="Generate"/>	

Stop Information

	Vehicle ID
1	A91E0C96-5298-480A-ADDC-6EDFA346661F
2	A91E0C96-5298-480A-ADDC-6EDFA346661F
3	A91E0C96-5298-480A-ADDC-6EDFA346661F
4	A91E0C96-5298-480A-ADDC-6EDFA346661F
5	A91E0C96-5298-480A-ADDC-6EDFA346661F
6	A91E0C96-5298-480A-ADDC-6EDFA346661F
7	A91E0C96-5298-480A-ADDC-6EDFA346661F
8	A91E0C96-5298-480A-ADDC-6EDFA346661F
9	A91E0C96-5298-480A-ADDC-6EDFA346661F
10	D5445322-CCF5-499C-B9E1-0E09A3AC695F
11	545B1611-7C38-E011-A912-00505681613D
12	D5445322-CCF5-499C-B9E1-0E09A3AC695F
13	1CE8212F-4701-48AD-A344-951AF1019535
14	A91E0C96-5298-480A-ADDC-6EDFA346661F
15	B7A70A11-2A45-E011-B112-00505681613D
16	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
17	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
18	A91E0C96-5298-480A-ADDC-6EDFA346661F
19	A91E0C96-5298-480A-ADDC-6EDFA346661F
20	A91E0C96-5298-480A-ADDC-6EDFA346661F
21	A91E0C96-5298-480A-ADDC-6EDFA346661F
22	A91E0C96-5298-480A-ADDC-6EDFA346661F
23	A91E0C96-5298-480A-ADDC-6EDFA346661F
24	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
25	A91E0C96-5298-480A-ADDC-6EDFA346661F
26	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
27	D5445322-CCF5-499C-B9E1-0E09A3AC695F
28	D5445322-CCF5-499C-B9E1-0E09A3AC695F
29	D5445322-CCF5-499C-B9E1-0E09A3AC695F

The page at localhost:3000 says:

GEOFENCE PARTITION MICRO-CLUSTERS:

983055C6-F559-DD11-AF49-001D091BD8DE:
 Micro-Cluster 1 = 547
 Micro-Cluster 2 = 130
 Micro-Cluster 3 = 430
 Micro-Cluster 4 = 697
 Micro-Cluster 5 = 965

B064F76C-8177-E111-AAA3-782BCB2814F2:
 Micro-Cluster 1 = 409
 Micro-Cluster 2 = 516
 Micro-Cluster 3 = 940
 Micro-Cluster 4 = 1148
 Micro-Cluster 5 = 551

4936C7E9-C93C-DD11-AF49-001D091BD8DE:
 Micro-Cluster 1 = 279
 Micro-Cluster 2 = 490
 Micro-Cluster 3 = 802
 Micro-Cluster 4 = 111
 Micro-Cluster 5 = 684

Prevent this page from creating additional dialogs.

OK

Geofence Category	Arrival Time (NZT)	Departure Time (NZT)	Duration	
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	689	Delete
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	681	Delete
Load/Unload	1/06/2013 7:51	1/06/2013 8:01	596	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:51	1022	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:50	976	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:42	514	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:44	582	Delete
Load/Unload	1/06/2013 8:44	1/06/2013 8:50	371	Delete
Service Centre	1/06/2013 9:05	1/06/2013 9:17	724	Delete
Load/Unload	4/06/2013 5:07	4/06/2013 6:46	5952	Delete
Load/Unload	4/06/2013 5:47	4/06/2013 6:12	1490	Delete
Queue	4/06/2013 6:46	4/06/2013 7:00	853	Delete
Service Centre	4/06/2013 7:28	4/06/2013 7:31	196	Delete
Queue	4/06/2013 8:02	4/06/2013 8:30	1647	Delete
Queue	4/06/2013 8:38	4/06/2013 11:59	12068	Delete
Queue	4/06/2013 8:40	4/06/2013 9:07	1670	Delete
Queue	4/06/2013 9:07	4/06/2013 9:16	497	Delete
Load/Unload	4/06/2013 9:10	4/06/2013 9:26	1004	Delete
Load/Unload	4/06/2013 9:11	4/06/2013 9:24	806	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2627	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2621	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	559	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	507	Delete
Load/Unload	4/06/2013 9:39	4/06/2013 10:17	2303	Delete
Load/Unload	4/06/2013 9:40	4/06/2013 10:12	1899	Delete
Load/Unload	4/06/2013 9:41	4/06/2013 10:17	2171	Delete
Load/Unload	4/06/2013 9:43	4/06/2013 10:04	1273	Delete
Queue	4/06/2013 10:05	4/06/2013 10:11	384	Delete
Load/Unload	4/06/2013 10:13	4/06/2013 10:28	942	Delete

BTECH 451

Stop Duration Prediction

STOP DURATION	
Vehicle ID:	
Geofence ID:	
Month:	
Time Period:	
Stop Duration Prediction:	---
<input type="button" value="Generate"/>	

