GPS 室内外判别
GPS indoor / outdoor classification

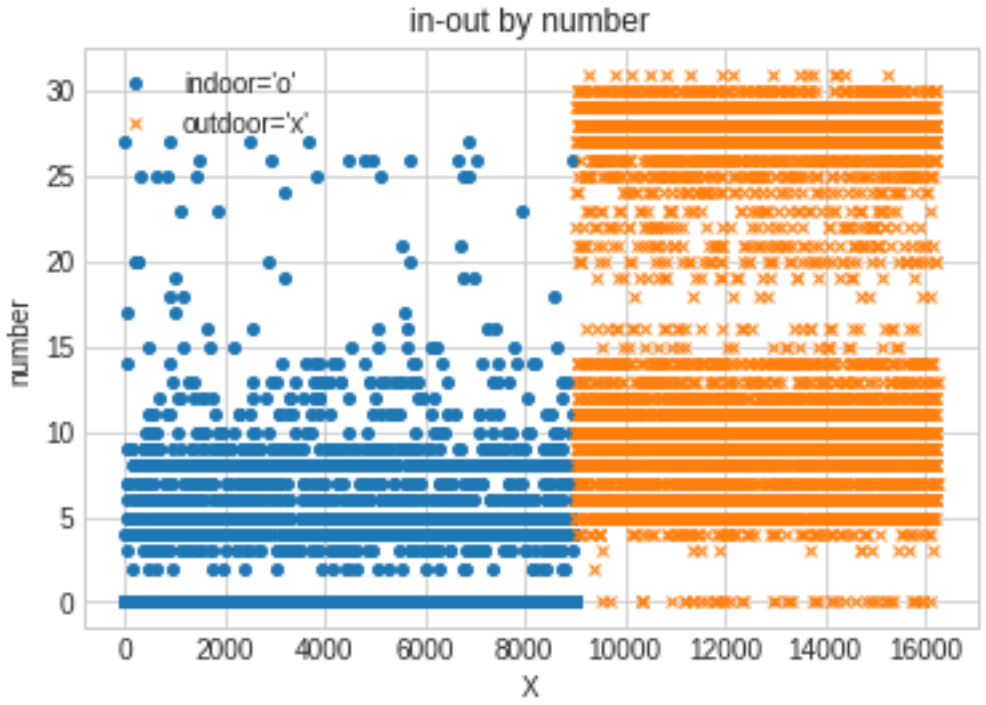
- 特征分析 feature analysis
- 模型 调试 model trials

- Notice: for this project, training data & testing data collected by different people. So there is a need to compare the features between them before deciding which model will be suitable.

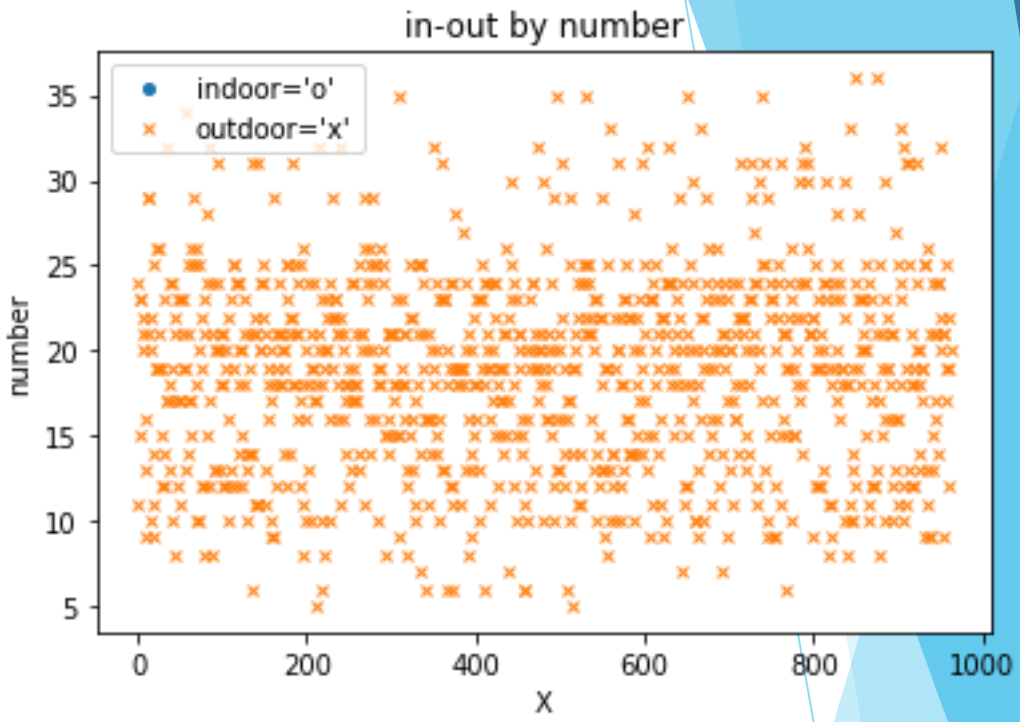
特征分析 - 采集的数据对比
feature analysis, comparisons between training data & testing data

- 12 个 特征的值域， 分布对比 compare the features between training data & testing data
- 地铁室外跑 组 the testing data when subway-train running outdoors
- 地铁站内 组 the testing data when in the subway stations (indoors)
- 其他 组 other main scenes such as streets, communities, stores, buildings, etc.

