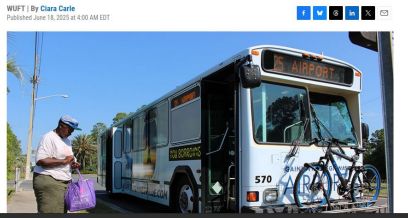


Bus Capacity Prediction

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RTS bus route cuts leave Gainesville riders scrambling for alternatives



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Over the past year, the University of Florida cut millions of dollars from Regional Transit System's (RTS) annual budget, representing a twenty percent decrease. Additionally, more cuts are consistently being proposed. RTS operates bus routes servicing students, faculty, and other members of the Gainesville community [1][2]. Assuming that these cuts are permanent, they present a dire need to optimize the bus system. When making decisions on which routes to cut, consolidate, or shorten (as has all been the case for many routes), it would be highly beneficial to accurately predict the number of passengers on a bus at a given point, so as to prioritize the highly trafficked routes. Unfortunately, bus drivers cannot feasibly be expected to always keep track of their passenger count, as this would require counting both oncomers and ongoers. Instead, drivers are responsible for checking the IDs of oncoming passengers and pressing a button to count each one. Given the count of oncoming passengers, paired with the busses' stop ID, the goal will be to confidently predict the current number of passengers on the bus.

```
43 #defining the pytorch model, layers come from torch module nn.
44 class CNN(nn.Module):
45     def __init__(self):
46         super().__init__()
47         self.conv = nn.Sequential(
48             nn.Conv2d(in_channels = 1, out_channels = 16, kernel_size=2),
49             nn.ReLU(),
50             nn.Conv2d(16, 32, kernel_size=2),
51             nn.ReLU(),
52             self.fc = nn.Sequential(
53                 nn.Linear(64, 16),
54                 nn.ReLU(),
55                 nn.Linear(16, 1))
56         )
57     def forward(self, x):
58         x = x.unsqueeze(1)
59         x = self.conv(x)
60         x = x.view(x.size(0), -1)
61         return self.fc(x)
62
63 model = CNN()
```

Epoch 27/50, Training Loss: 274.8409	Testing Loss: 128.2452
Epoch 28/50, Training Loss: 266.6396	Testing Loss: 125.2736
Epoch 29/50, Training Loss: 259.1278	Testing Loss: 125.8833
Epoch 30/50, Training Loss: 265.8452	Testing Loss: 119.4372
Epoch 31/50, Training Loss: 228.9860	Testing Loss: 116.2234
Epoch 32/50, Training Loss: 226.4443	Testing Loss: 112.1305
Epoch 33/50, Training Loss: 217.2218	Testing Loss: 108.0776
Epoch 34/50, Training Loss: 204.2924	Testing Loss: 104.6854
Epoch 35/50, Training Loss: 196.5613	Testing Loss: 110.0146
Epoch 36/50, Training Loss: 201.5677	Testing Loss: 90.2631
Epoch 37/50, Training Loss: 172.0460	Testing Loss: 96.0120
Epoch 38/50, Training Loss: 180.4486	Testing Loss: 92.5704
Epoch 39/50, Training Loss: 178.8169	Testing Loss: 88.6159
Epoch 40/50, Training Loss: 160.1140	Testing Loss: 87.6441
Epoch 41/50, Training Loss: 149.0189	Testing Loss: 82.8955
Epoch 42/50, Training Loss: 144.0997	Testing Loss: 87.3913
Epoch 43/50, Training Loss: 136.2702	Testing Loss: 88.2055
Epoch 44/50, Training Loss: 134.3125	Testing Loss: 80.4172
Epoch 45/50, Training Loss: 139.4559	Testing Loss: 76.6419
Epoch 46/50, Training Loss: 125.6626	Testing Loss: 73.5708
Epoch 47/50, Training Loss: 101.5869	Testing Loss: 68.3910
Epoch 48/50, Training Loss: 88.7020	Testing Loss: 70.5560
Epoch 49/50, Training Loss: 88.9444	Testing Loss: 64.3768
Epoch 50/50, Training Loss: 78.8759	Testing Loss: 64.3367

Data

	A	B	C	D	E	F	G	H
1	busNumber	stopNumber	stopID	prevCapacity	oncomers	stopName	actualCapacity	
2	33	10	925	12	13	0925 The Hub	15	
3	33	1	1192	15	5	1192 Turlington Hall	20	
4	33	2	1193	20	2	1193 Rawlings Hall	19	
5	33	3	14	19	1	10014 Frazer Rogers Hall	17	
6	33	4	1194	17	0	1194 Commuter Lot	17	
7	33	5	477	17	1	10477 Cancer and Genetics Research Complex	18	
8	33	6	1482	18	0	1482 Lake Alice Conservation Area	18	
9	33	7	478	18	0	04078 JES Lab	18	
10	33	8	1177	18	0	1177 Fifield Hall	18	
11	33	10	1179	18	0	1179 Pugsby Softball Stadium	18	
12	33	11	1180	18	3	1180 Southwest Recreation Center	13	
13	33	12	807	13	0	0807 University Village South	13	
14	33	13	1181	13	0	1181 LE Orthopaedics Institute	12	
15	33	14	1480	12	0	1480 Village Point 4	9	
16	33	15	1486	9	0	1486 Campus Circle Apartments	1	
17	33	16	813	4	0	0813 Kensington North Apartments	1	
18	33	17	814	1	0	0814 Pinetree Gardens Apartments	1	
19	33	18	1271	1	0	1271 Forest Park	1	
20	33	19	1272	1	0	1272 Southfork Oaks	1	
21	33	20	1559	1	0	1559 Butler Plaza North	1	
22	33	21	1493	1	2	1493 Butler Plaza Transfer Station	2	
23	33	22	1555	2	3	1555 Pod @ Plaza Blvd Eastbound	5	
24	33	23	1557	5	5	1557 The Ridge @ SW 38th Ter Northbound	10	
25	33	24	1273	10	3	1273 Sw 38 Ter @ SW 20th Ave	13	
26	33	25	1484	13	5	1484 Varsity House Apartments	18	
27	33	26	1483	18	0	1483 Aloft Hotel @ Hull Rd	18	
28	33	27	1237	18	4	1237 Museum Walk Apartments	22	