Stop Information

Data Entry	Vehicle ID
1	A91E0C96-5298-480A-ADDC-6EDFA346661F
2	A91E0C96-5298-480A-ADDC-6EDFA346661F
3	A91E0C96-5298-480A-ADDC-6EDFA346661F
4	A91E0C96-5298-480A-ADDC-6EDFA346661F
5	A91E0C96-5298-480A-ADDC-6EDFA346661F
6	A91E0C96-5298-480A-ADDC-6EDFA346661F
7	A91E0C96-5298-480A-ADDC-6EDFA346661F
8	A91E0C96-5298-480A-ADDC-6EDFA346661F
9	A91E0C96-5298-480A-ADDC-6EDFA346661F
10	D5445322-CCF5-499C-B9E1-0E09A3AC695F
11	545B1611-7C38-E011-A912-00505681613D
12	D5445322-CCF5-499C-B9E1-0E09A3AC695F
13	1CE8212F-4701-48AD-A344-951AF1019535
14	A91E0C96-5298-480A-ADDC-6EDFA346661F
15	B7A70A11-2A45-E011-B112-00505681613D
16	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
17	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
18	A91E0C96-5298-480A-ADDC-6EDFA346661F
19	A91E0C96-5298-480A-ADDC-6EDFA346661F
20	A91E0C96-5298-480A-ADDC-6EDFA346661F
21	A91E0C96-5298-480A-ADDC-6EDFA346661F
22	A91E0C96-5298-480A-ADDC-6EDFA346661F
23	A91E0C96-5298-480A-ADDC-6EDFA346661F
24	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
25	A91E0C96-5298-480A-ADDC-6EDFA346661F
26	EB756A4F-7D3B-4C0D-828B-B651B54EBA27
27	D5445322-CCF5-499C-B9E1-0E09A3AC695F
28	D5445322-CCF5-499C-B9E1-0E09A3AC695F
29	D5445322-CCF5-499C-B9E1-0E09A3AC695F

The page at localhost:3000 says:

MICRO-CLUSTER SILHOUTTE MEASURE:

983055C6-F559-DD11-AF49-001D091BD8DE:
 Micro-Cluster 1 = -0.21738068850593809
 Micro-Cluster 2 = -0.19688167658013803
 Micro-Cluster 3 = -0.2398990260227227
 Micro-Cluster 4 = -0.12738201358221762
 Micro-Cluster 5 = 0.03468616368802445

B064F76C-8177-E111-AAA3-782BCB2814F2:
 Micro-Cluster 1 = -0.17445473626430713
 Micro-Cluster 2 = -0.645587195036785
 Micro-Cluster 3 = -0.18999332147853754
 Micro-Cluster 4 = -0.23903043029648202
 Micro-Cluster 5 = 0.03020900016922356

4936C7E9-C93C-DD11-AF49-001D091BD8DE:
 Micro-Cluster 1 = -0.15586132580477502
 Micro-Cluster 2 = -0.1813487182147818
 Micro-Cluster 3 = -0.20553915178323917
 Micro-Cluster 4 = 0.09750480462607905
 Micro-Cluster 5 = -0.1209015266663337

Event Category	Arrival Time (NZT)	Departure Time (NZT)	Duration	
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	689	Delete
Load/Unload	1/06/2013 7:50	1/06/2013 8:01	681	Delete
Load/Unload	1/06/2013 7:51	1/06/2013 8:01	596	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:51	1022	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:50	976	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:42	514	Delete
Load/Unload	1/06/2013 8:34	1/06/2013 8:44	582	Delete
Load/Unload	1/06/2013 8:44	1/06/2013 8:50	371	Delete
Service Centre	1/06/2013 9:05	1/06/2013 9:17	724	Delete
Load/Unload	4/06/2013 5:07	4/06/2013 6:46	5952	Delete
Load/Unload	4/06/2013 5:47	4/06/2013 6:12	1490	Delete
Queue	4/06/2013 6:46	4/06/2013 7:00	853	Delete
Service Centre	4/06/2013 7:28	4/06/2013 7:31	196	Delete
Queue	4/06/2013 8:02	4/06/2013 8:30	1647	Delete
Queue	4/06/2013 8:38	4/06/2013 11:59	12068	Delete
Queue	4/06/2013 8:40	4/06/2013 9:07	1670	Delete
Queue	4/06/2013 9:07	4/06/2013 9:16	497	Delete
Load/Unload	4/06/2013 9:10	4/06/2013 9:26	1004	Delete
Load/Unload	4/06/2013 9:11	4/06/2013 9:24	806	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2627	Delete
Load/Unload	4/06/2013 9:28	4/06/2013 10:12	2621	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	559	Delete
Load/Unload	4/06/2013 9:31	4/06/2013 9:40	507	Delete
Load/Unload	4/06/2013 9:39	4/06/2013 10:17	2303	Delete
Load/Unload	4/06/2013 9:40	4/06/2013 10:12	1899	Delete
Load/Unload	4/06/2013 9:41	4/06/2013 10:17	2171	Delete
Load/Unload	4/06/2013 9:43	4/06/2013 10:04	1273	Delete
Queue	4/06/2013 10:05	4/06/2013 10:11	384	Delete
Load/Unload	4/06/2013 10:13	4/06/2013 10:28	942	Delete

NEXT STAGES

- Improve accuracy of clusters and centroids
- Research and implement techniques to find a final prediction result
- Final evaluation of this final stop prediction

RELATED WORK

- Supervised Vs Unsupervised Learning
 - Chaovalit, P., & Zhou, L. (2005, January). Movie review mining: A comparison between supervised and unsupervised classification approaches. In *Proceedings of the 38th Annual Hawaii International Conference on System Sciences, 2005. HICSS'05.* (pp. 112c-112c). IEEE.
- Clustering for Recommender Systems
 - Zhang, F., Liu, H., & Chao, J. (2010). A Two-stage Recommendation Algorithm Based on K-means Clustering In Mobile E-commerce. *Journal of Computational Information Systems*, 6(10), 3327-3334.
 - Kim, T. H., & Yang, S. B. (2005). An effective recommendation algorithm for clustering-based recommender systems. In *AI 2005: Advances in Artificial Intelligence* (pp. 1150-1153). Springer Berlin Heidelberg.

THANK YOU