地铁室外跑 the testing data when subway-train running outdoors

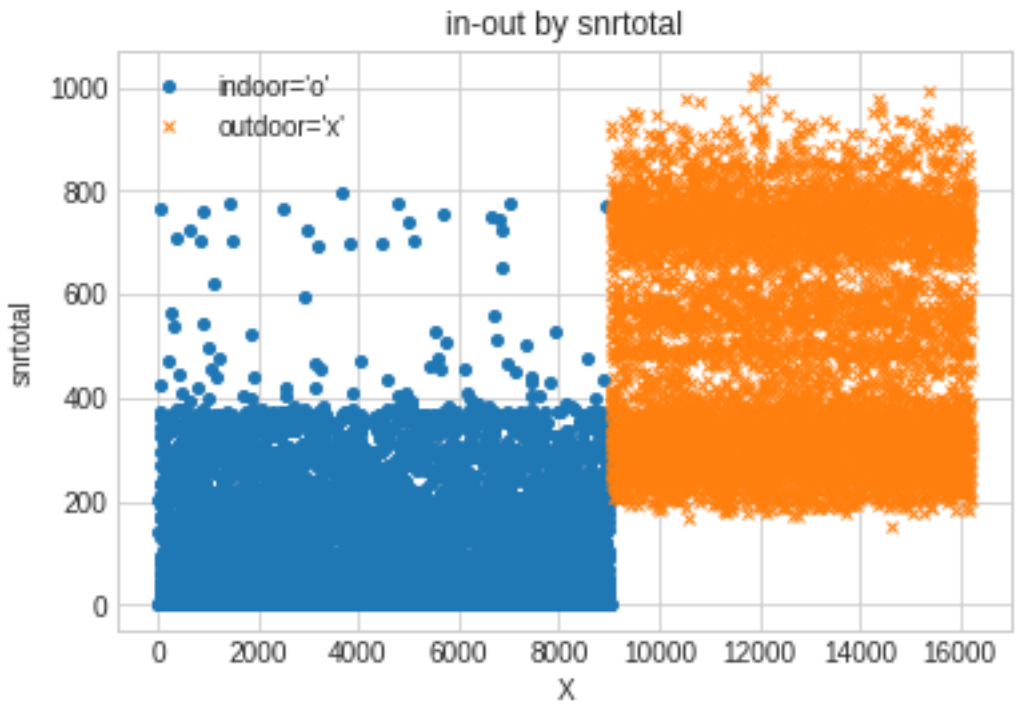


Training data

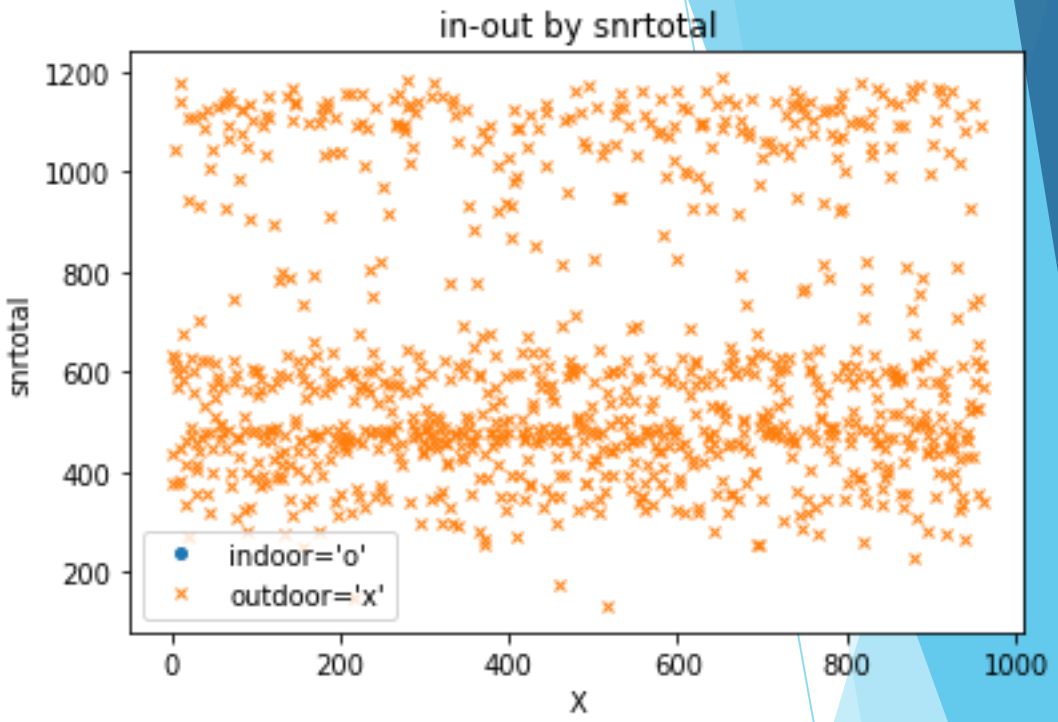


Testing data

特征 1 / feature 1
number: 手机将卫星用于定位的数量



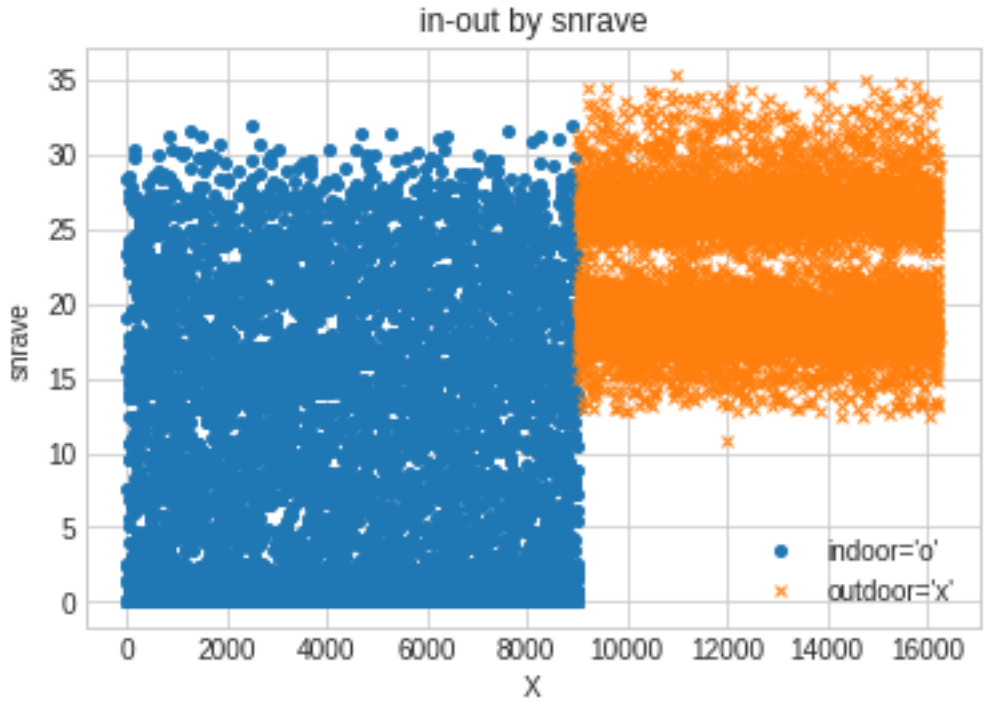
Training data



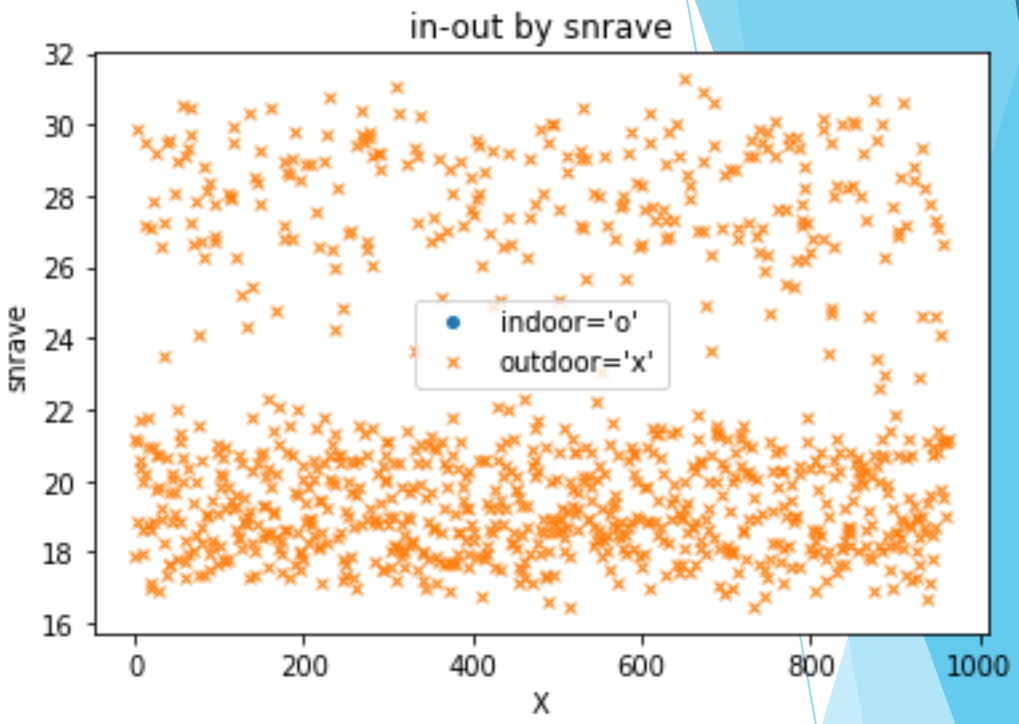
Testing data

特征 2 / feature 2

snrtotal :所有能检测到卫星的信噪比总和



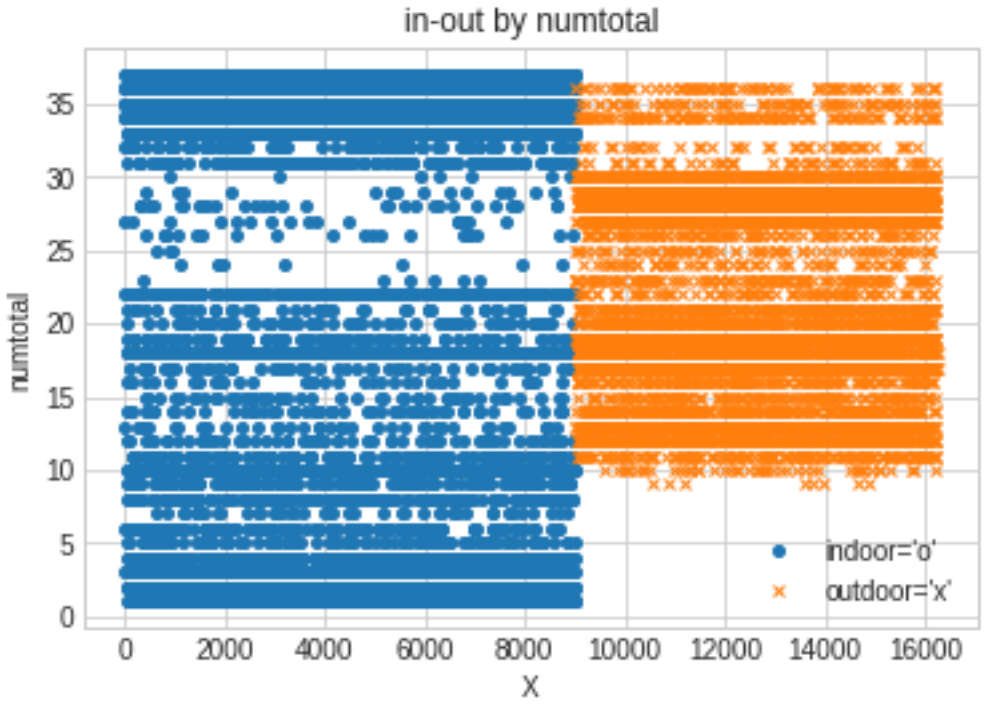
Training data



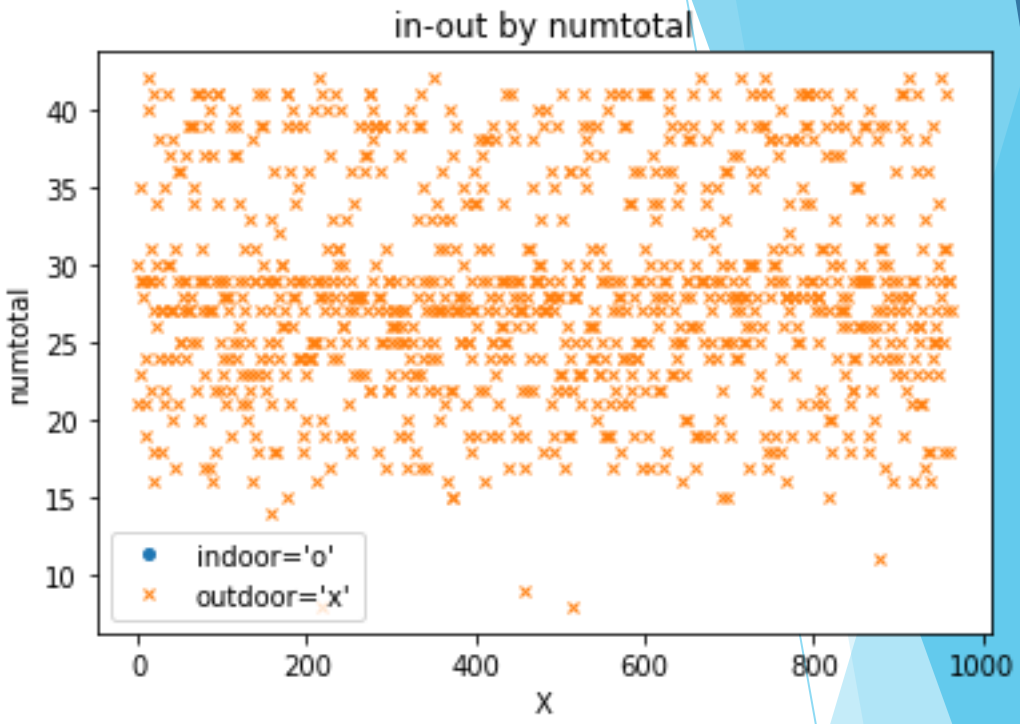
Testing data

特征 3 / feature 3

snrave :所有能检测到卫星的信噪比的平均值



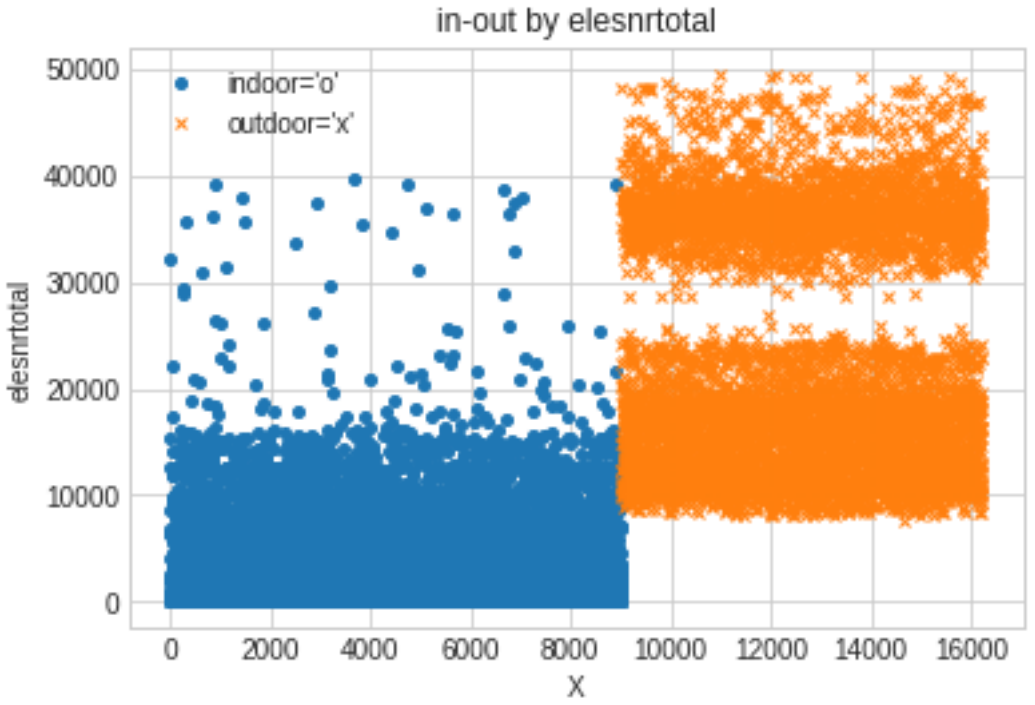
Training data



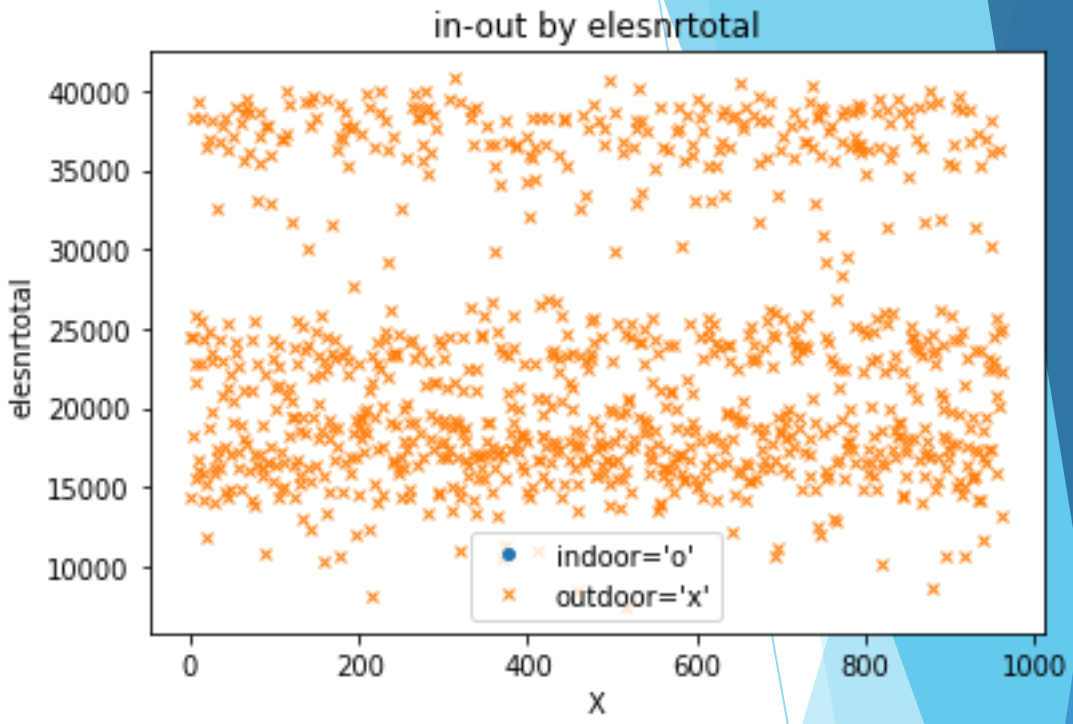
Testing data

特征 4 / feature 4

numtotal：当前手机所能检测的所有卫星数量 (包括信号强度低的卫星)



