EVALUATION OF BEST CHOICE MODE OF TRANSPORTATION

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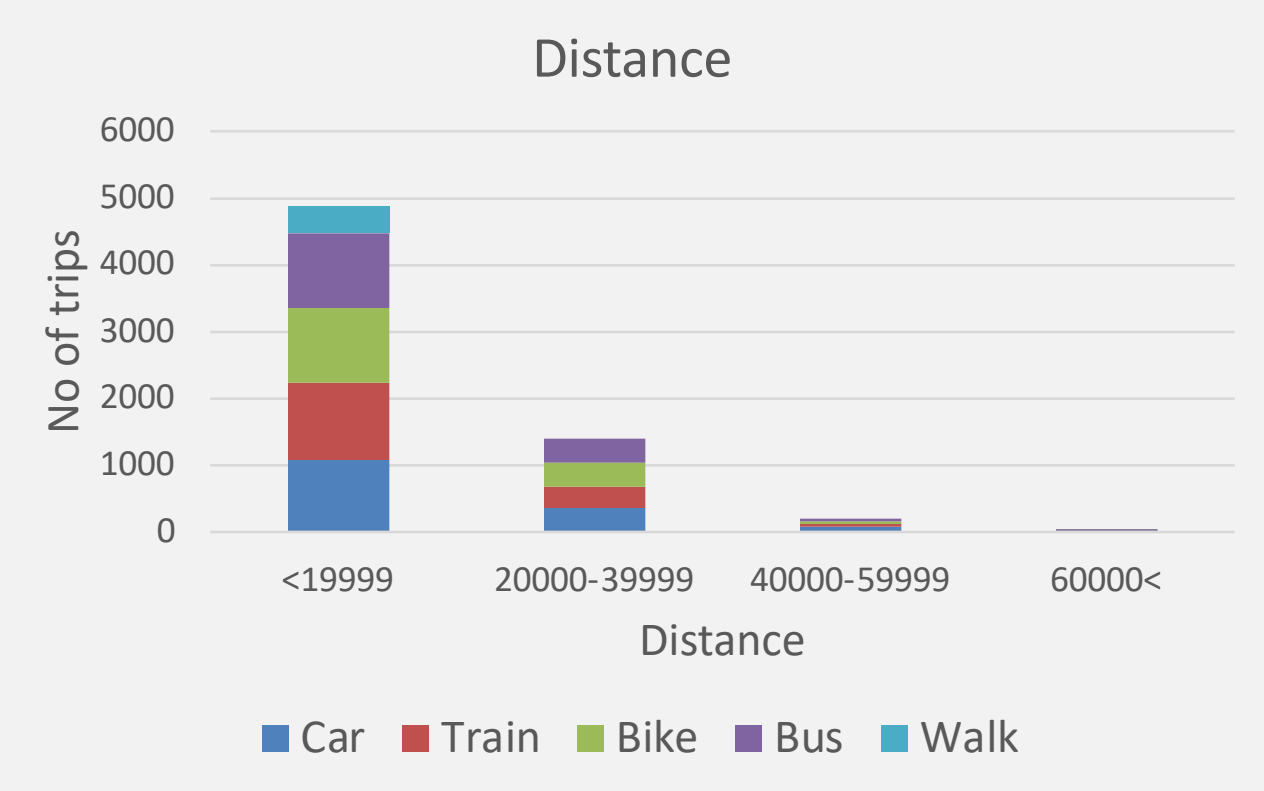
Variable Analysis