Epoch 27/50, Training Loss: 274.8409	Testing Loss: 128.2452	Stop Name: 0814 Pinetree Gardens Apartments Actual Capacity: 1 Predicted Capacity: 4
Epoch 28/50, Training Loss: 266.6396	Testing Loss: 125.2736	Stop Name: 1271 Forest Park Actual Capacity: 2 Predicted Capacity: 5
Epoch 29/50, Training Loss: 259.1278	Testing Loss: 125.8833	Stop Name: 1272 Southfork Oaks Actual Capacity: 2 Predicted Capacity: 6
Epoch 30/50, Training Loss: 265.8452	Testing Loss: 119.4372	Stop Name: 1559 Butler Plaza North Actual Capacity: 3 Predicted Capacity: 6
Epoch 31/50, Training Loss: 228.9860	Testing Loss: 116.2234	Stop Name: 1493 Butler Plaza Transfer Station Actual Capacity: 2 Predicted Capacity: 7
Epoch 32/50, Training Loss: 226.4443	Testing Loss: 112.1305	Stop Name: 1555 Pod @ Plaza Blvd Eastbound Actual Capacity: 5 Predicted Capacity: 7
Epoch 33/50, Training Loss: 217.2218	Testing Loss: 108.0776	Stop Name: 1557 The Ridge @ SW 38th Ter Northbound Actual Capacity: 12 Predicted Capacity: 10
Epoch 34/50, Training Loss: 204.2924	Testing Loss: 104.6854	Stop Name: 1273 Sw 38 Ter @ SW 20th Ave Actual Capacity: 17 Predicted Capacity: 13
Epoch 35/50, Training Loss: 196.5613	Testing Loss: 110.0146	Stop Name: 1484 Varsity House Apartments Actual Capacity: 19 Predicted Capacity: 16
Epoch 36/50, Training Loss: 201.5677	Testing Loss: 90.2631	Stop Name: 1483 Aloft Hotel @ Hull Rd Actual Capacity: 21 Predicted Capacity: 18
Epoch 37/50, Training Loss: 172.0460	Testing Loss: 96.0120	Stop Name: 1237 Museum Walk Apartments Actual Capacity: 23 Predicted Capacity: 18
Epoch 38/50, Training Loss: 180.4486	Testing Loss: 92.5704	Stop Name: 1173 Cultural Plaza Actual Capacity: 19 Predicted Capacity: 20
Epoch 39/50, Training Loss: 178.8169	Testing Loss: 88.6159	Stop Name: 1174 Lacrosse Field Actual Capacity: 21 Predicted Capacity: 17
Epoch 40/50, Training Loss: 160.1140	Testing Loss: 87.6441	Stop Name: 1176 Fifield Hall Actual Capacity: 19 Predicted Capacity: 18
Epoch 41/50, Training Loss: 149.0189	Testing Loss: 82.8955	Stop Name: 0466 IFAS Office and Forestry Field Lab Actual Capacity: 19 Predicted Capacity: 15
Epoch 42/50, Training Loss: 144.0997	Testing Loss: 87.3913	Stop Name: 1481 Cancer and Genetics Research Complex Actual Capacity: 19 Predicted Capacity: 17
Epoch 43/50, Training Loss: 136.2702	Testing Loss: 88.2055	Stop Name: 0467 Cancer and Genetics Research Complex Actual Capacity: 17 Predicted Capacity: 15
Epoch 44/50, Training Loss: 134.3125	Testing Loss: 80.4172	Stop Name: 0468 UF Parking and Transportation Services Actual Capacity: 14 Predicted Capacity: 14
Epoch 45/50, Training Loss: 139.4559	Testing Loss: 76.6419	Stop Name: 0469 Commuter Lot Parking Garage 14 Actual Capacity: 13 Predicted Capacity: 13
Epoch 46/50, Training Loss: 125.6626	Testing Loss: 73.5708	Stop Name: 1253 Graham Hall Actual Capacity: 10 Predicted Capacity: 12
Epoch 47/50, Training Loss: 101.5869	Testing Loss: 68.3910	Stop Name: 1254 Gator Corner Dining Facility @ Gale Lemerand Actual Capacity: 10 Predicted Capacity: 11
Epoch 48/50, Training Loss: 88.7020	Testing Loss: 70.5560	Stop Name: 0966 Welmer Hall College of Journalism Actual Capacity: 6 Predicted Capacity: 10
Epoch 49/50, Training Loss: 88.9444	Testing Loss: 64.3768	Final accuracy with margin of error 0.75: 0.6491228078175439
Epoch 50/50, Training Loss: 78.8759	Testing Loss: 64.3367	(venv) christopher@DELLoris: ~/Documents/725/A/Bus-Capacity-Prediction