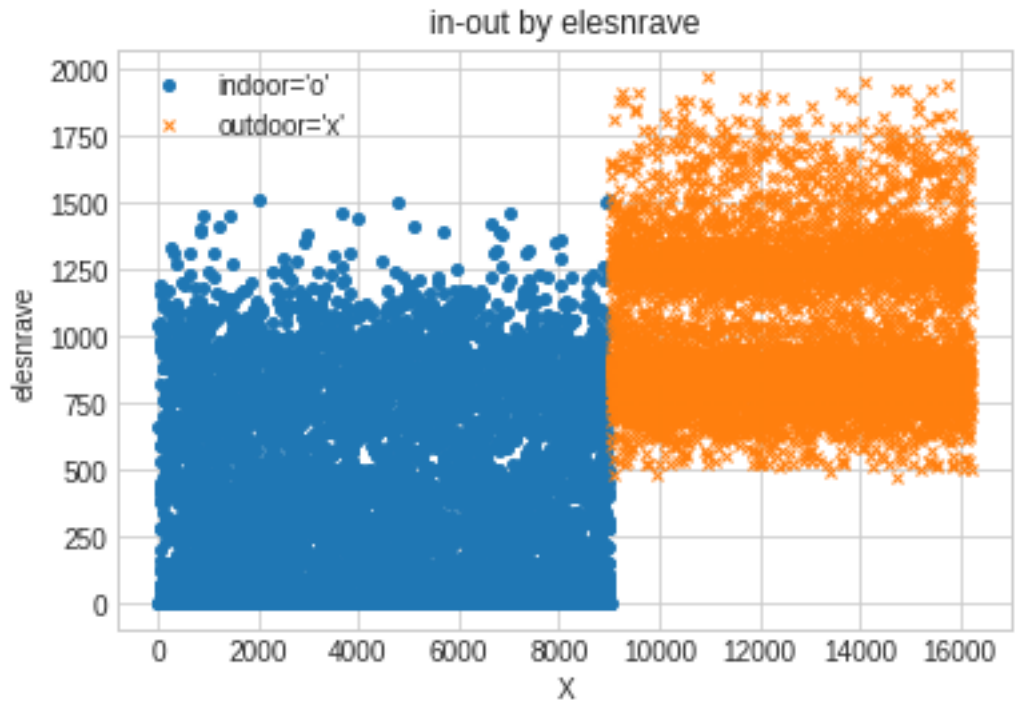
Training data



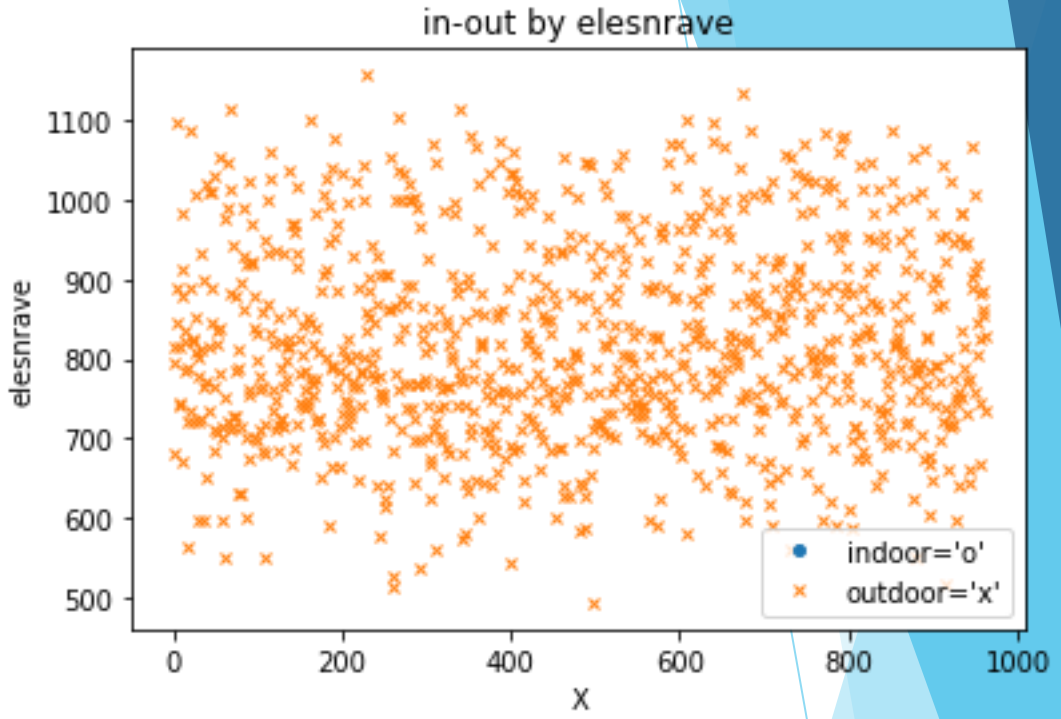
Testing data

特征 5 / feature 5

elesnrtotal :所有能检测到卫星的俯仰角和信噪比 乘积的总和



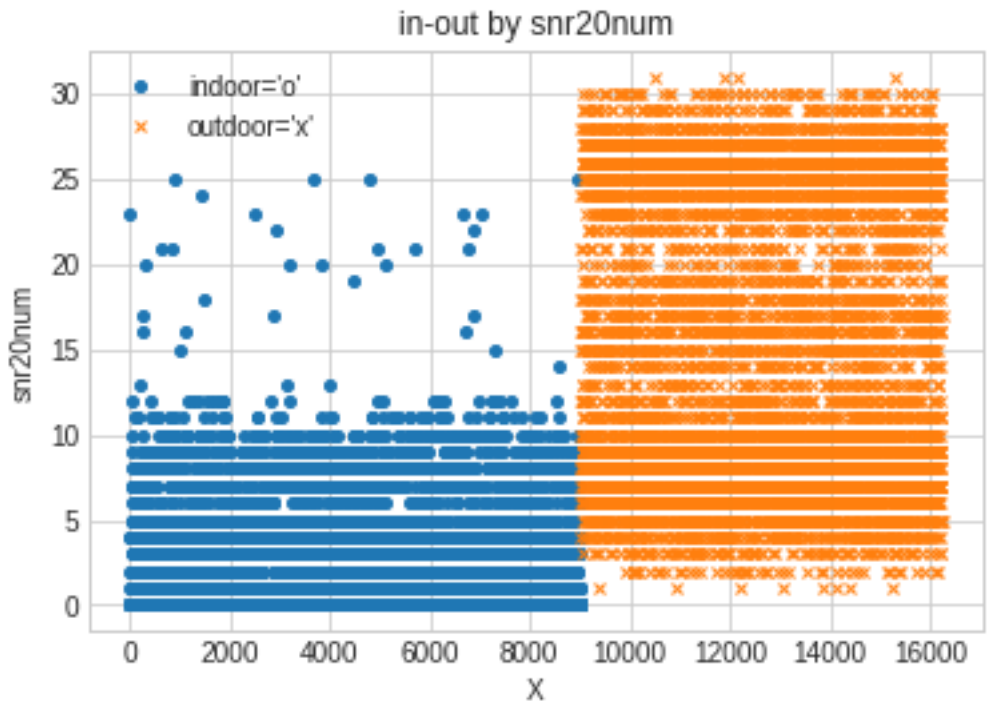
Training data



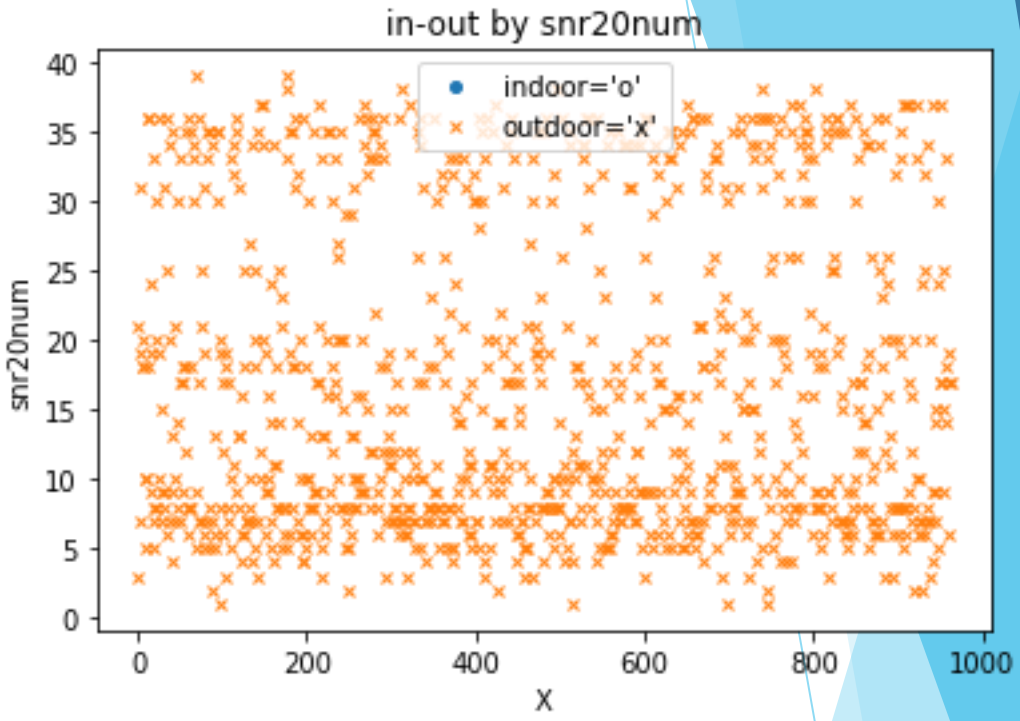
Testing data

特征 6 / feature 6

elesnrave :所有能检测到卫星的俯仰角和信噪比 乘积的平均值



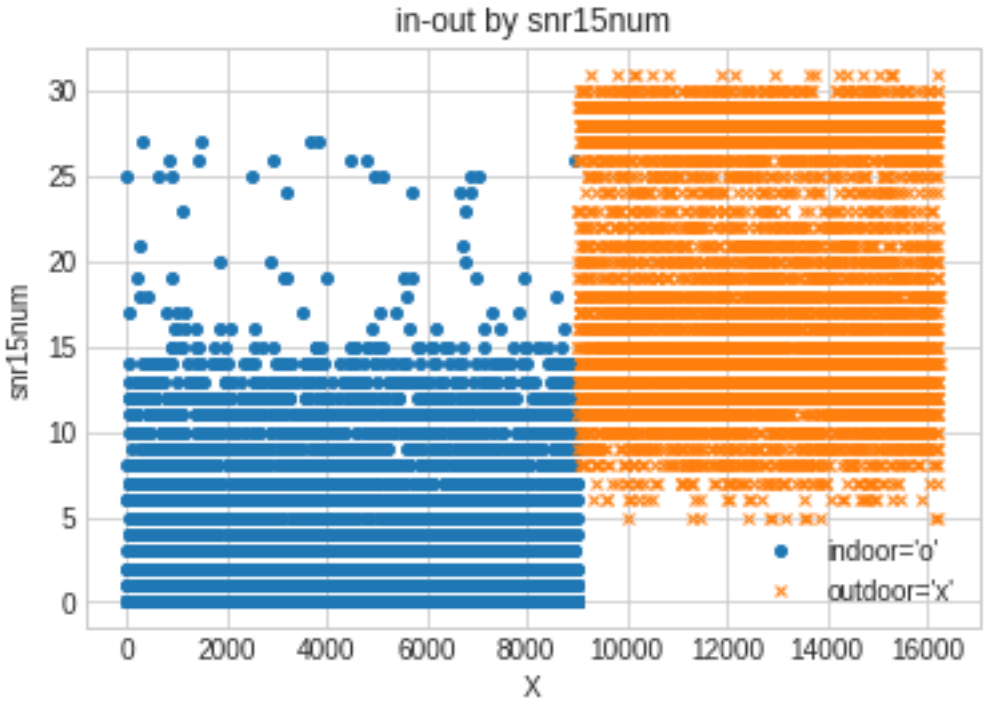
Training data



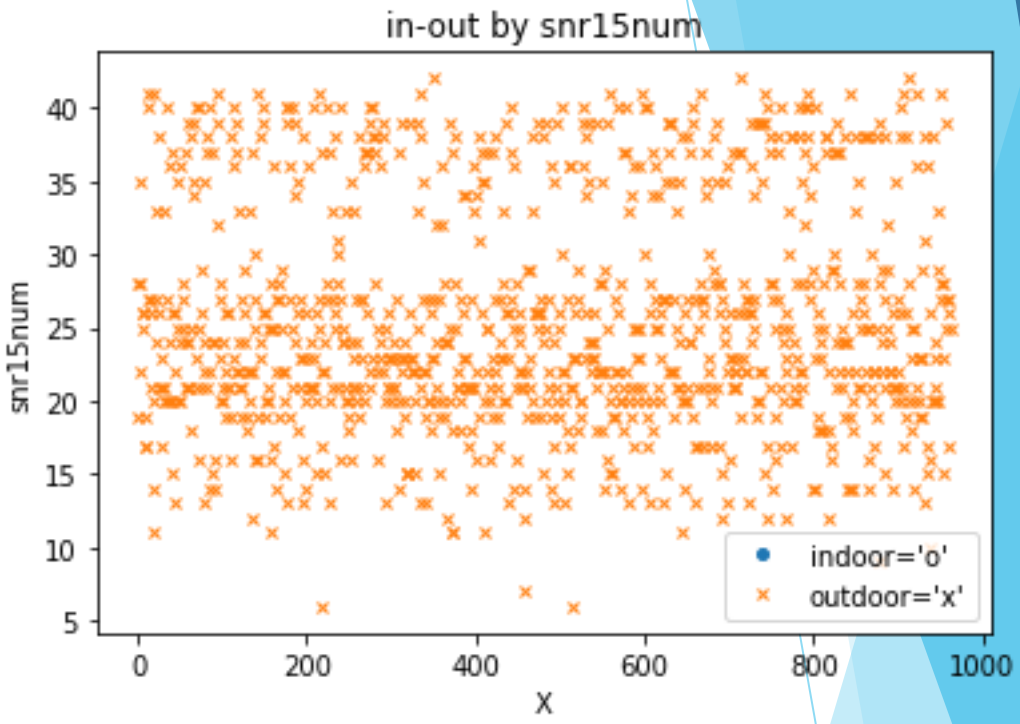
Testing data

特征 7 / feature 7

snr20num：手机检测到信噪比大于等于 20 的卫星 数量



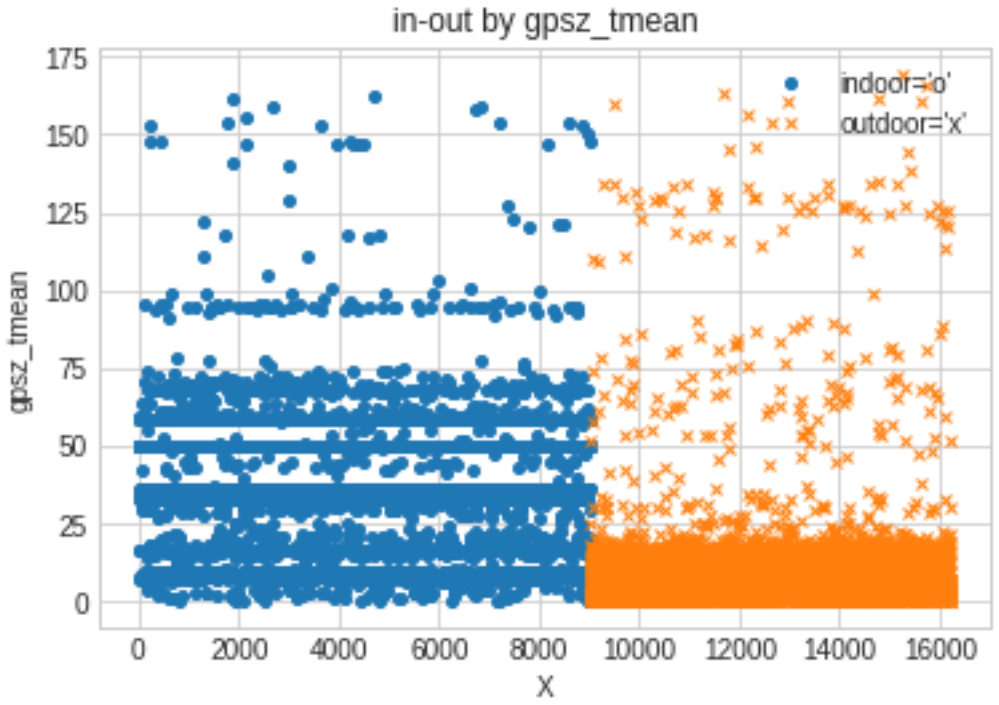
Training data



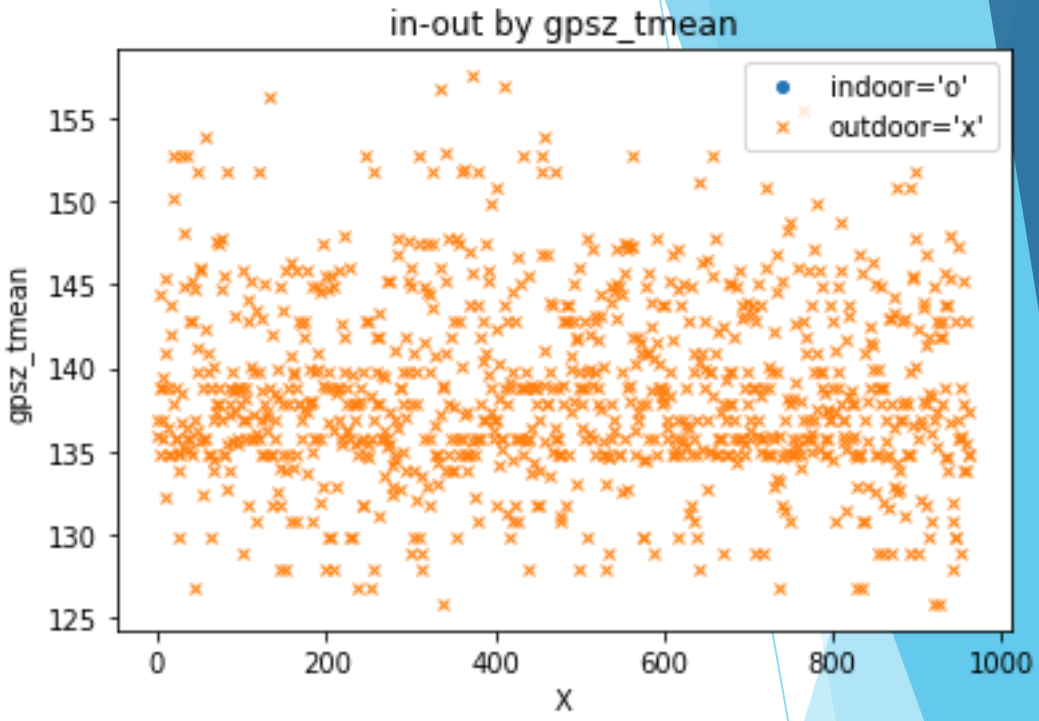
Testing data

特征 8 / feature 8

snr15num :手机检测到信噪比大于等于 15 的卫星 数量



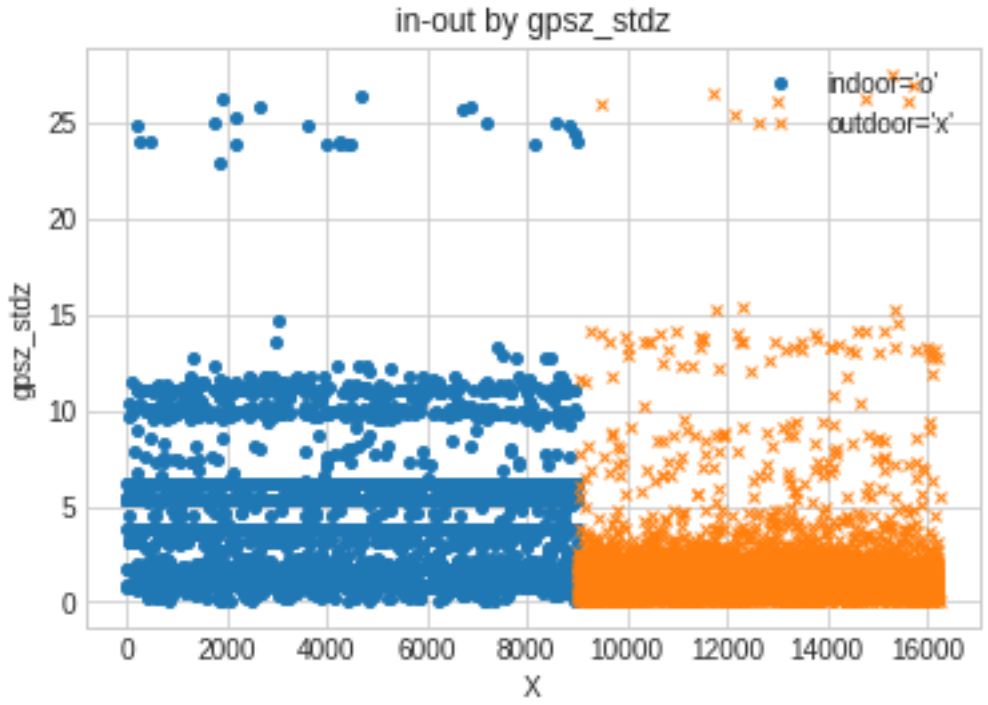
Training data