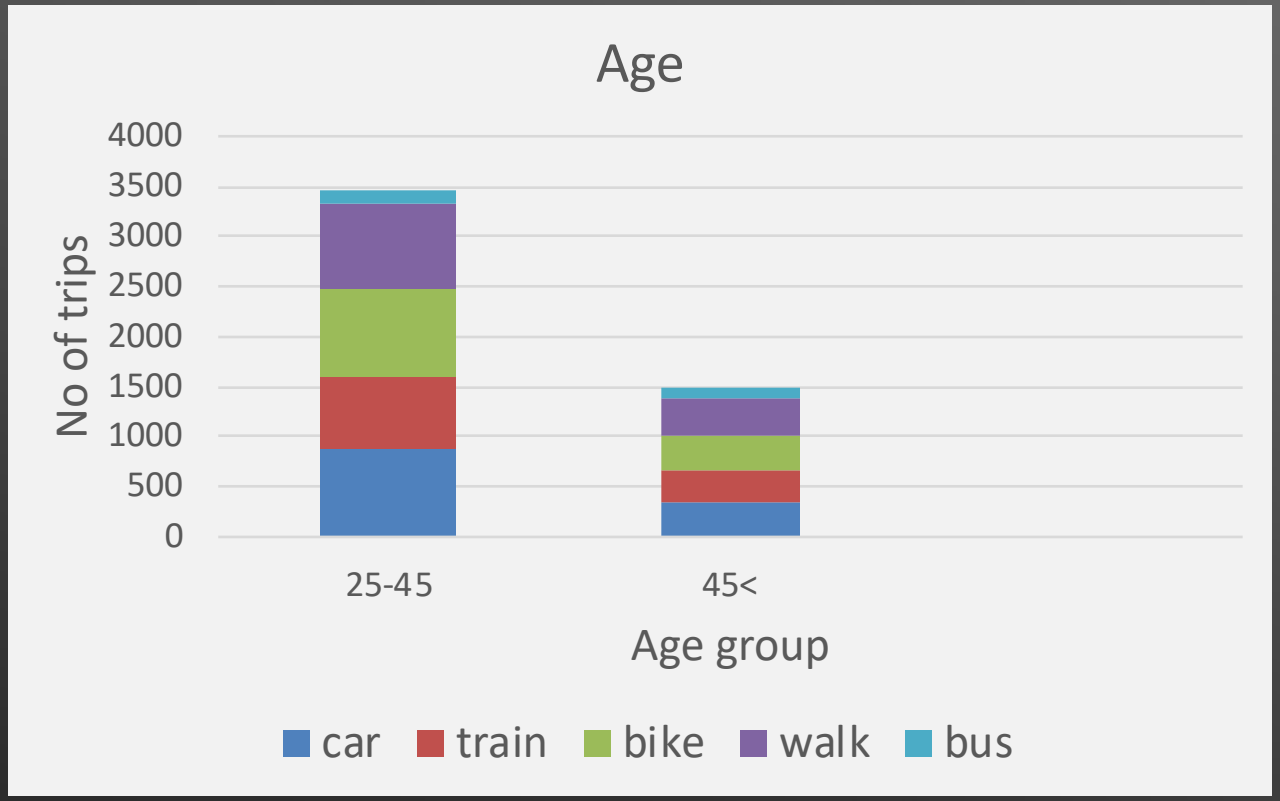
- Distance
- Age
- Gender
- Travel time

Distance



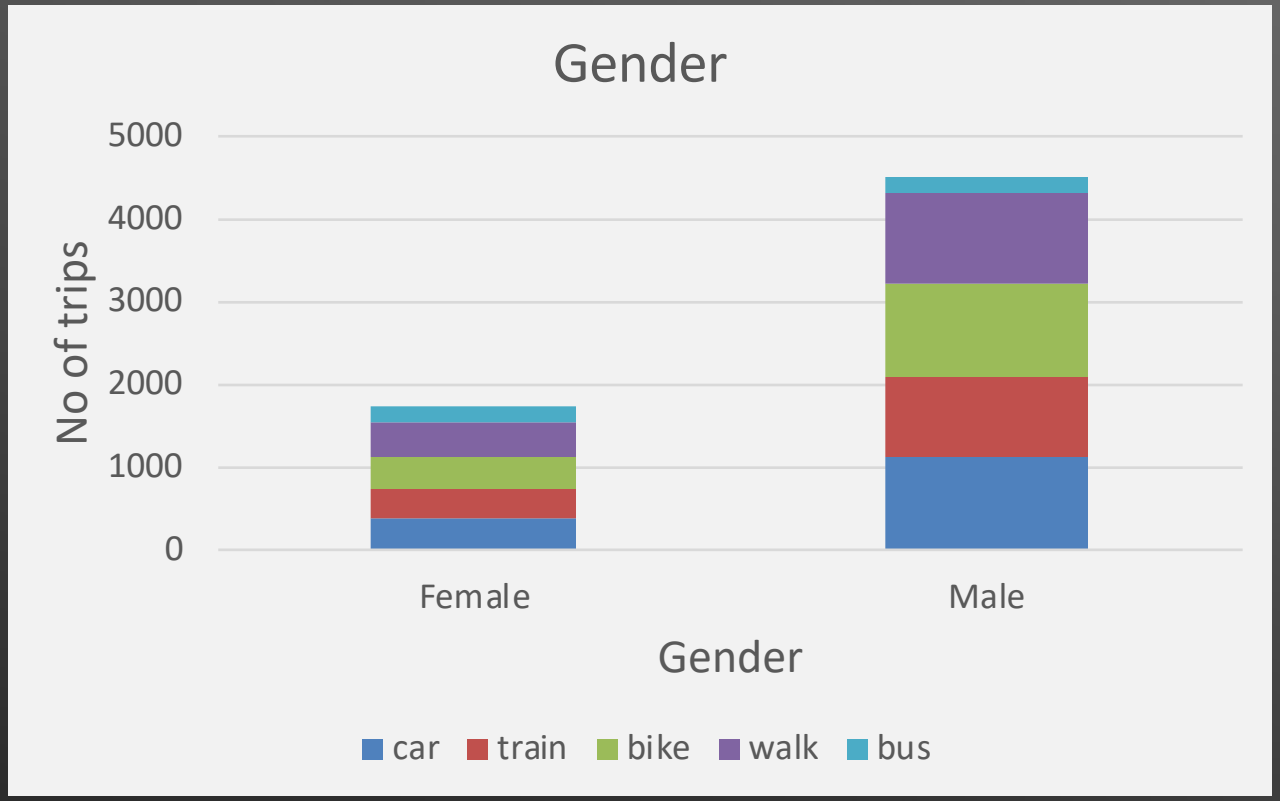
Car and bus use increases with distance

AGE



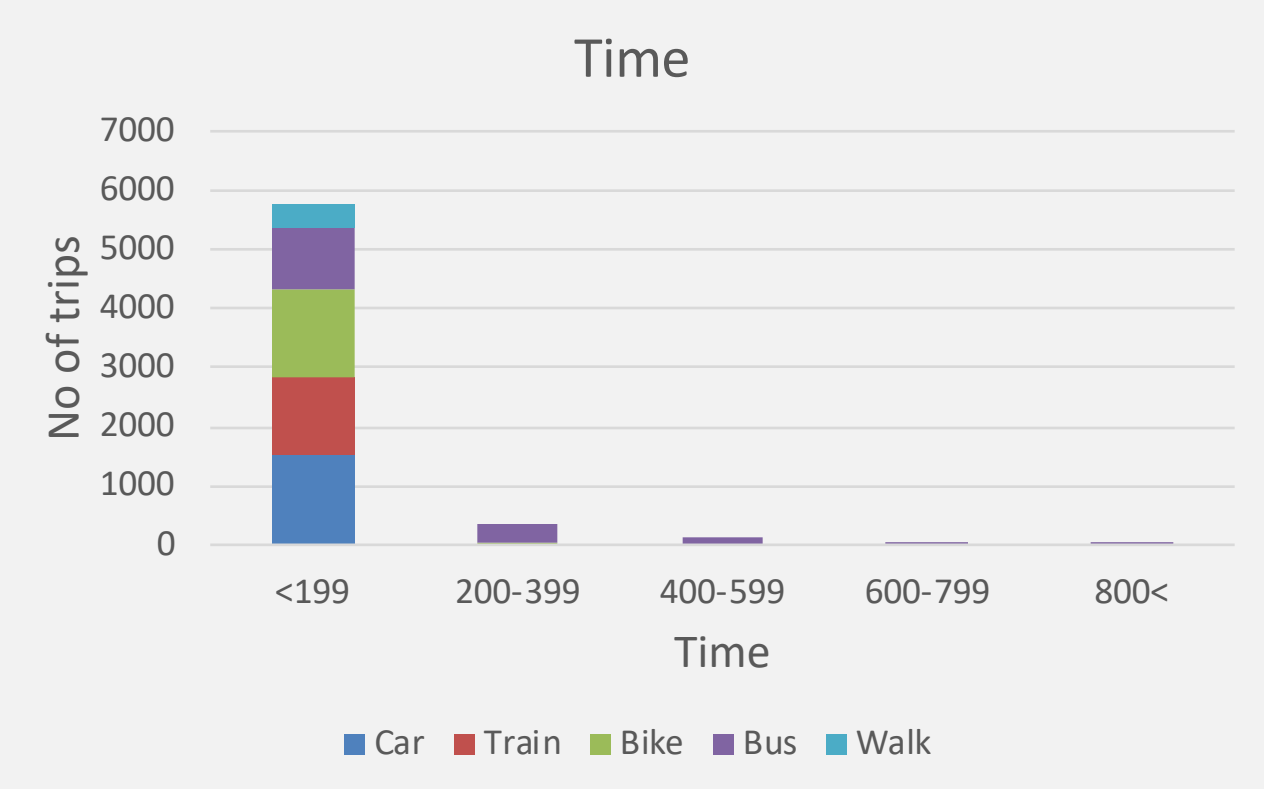
Bus use not depend on age

GENDER



Bus use not depend on gender

TRAVEL TIME



- Bus use increase with time
- Cars, trains, and buses not use for trips when travel time greater than 400min.

Model Structures

1. Travel Time
2. Travel time for different age groups
3. Travel time for gender
4. Travel time + Cost
5. Distance
6. Travel time + Distance
7. Travel time + Distance + cost
8. Travel time + Distance + cost for gender
9. Travel time + Distance + cost for different age groups

RESULTS FROM MULTINOMIAL LOGIT MODEL

1. Travel Time

Utility Function

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-1.3591050	-10.091787
2	ASC_{Bus}	-2.1683782	-11.134657
3	ASC_{Car}	-0.9733654	-9.217448
4	ASC_{Bike}	-1.0260443	-9.838078
5	$\beta_{Travel\ time}$	-7.7243356	-15.917717

Summary statistics

- Number of observations = 1522
- LL(0) = -2135.675
- LL(β) = -1546.092