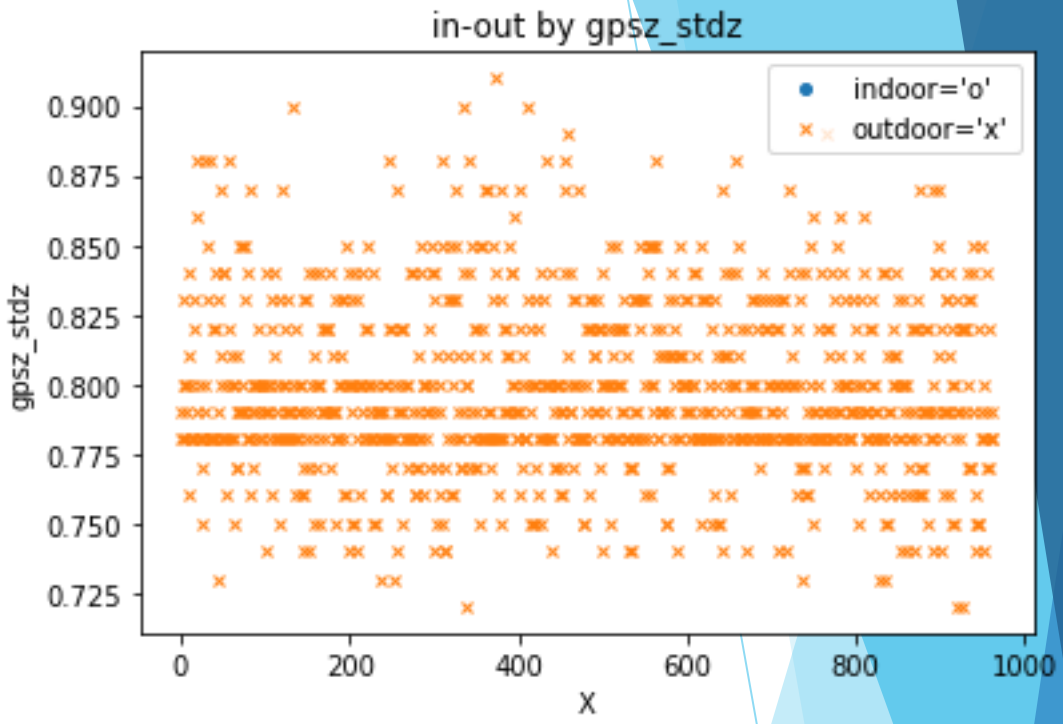
Testing data

特征 9 / feature 9

gpsz_tmean：当前位置的 GPS 海拔高度与手机测试 海拔高度差的绝对值



Training data

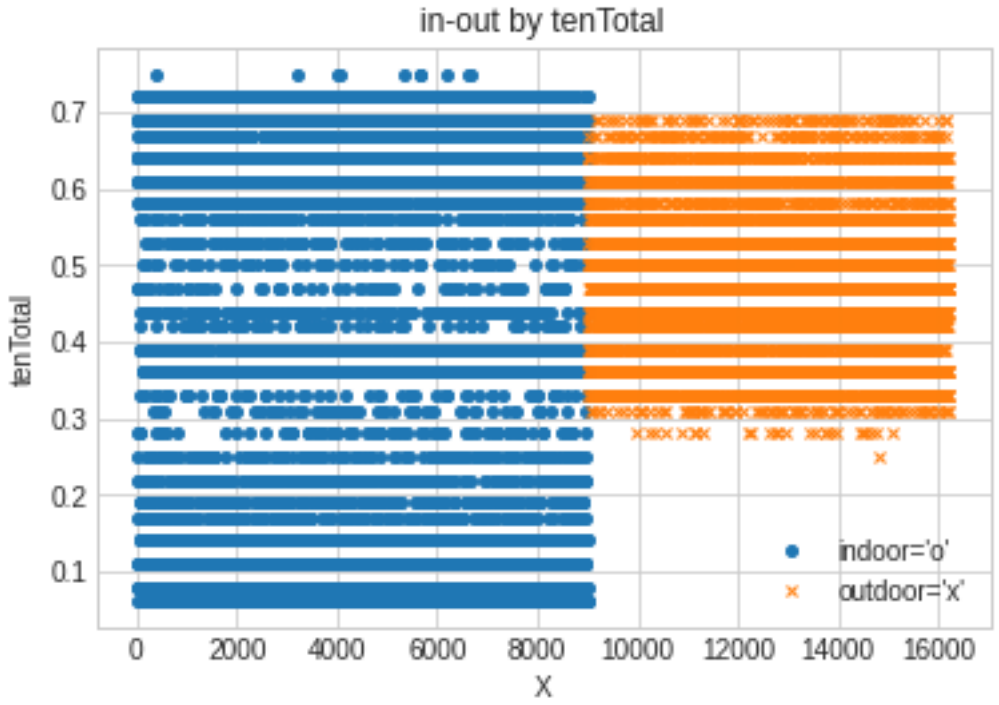


Testing data

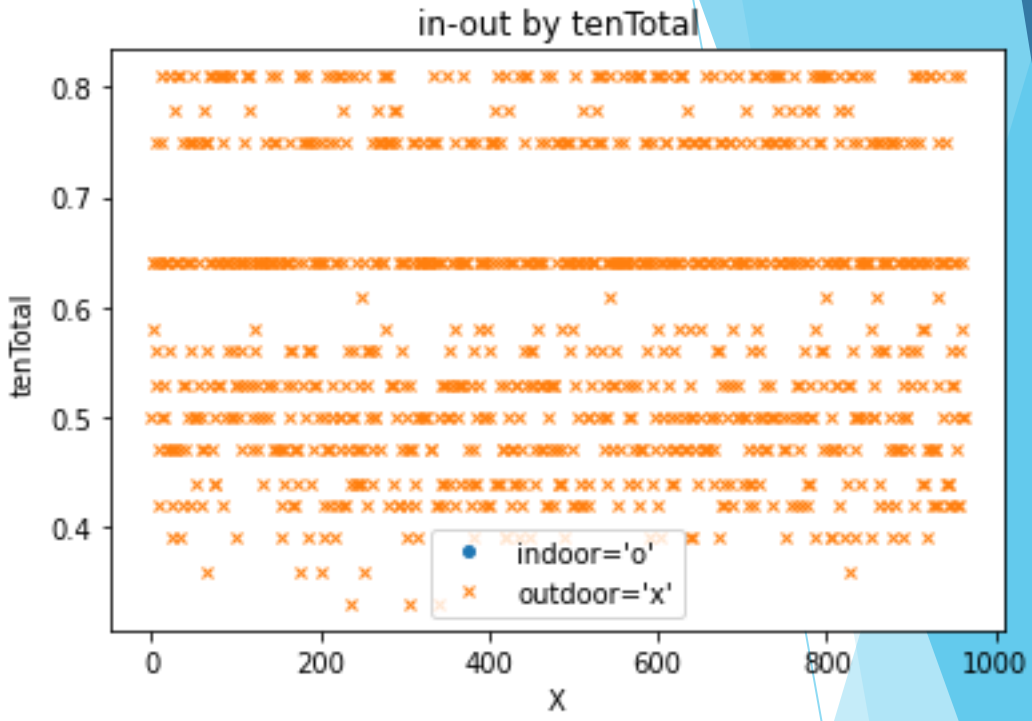
gpsz_stdz 特征处理明显不一致， 所以后面去掉这个特征

特征 10 / feature 10

gpsz_stdz：当前位置的 GPS 海拔高度与手机测试 海拔高度差的绝对值是否小于标准差 (0 or 1)



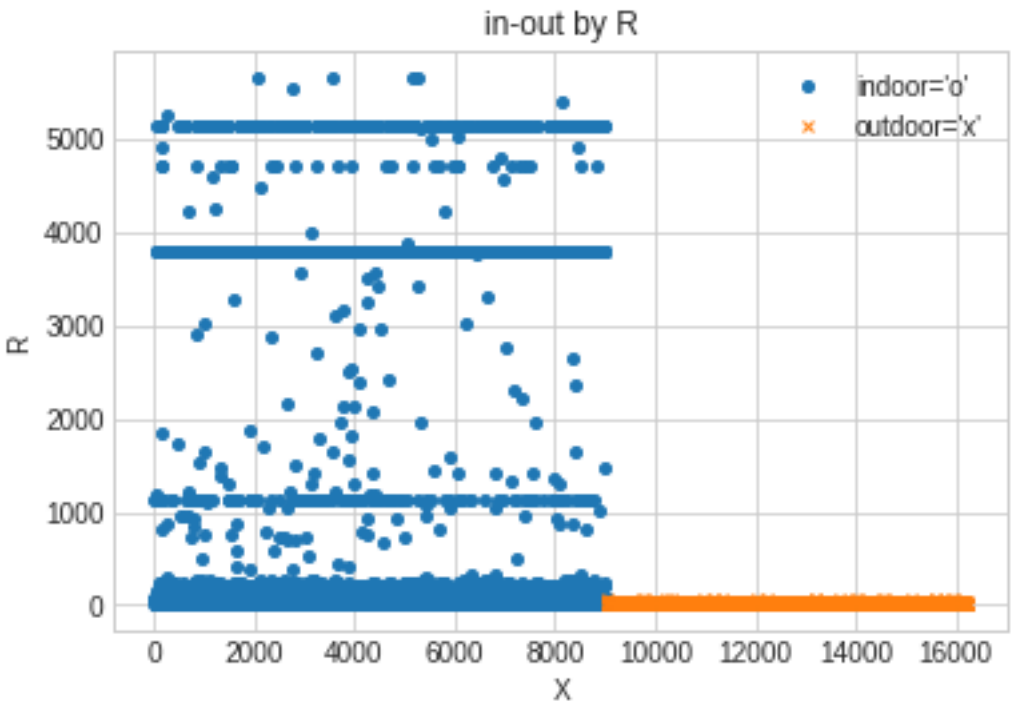
Training data



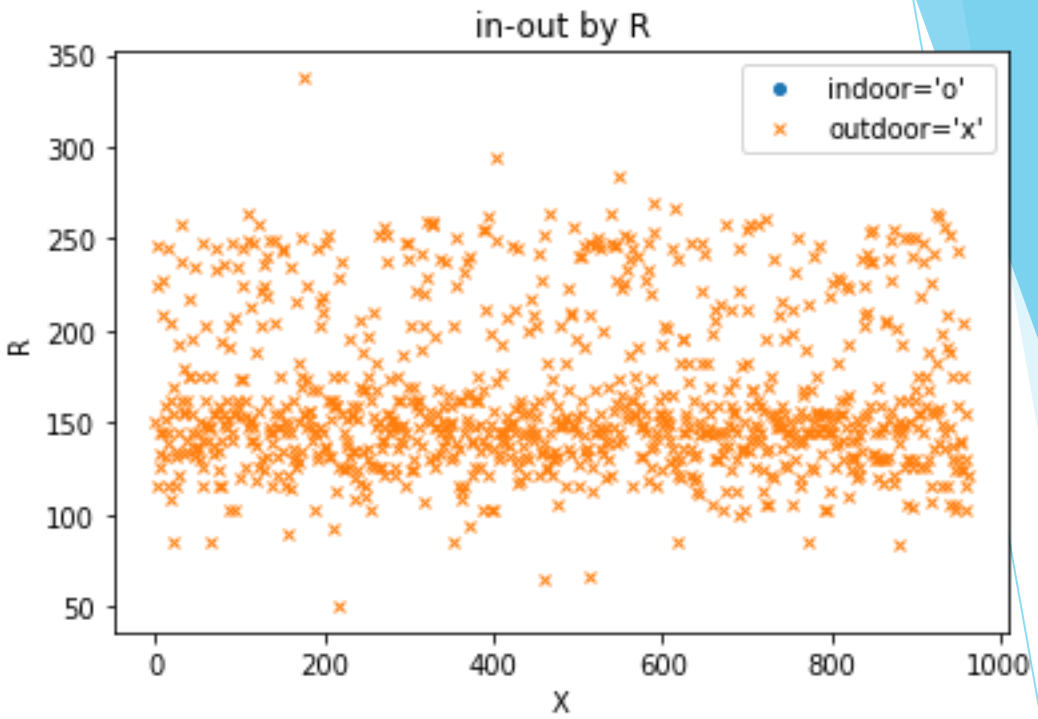
Testing data

特征 11 / feature 11

tenTotal :将 360° 分为 36 份(10°)，包含卫星的份数总和与 36 之比



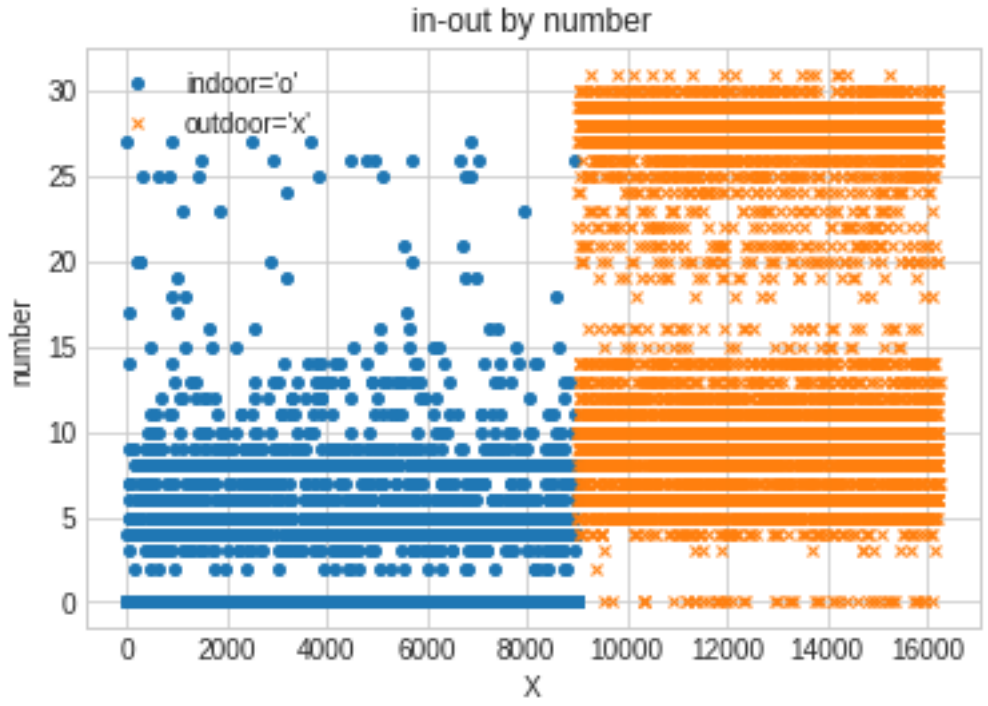
Training data



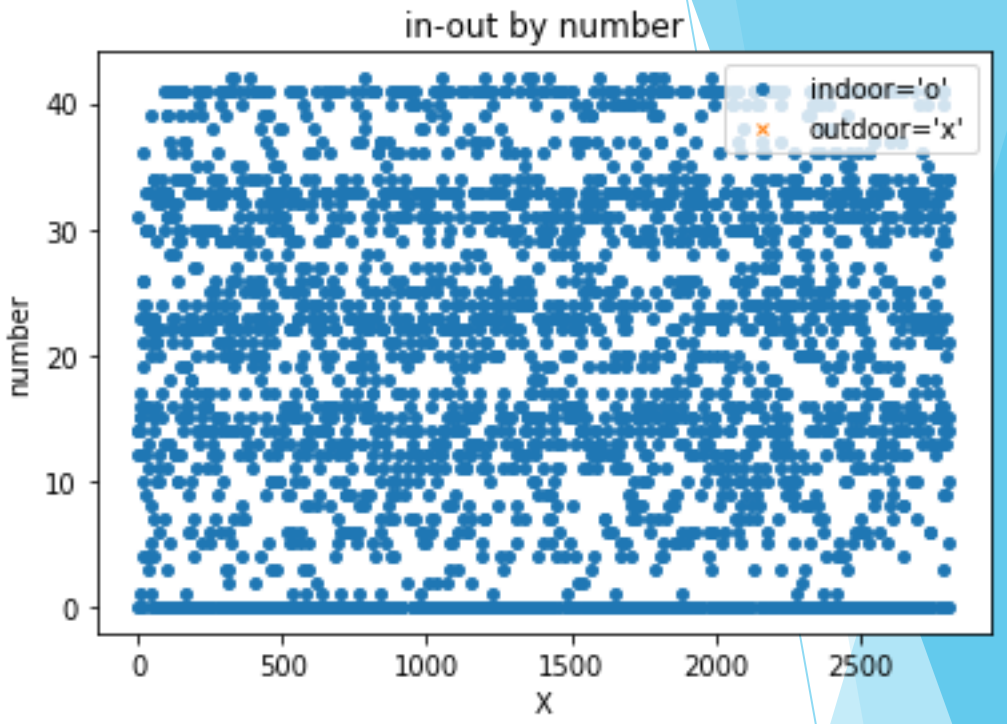
Testing data

特征 12 / feature 12
R :GPS 预测误差半径

地铁站内 the testing data when in the subway stations (indoors)