- -2[LL(0)- LL(β)] = 1179.166
- $\rho 2$ = 0.2760637
- ρ ?2 = 0.2737226
- **Sample direct elasticity for car travel time = -0.993642 %**

2. Travel time for different age groups

Age 25-45

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-1.560022	-8.129202
2	ASC_{Bus}	-4.809834	-6.466323
3	ASC_{Car}	-1.554514	-9.917323
4	ASC_{Bike}	-1.722381	-10.934052
5	$\beta_{Travel\ time}$	-6.727526	-11.088963

Summary statistics

- Number of observations = 788
- LL(0) = -1085.435
- LL(β) = -686.0021
- $\rho 2$ = 0.3679935
- □2 = 0.3633871

Age 45<

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-1.2110011	-4.154739
2	ASC_{Bus}	-0.4991863	-1.897610
3	ASC_{Car}	-0.3346996	-1.512112
4	ASC_{Bike}	-1.6334852	-5.965306
5	$\beta_{Travel\ time}$	-6.8084457	-7.033775

Summary statistics

- Number of observations = 435
- LL(0) = -617.5555
- LL(β) = -427.7145
- $\rho 2$ = 0.3074071
- $\bar{\rho} 2$ = 0.2993106

3. Travel time for gender

Male

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-1.3428932	-8.218913
2	ASC_{Bus}	-4.5146389	-7.304235
3	ASC_{Car}	-0.9164247	-7.217129
4	ASC_{Bike}	-1.5903454	-11.119280