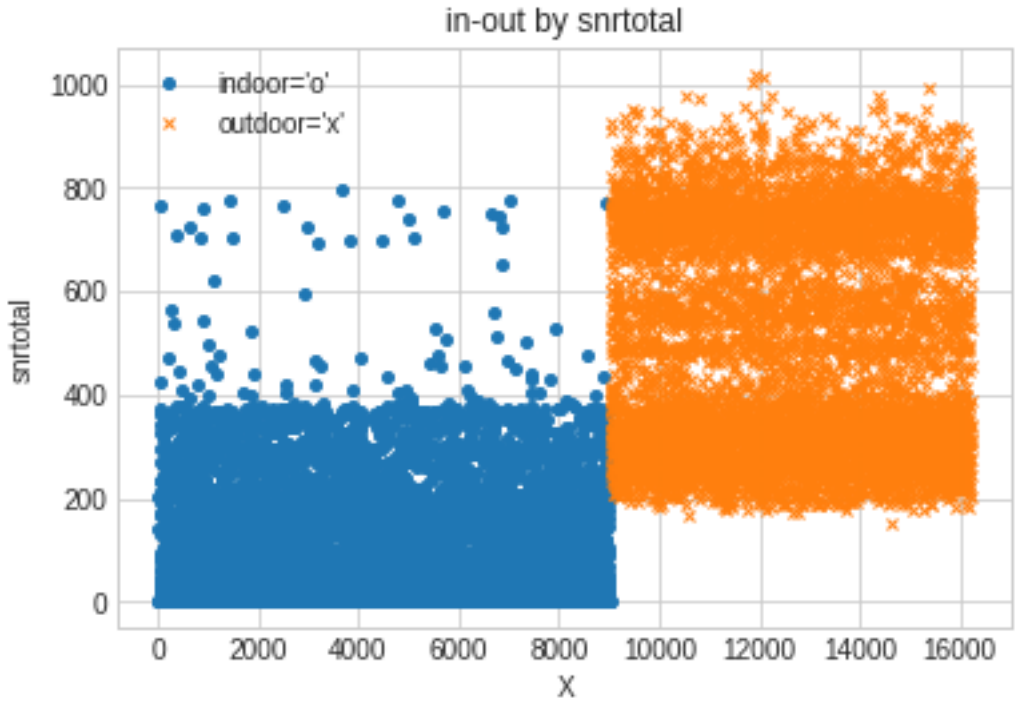


Training data

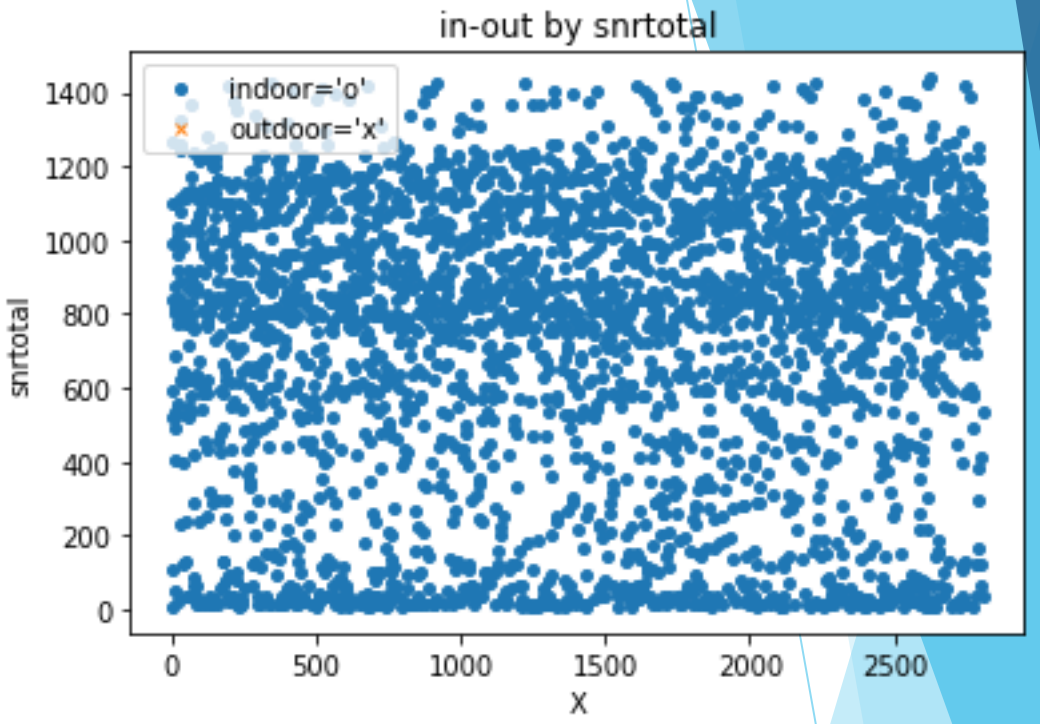


Testing data

特征 1 / feature 1
number: 手机将卫星用于定位的数量



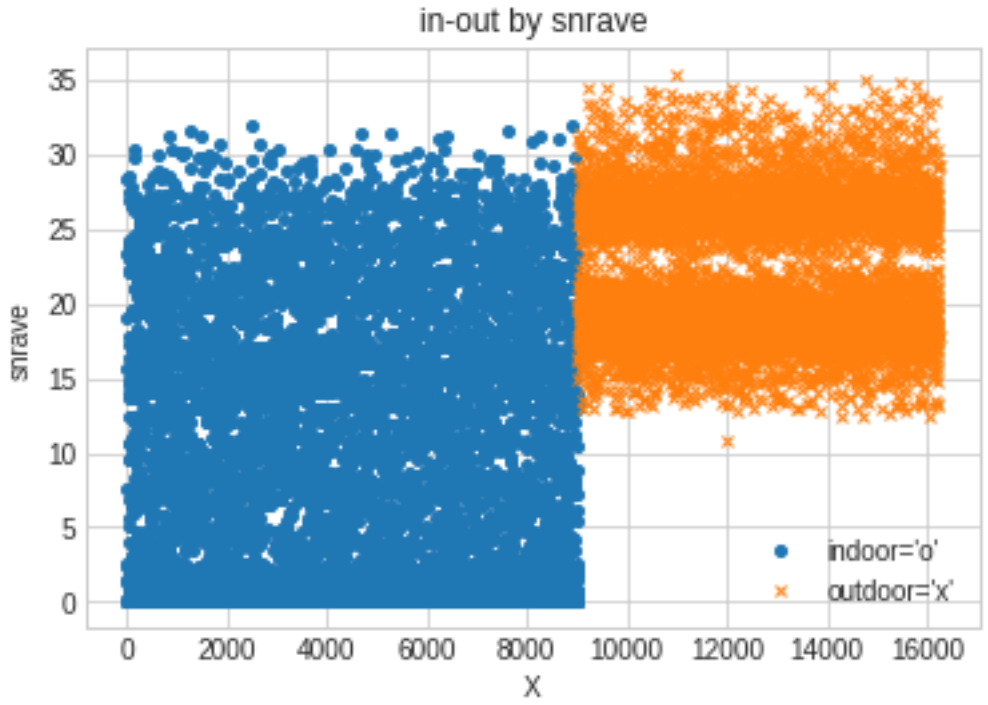
Training data



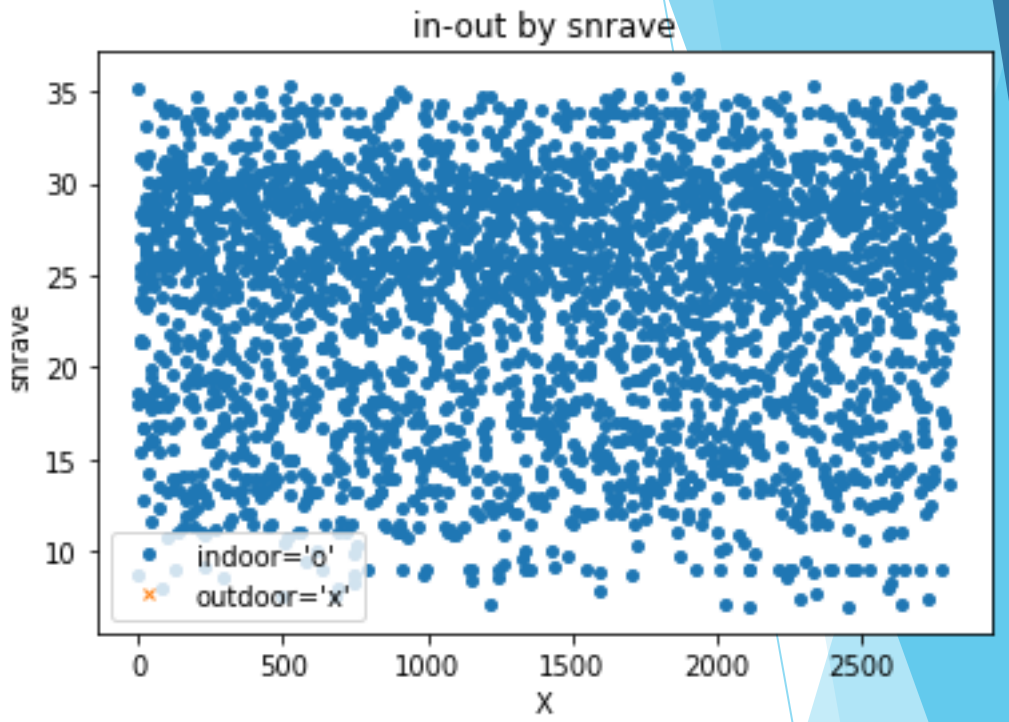
Testing data

特征 2 / feature 2

snrtotal :所有能检测到卫星的信噪比总和



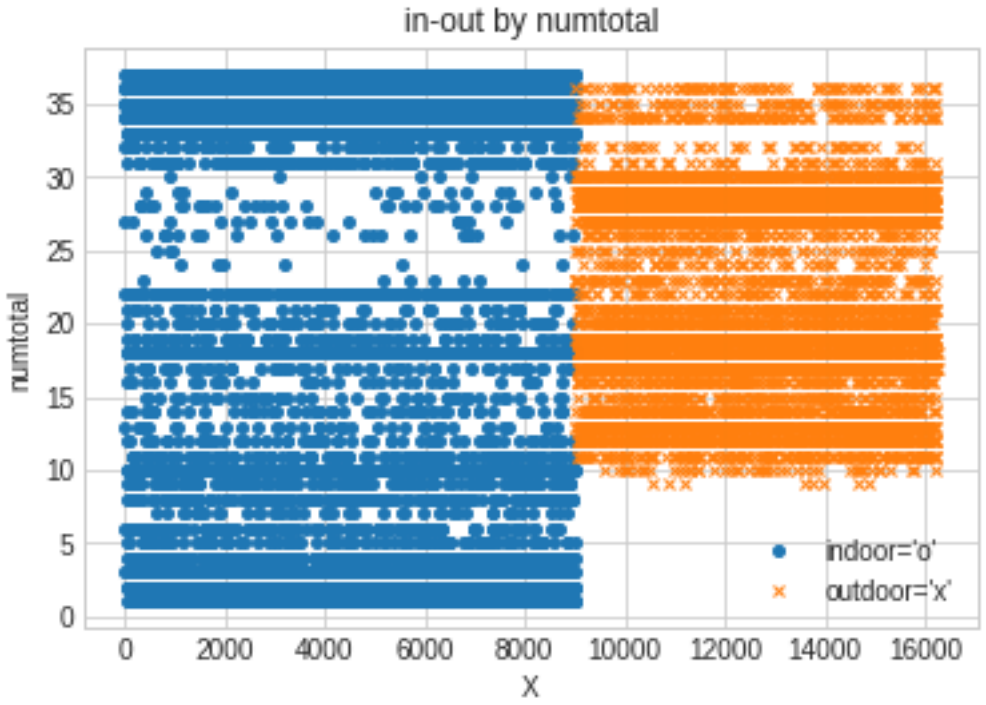
Training data



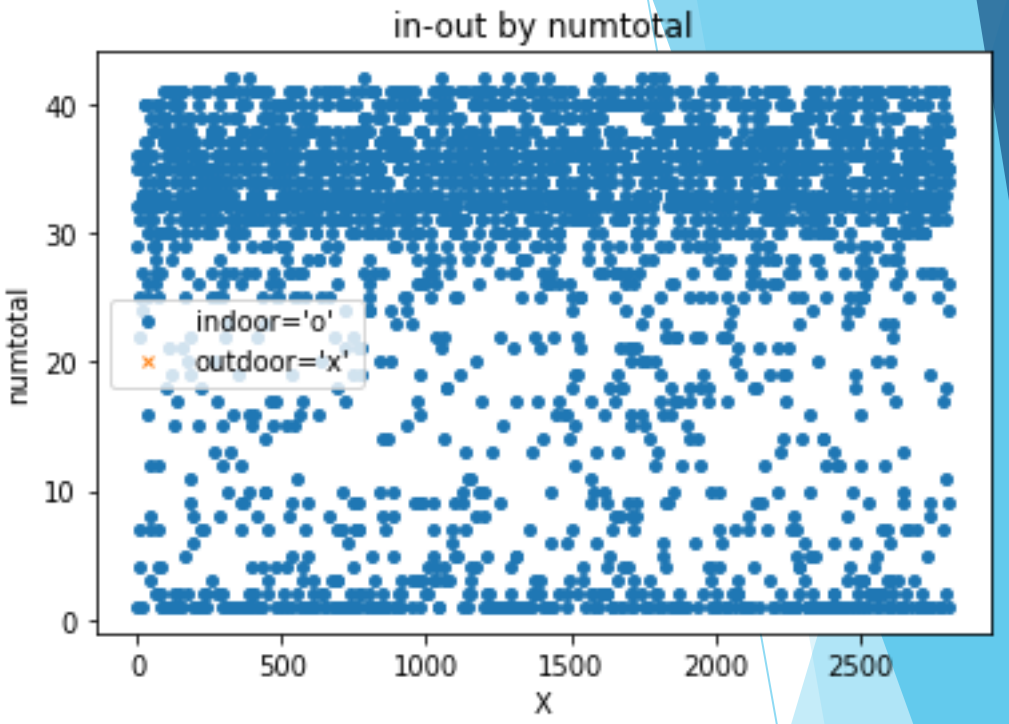
Testing data

特征 3 / feature 3

snrave :所有能检测到卫星的信噪比的平均值



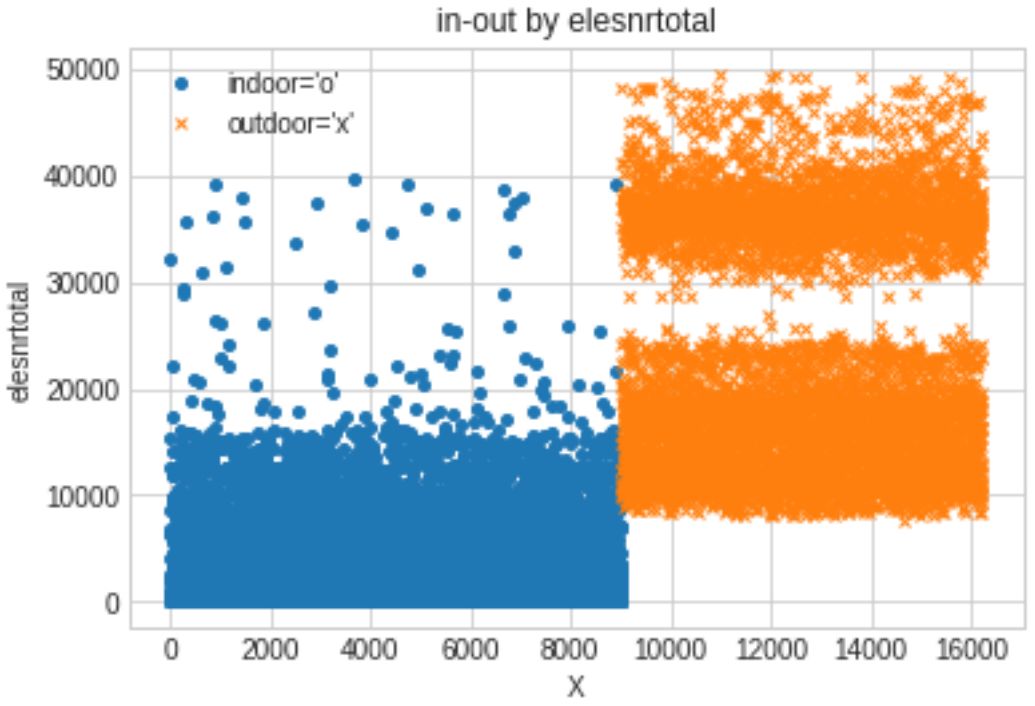
Training data



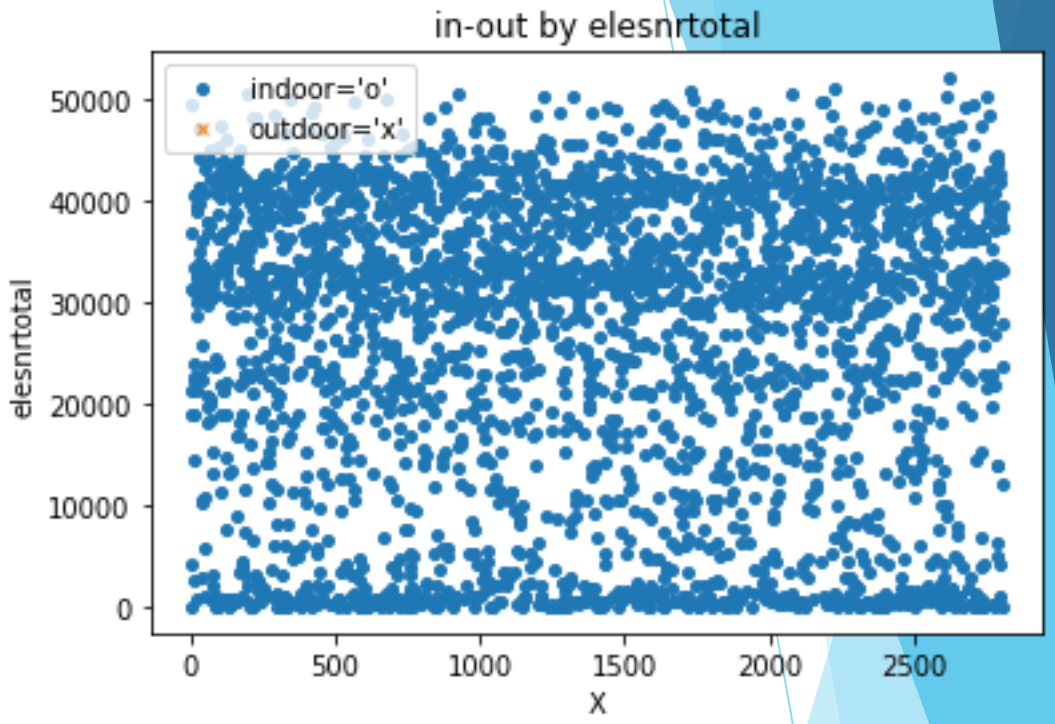
Testing data

特征 4 / feature 4

numtotal：当前手机所能检测的所有卫星数量 (包括信号强度低的卫星)