5	$\beta_{Travel\ time}$	-7.4581085	-12.695970

Summary statistics

- Number of observations = 1125
- LL(0) = -1555.243
- LL(β) = -1002.38
- $\rho 2$ = 0.3554831
- $\bar{\rho} 2$ = 0.3522682

Female

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-1.4957595	-5.461912
2	ASC_{Bus}	-1.2460691	-4.995333
3	ASC_{Car}	-1.3120038	-6.053370
4	ASC_{Bike}	-0.3995613	-2.170302
5	$\beta_{Travel\ time}$	-9.5851793	-8.720450

Summary statistics

- Number of observations = 397
- LL(0) = -580.4318
- LL(β) = -478.1551
- $\rho 2$ = 0.1762079
- $\bar{\rho} 2$ = 0.1675936

4. Travel time + Cost

Utility Function

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-1.5364854950	-5.338570
2	ASC_{Bus}	-1.1480917312	-4.594728
3	ASC_{Car}	-1.0728923267	-4.526853
4	ASC_{Bike}	-0.3514945401	-1.883316
5	$\beta_{Travel\ time}$	-5.7768135618	-8.680742
6	β_{Cost}	-0.0003195865	-1.325635

Summary statistics

- Number of observations = 397
- LL(0) = -580.4318
- LL(β) = -477.2585
- -2[LL(0)- LL(β)] = 206.3466
- $\rho 2$ = 0.1777526
- $\bar{\rho} 2$ = 0.1674155
- Sample direct elasticity for car travel time -4.868969%