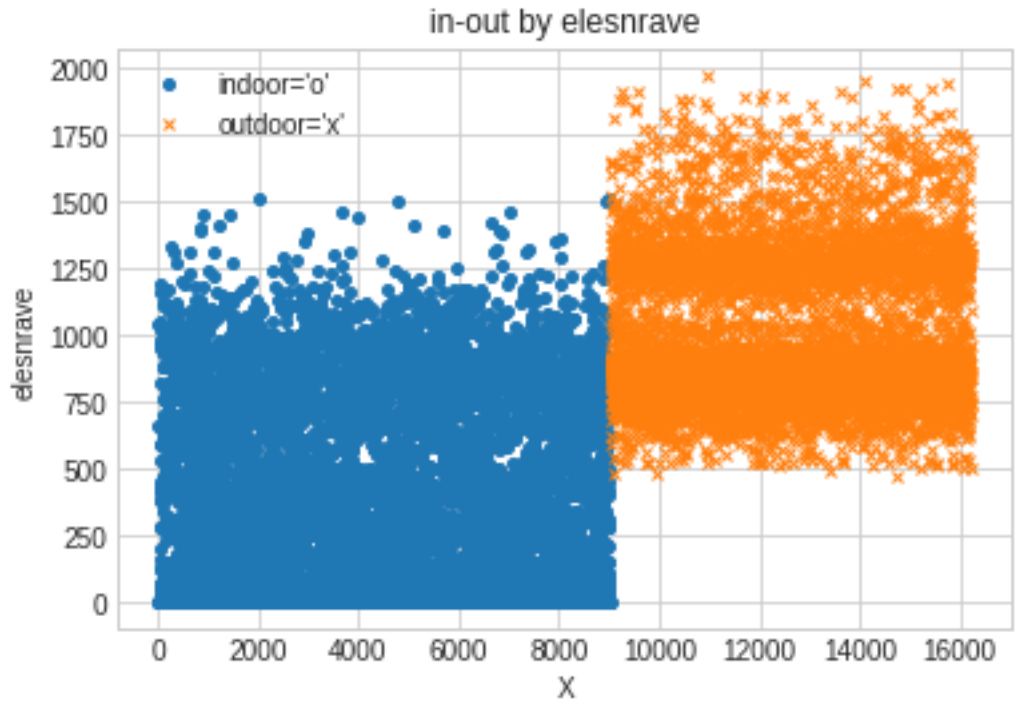
Training data



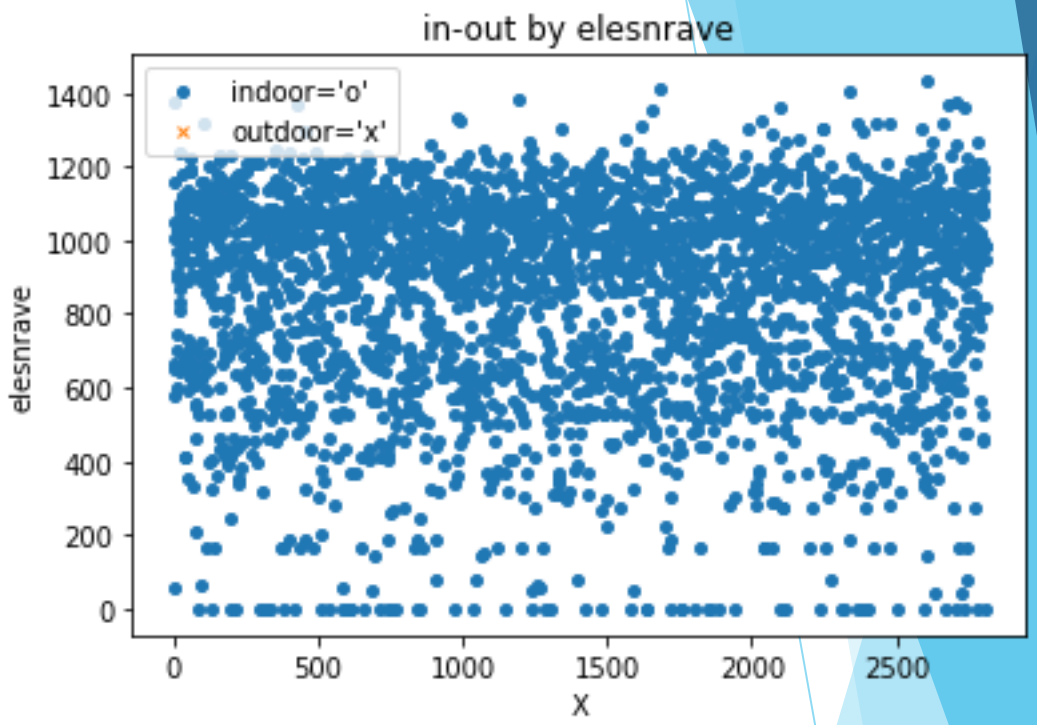
Testing data

特征 5 / feature 5

elesnrtotal :所有能检测到卫星的俯仰角和信噪比 乘积的总和



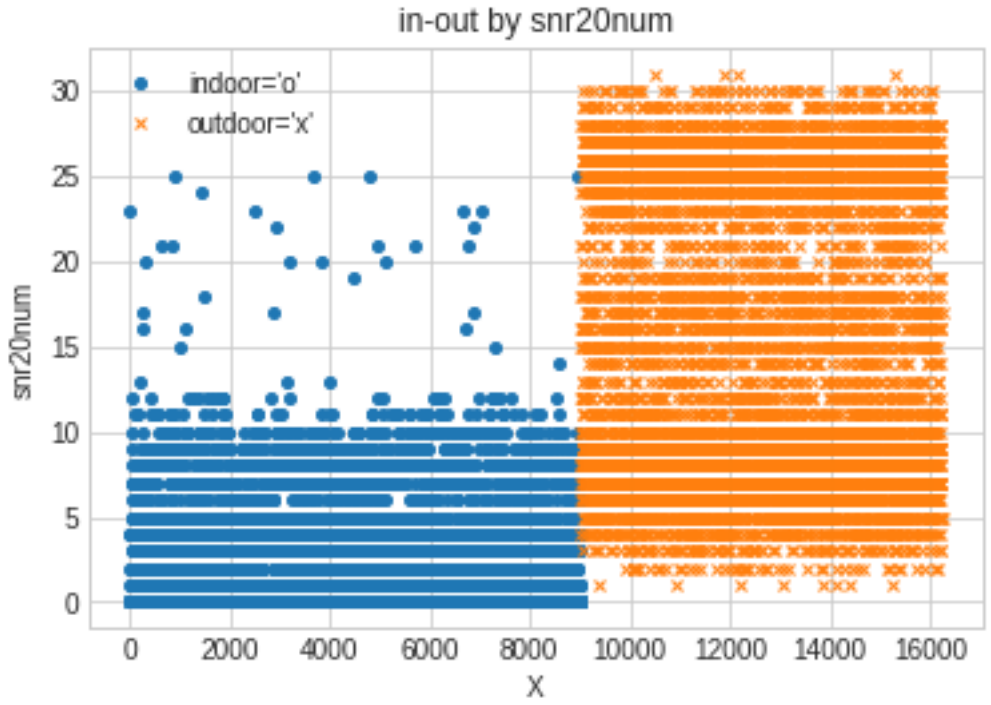
Training data



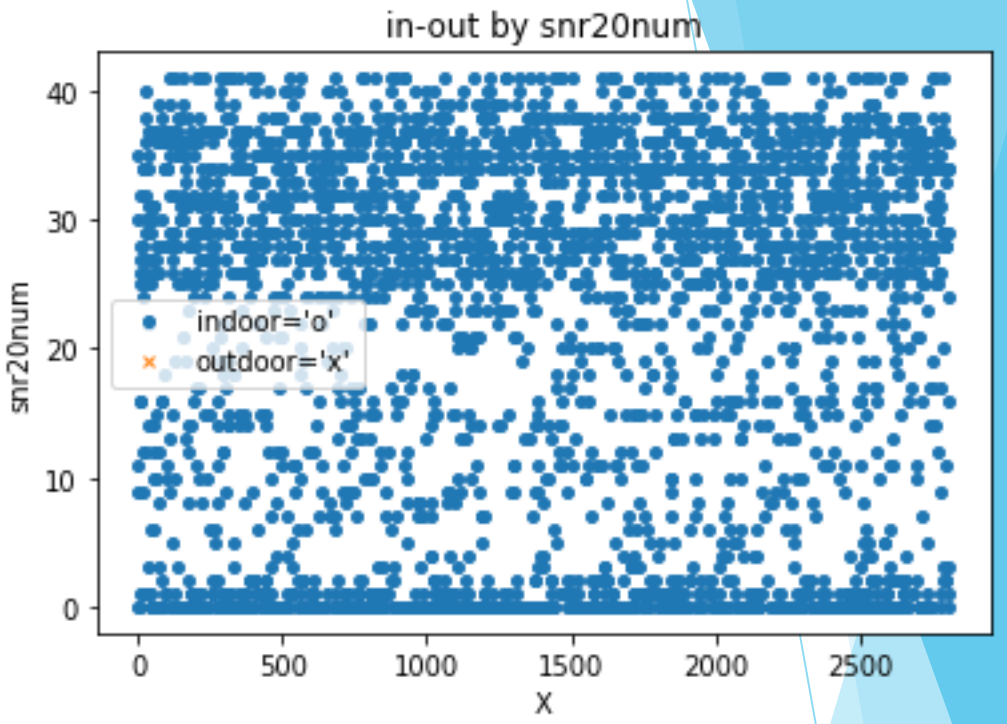
Testing data

特征 6 / feature 6

elesnrave :所有能检测到卫星的俯仰角和信噪比 乘积的平均值



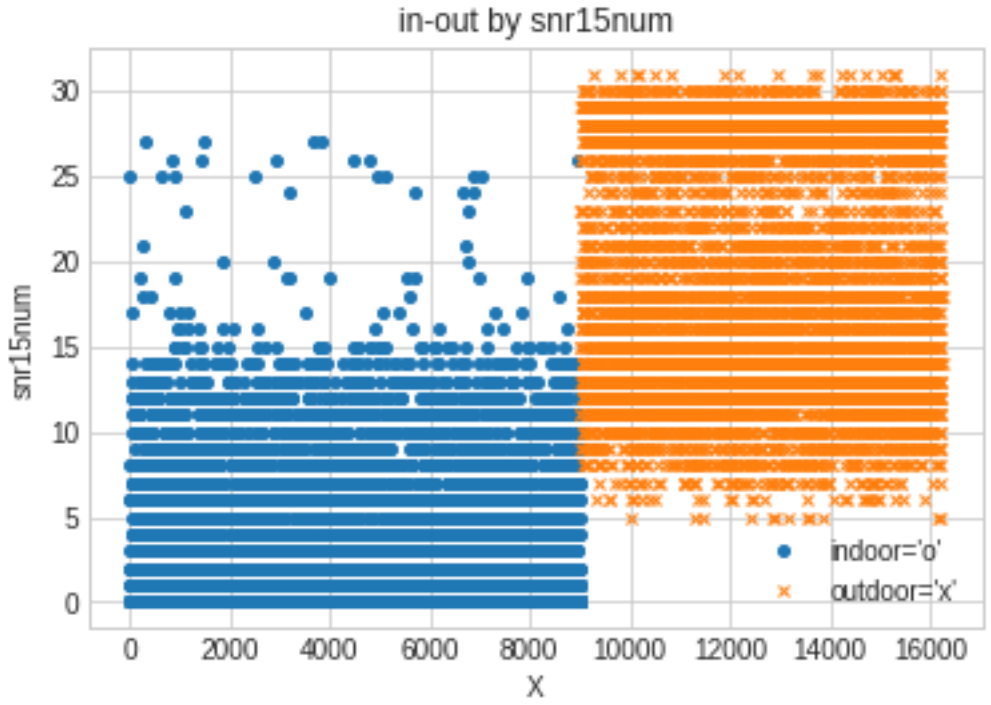
Training data



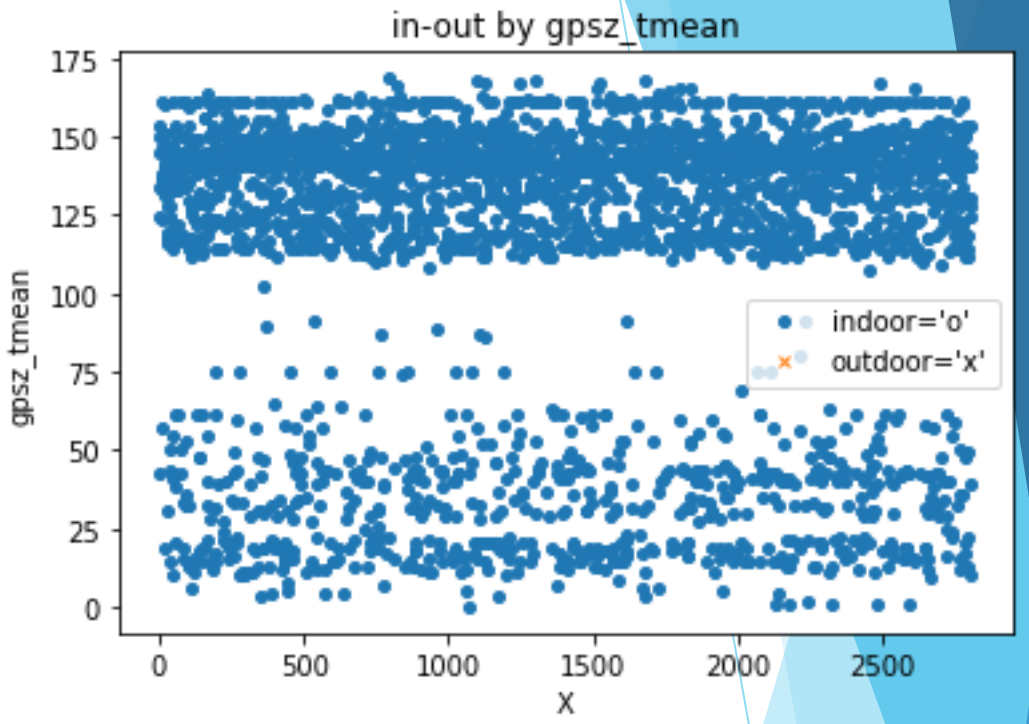
Testing data

特征 7 / feature 7

snr20num：手机检测到信噪比大于等于 20 的卫星 数量



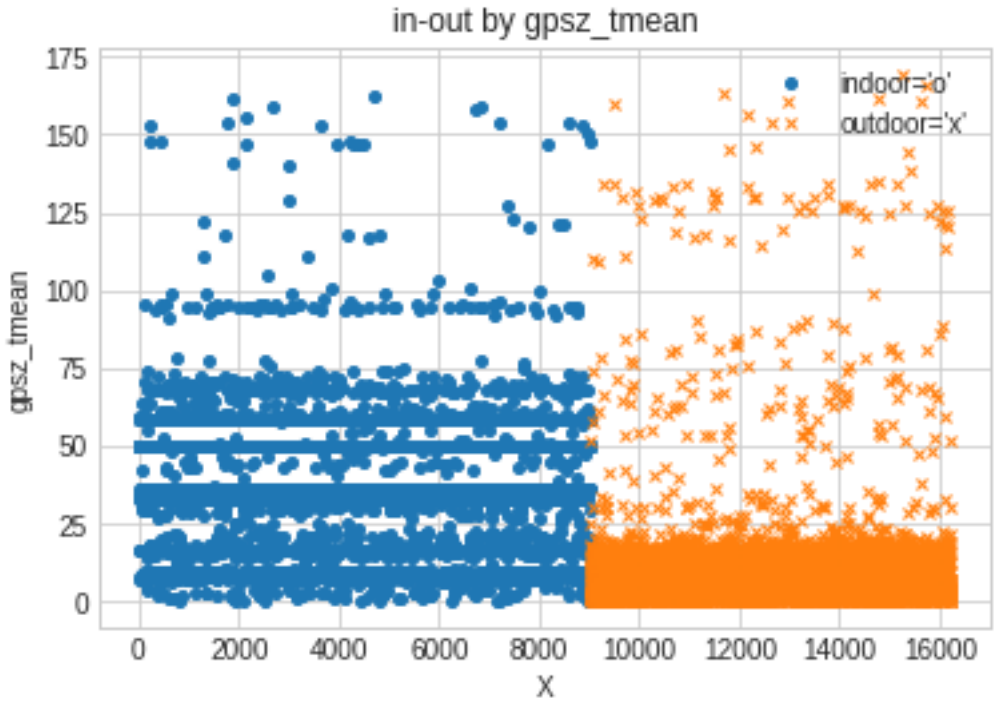
Training data



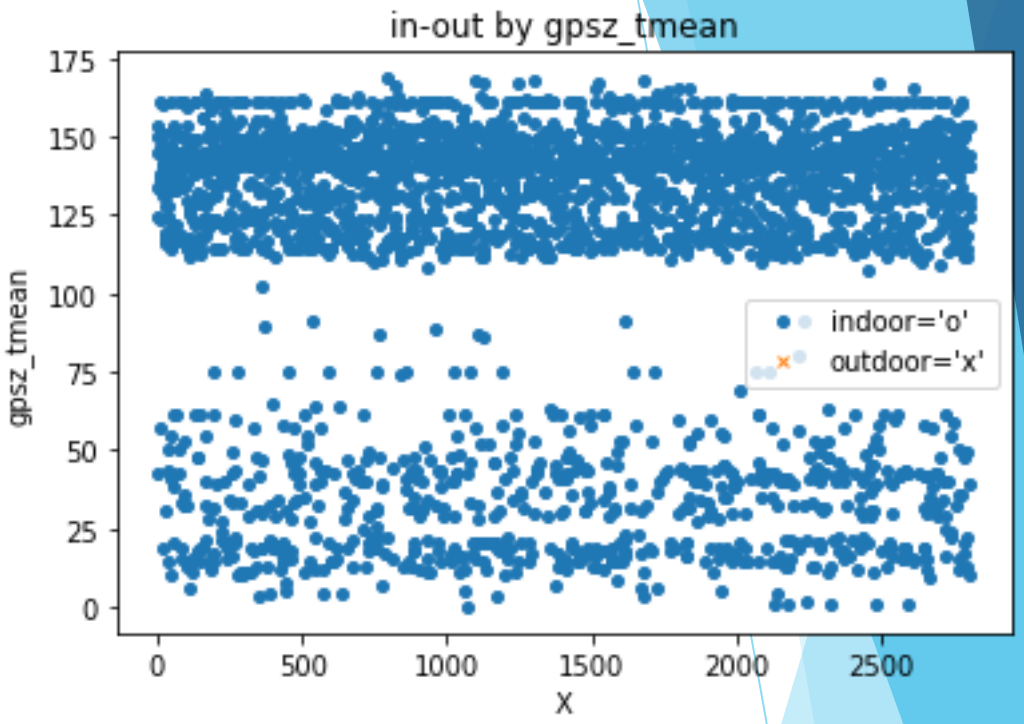
Testing data

特征 8 / feature 8

snr15num：手机检测到信噪比大于等于 15 的卫星 数量



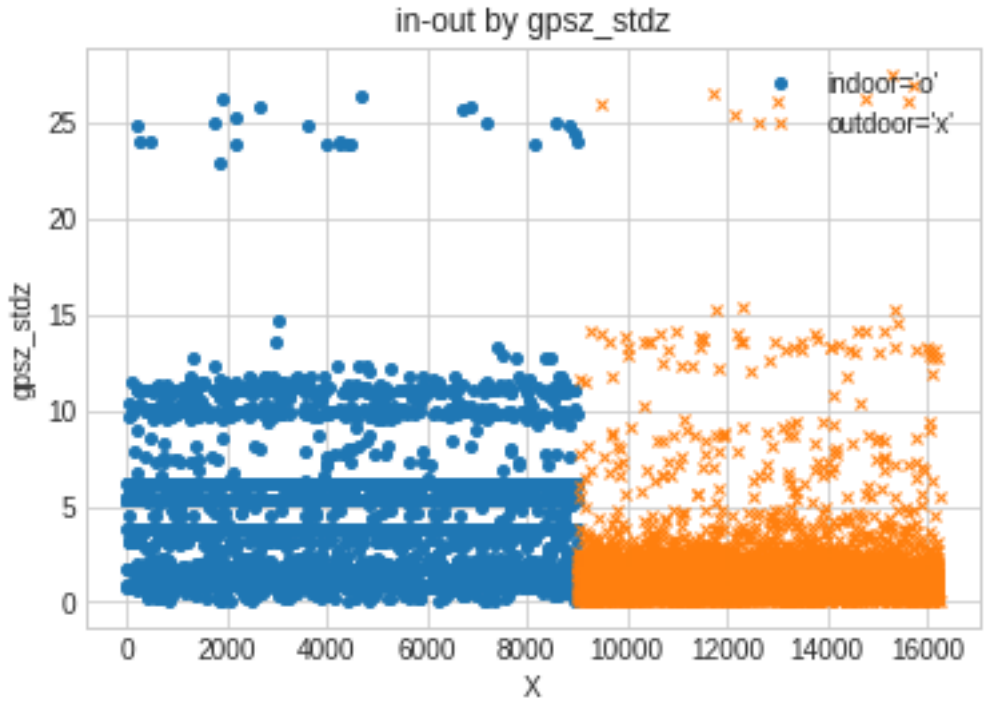
Training data



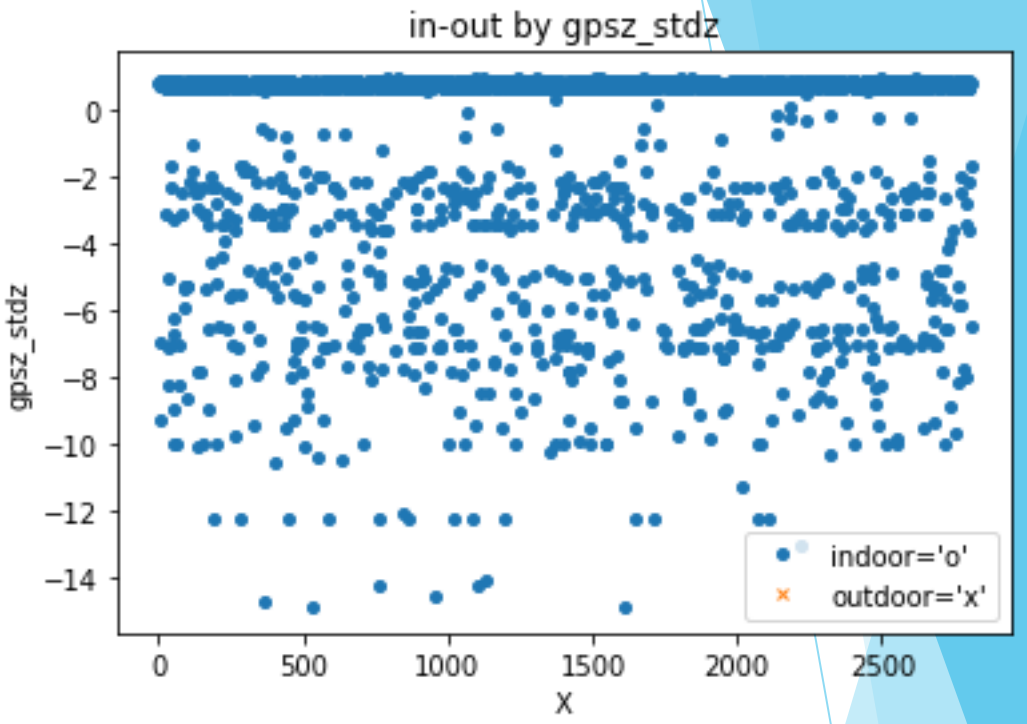
Testing data

特征 9 / feature 9

gpsz_tmean：当前位置的 GPS 海拔高度与手机测试 海拔高度差的绝对值



Training data

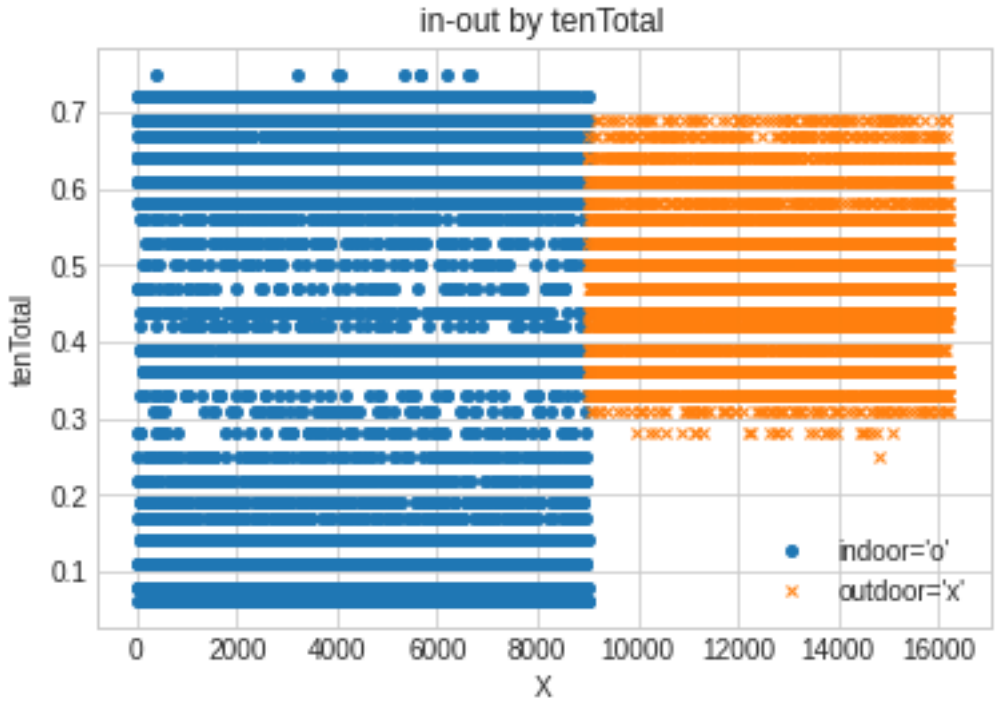


Testing data

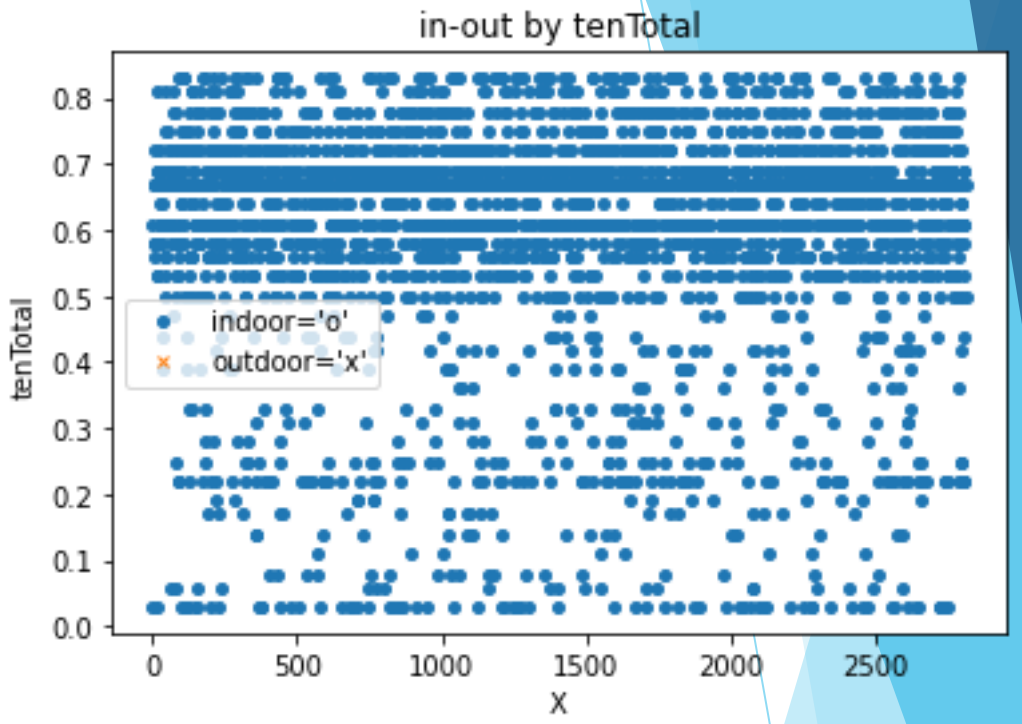
gpsz_stdz 特征处理明显不一致， 所以后面去掉这个特征

特征 10 / feature 10

gpsz_stdz：当前位置的 GPS 海拔高度与手机测试 海拔高度差的绝对值是否小于标准差 (0 or 1)