5. Distance

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	1.216100862	13.8107542
2	ASC_{Bus}	-0.165226744	-0.9181623
3	ASC_{Car}	0.691552369	8.0980831
4	ASC_{Bike}	-0.086918969	-0.9119646
5	$\beta_{Distance}$	0.006085601	3.5834051

Summary statistics

- Number of observations = 1522
- LL(0) = -2135.675
- LL(β) = -1945.341
- $\rho 2$ = 0.08912084
- $\bar{\rho} 2$ = 0.08677966

6. Travel time + Distance

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-0.7636007	-5.069040
2	ASC_{Bus}	-1.1925582	-6.466542
3	ASC_{Car}	-0.4302747	-3.396084
4	ASC_{Bike}	-0.4857189	-4.017920
5	$\beta_{Travel\ time}$	-6.2328696	-16.192172
6	β_{Cost}	0.0108089	6.122338

Summary statistics

- Number of observations = 1522
- LL(0) = -2135.675
- LL(β) = -1563.589
- $\rho 2$ = 0.2678713
- ρ□2 = 0.2678713
- **Sample direct elasticity for car travel time 0.2678713%**

7. Travel time + Distance + cost

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-0.0504824906	-0.3495295
2	ASC_{Bus}	0.4999002249	3.2265689
3	ASC_{Car}	-0.3309842013	-2.4566500
4	ASC_{Bike}	0.2671153894	2.3191231
5	$\beta_{Travel\ time}$	-3.4364515881	-15.4326769
6	β_{Cost}	-0.0002990476	-3.6675902

Summary statistics

- Number of observations = 1522
- LL(0) = -2135.675
- LL(β) = -1629.85
- $\rho 2$ = 0.2368453
- □2 = 0.2335676

8. Travel time + Distance + cost for gender

Female

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-0.697599589	-2.44196556
2	ASC_{Bus}	-0.421216484	-1.29495640
3	ASC_{Car}	-0.494234142	-1.95174489
4	ASC_{Bike}	0.363574659	1.75129665
5	$\beta_{Travel\ time}$	-5.098771113	-8.10928481
6	β_{Cost}	-0.000447685	-0.95108375
7	$\beta_{Distance}$	0.000621226	0.04402392

Summary statistics

- Number of observations = 397
- LL(0) = -580.4318
- LL(β) = -487.7898
- $\rho 2$ = 0.1596087
- $\bar{\rho} 2$ = 0.1475488

Male

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	-0.3494547180	-2.1253135
2	ASC_{Bus}	0.1739895658	0.8666538
3	ASC_{Car}	-0.9134401018	-6.0735835
4	ASC_{Bike}	-1.1200758167	-7.7503658
5	$\beta_{Travel\ time}$	-4.1605190624	-12.5905612
6	β_{Cost}	-0.0005665128	-6.2511649
7	$\beta_{Distance}$	0.0344856703	13.6470230

Summary statistics

- Number of observations = 1125
- LL(0) = -1555.243
- LL(β) = -1022.161
- $\rho 2$ = 0.3427645
- $\bar{\rho} 2$ = 0.3382636

9. Travel time + Distance + cost for different age groups

i. Age 25-45

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	1.0504962898	5.922494
2	ASC_{Bus}	-1.5063019780	-3.321639
3	ASC_{Car}	-0.3929802514	-2.258604
4	ASC_{Bike}	-0.4705268168	-2.832866
5	$\beta_{Travel\ time}$	-1.6205917193	-7.016691
6	β_{Cost}	-0.0005665128	3.421240
7	$\beta_{Distance}$	0.0053125020	1.873024

Summary statistics

- Number of observations = 788
- LL(0) = -1085.435
- LL(β) = -745.9189
- $\rho 2$ = 0.3127929
- $\bar{\rho} 2$ = 0.3063438

ii. Age 45<

Variable Number	Variable Name	Coefficient Estimate	T - Statistic
1	ASC_{Train}	0.2831811644	0.8559505
2	ASC_{Bus}	0.7998620665	2.4333946
3	ASC_{Car}	0.9316001621	3.1940843
4	ASC_{Bike}	-0.3710963561	-1.1658886
5	$\beta_{Travel\ time}$	-2.3937751939	-5.0274815
6	β_{Cost}	-0.0003972218	-2.5180741
7	$\beta_{Distance}$	0.0194819826	4.3097994

Summary statistics

- Number of observations = 435
- LL(0) = -508.1899
- LL(β) = -353.3985
- $\rho 2$ = 0.3045936
- $\bar{\rho} 2$ = 0.2908192

Prediction Of Data Using Random Forest And Cross-Validation

Random Forest - Results

Before Refinement:
Overall Error Rate = 19.65%
Prediction Accuracy = 80.35%

Predicted \ Actual	Bicycle	Bus	Car	Rail	Walk
Bicycle	141	0	15	11	28
Bus	2	27	2	1	3
Car	36	0	351	46	20
Rail	8	2	43	414	11
Walk	21	0	16	4	167

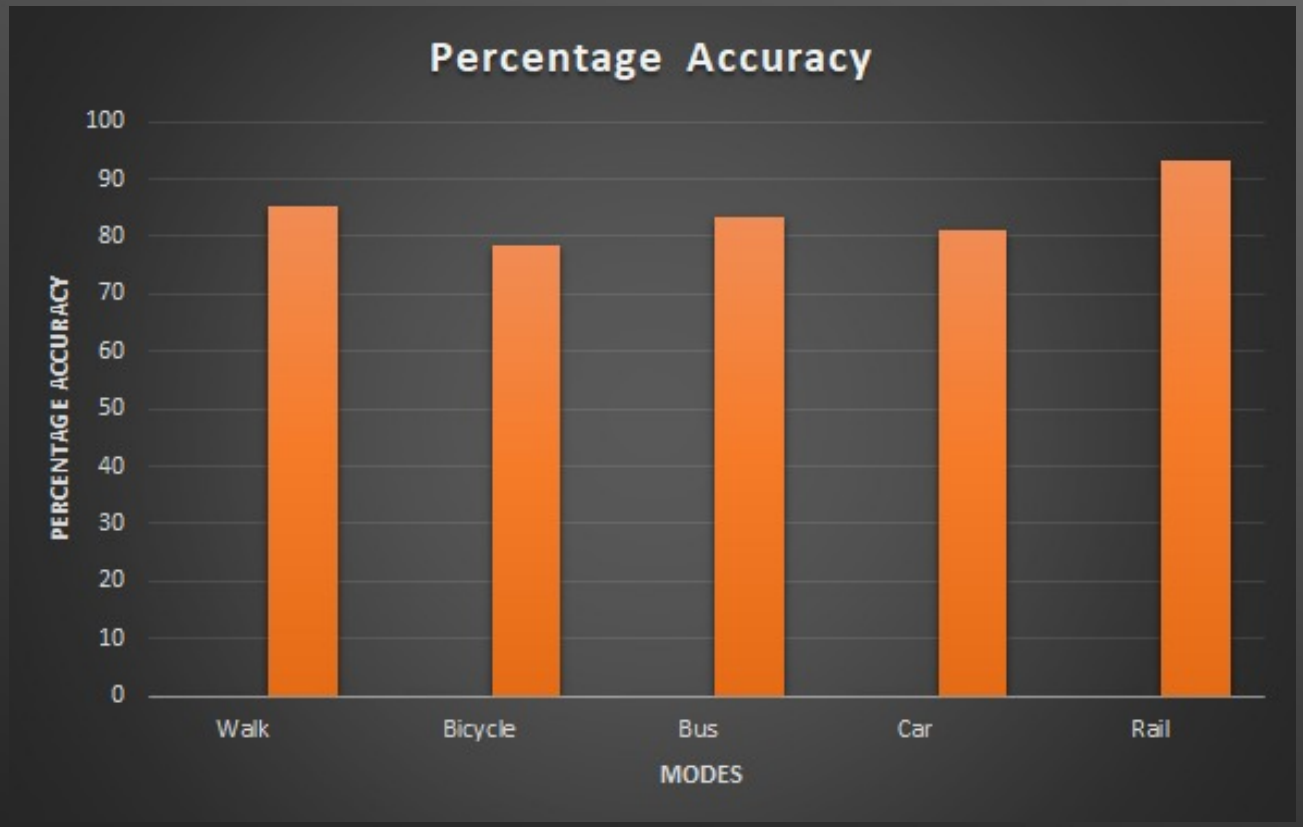
Random Forest – Results cont.

After Refinement:
Overall Error Rate = 18.04%
Prediction Accuracy = 81.96%

Final Output

Predicted \ Actual	Bicycle	Bus	Car	Rail	Walk
Bicycle	141	0	16	7	25
Bus	2	31	2	0	3
Car	34	1	364	45	19
Rail	6	1	43	414	10
Walk	14	0	16	3	172

PERCENTAGE ACCURACY OF EACH MODE



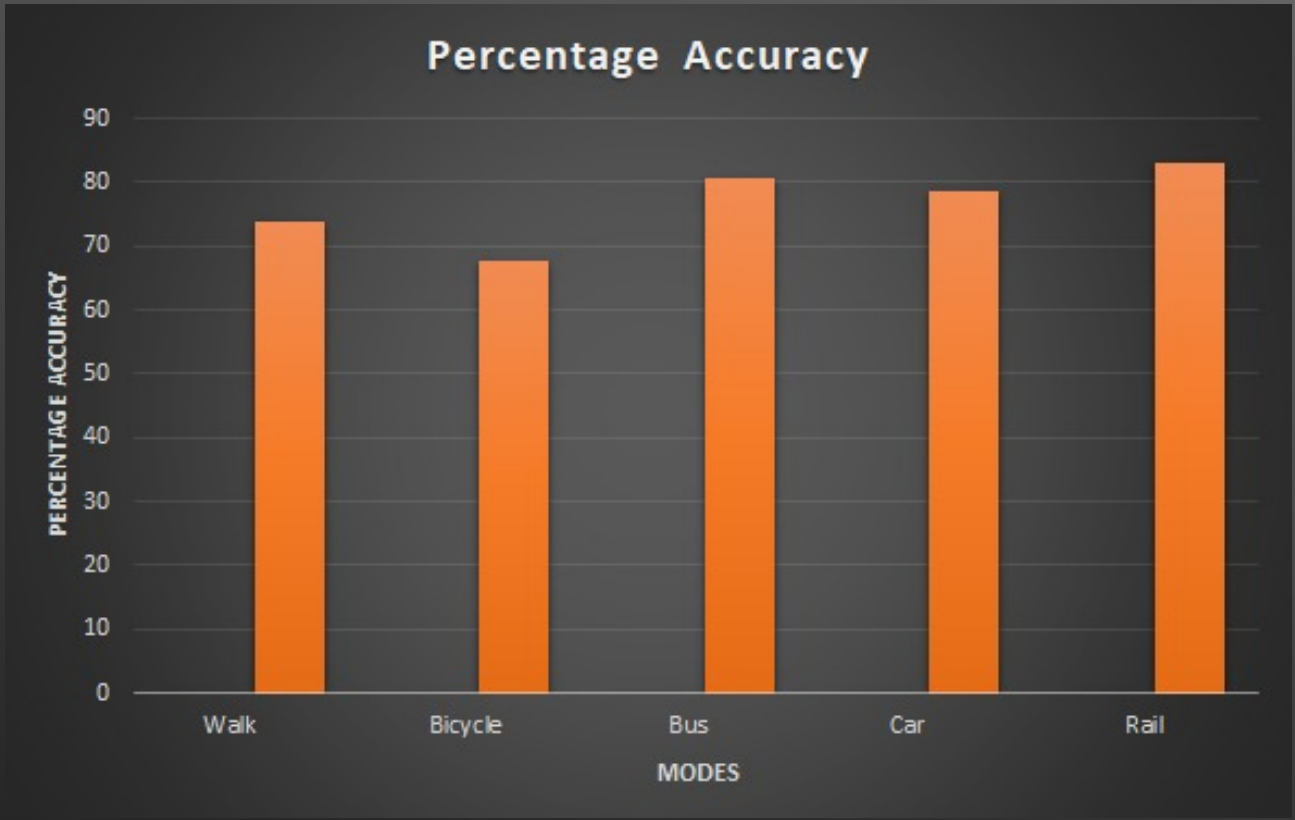
Cross-Validation RESULTS

Results:
Overall Error Rate = 22.15%
Prediction Accuracy = 77.85%

Actua

Predicted	Bicycle	Bus	Car	Rail	Walk
Bicycle	124	3	33	5	18
Bus	2	25	0	3	1
Car	15	0	300	52	14
Rail	11	3	51	358	9
Walk	17	2	26	5	142

PERCENTAGE ACCURACY OF EACH MODE



CONCLUSION

THANK YOU!