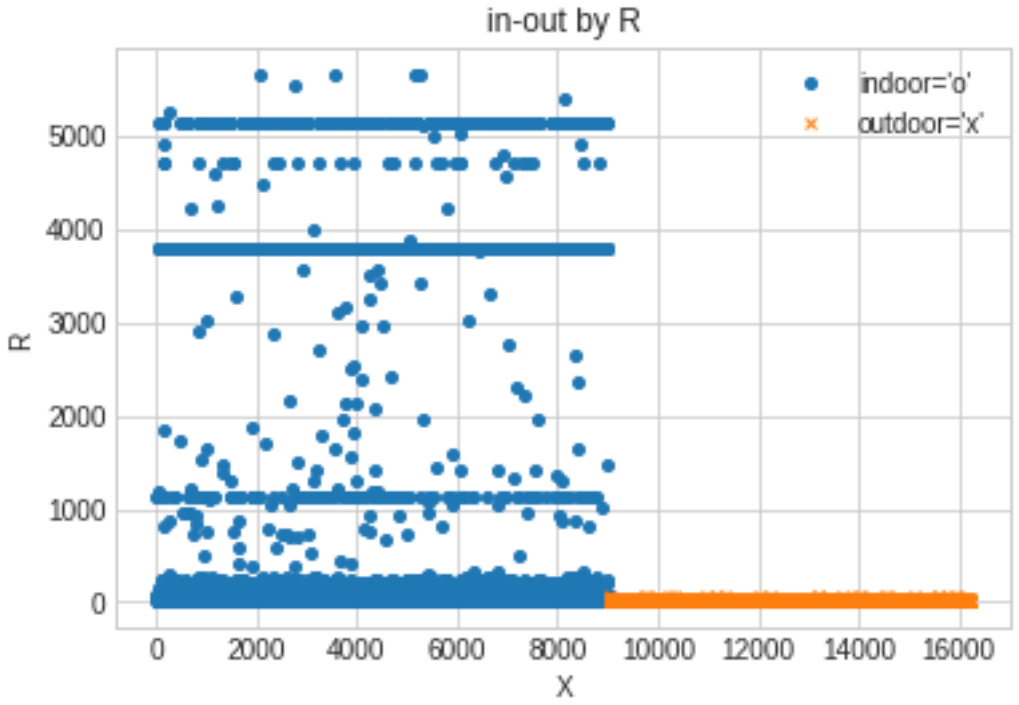
Training data



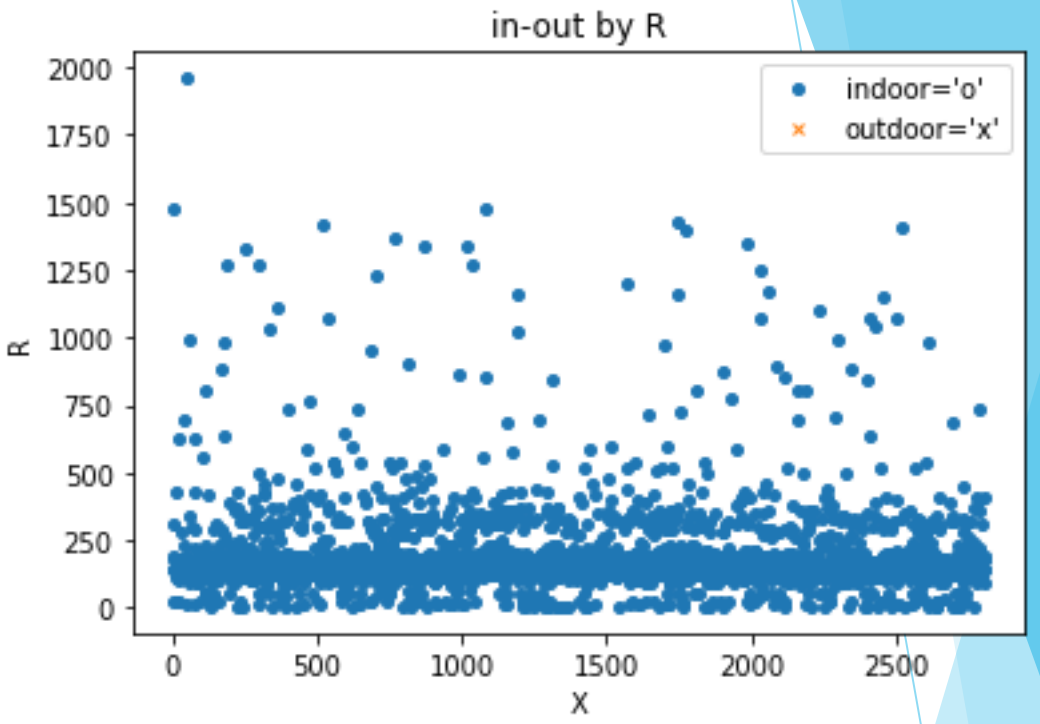
Testing data

特征 11 / feature 11

tenTotal :将 360° 分为 36 份(10°)，包含卫星的份数总和与 36 之比



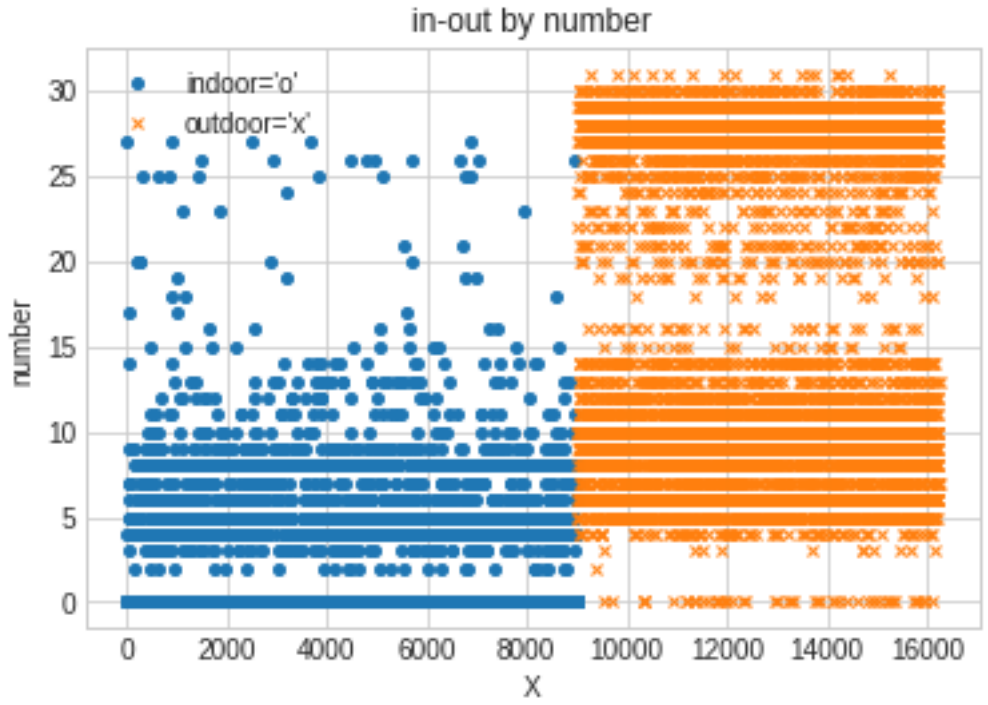
Training data



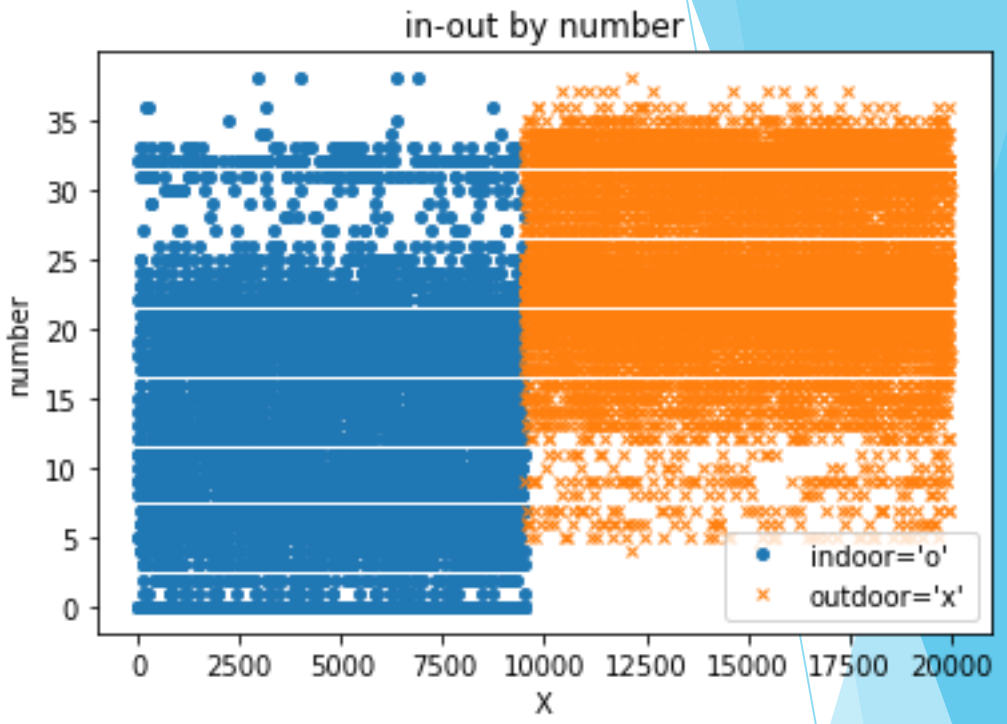
Testing data

特征 12 / feature 12
R :GPS 预测误差半径

其他 - 删掉了 地铁室外跑 & 地铁站内
other main scenes such as streets, communities, stores, buildings, etc. excluding scenes related to Subway

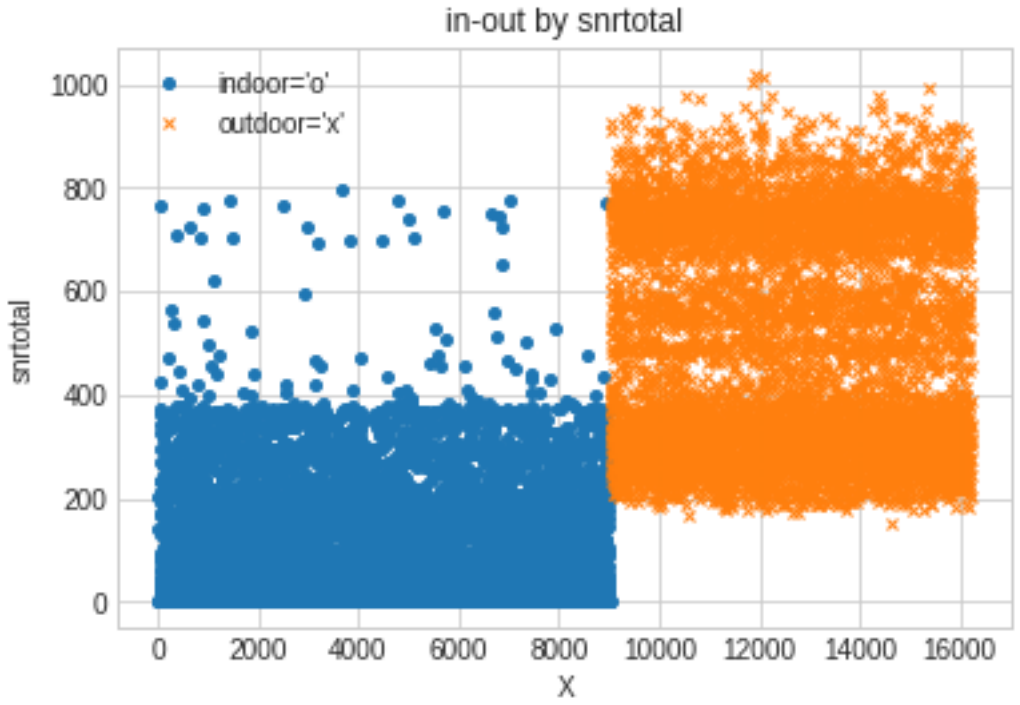


Training data

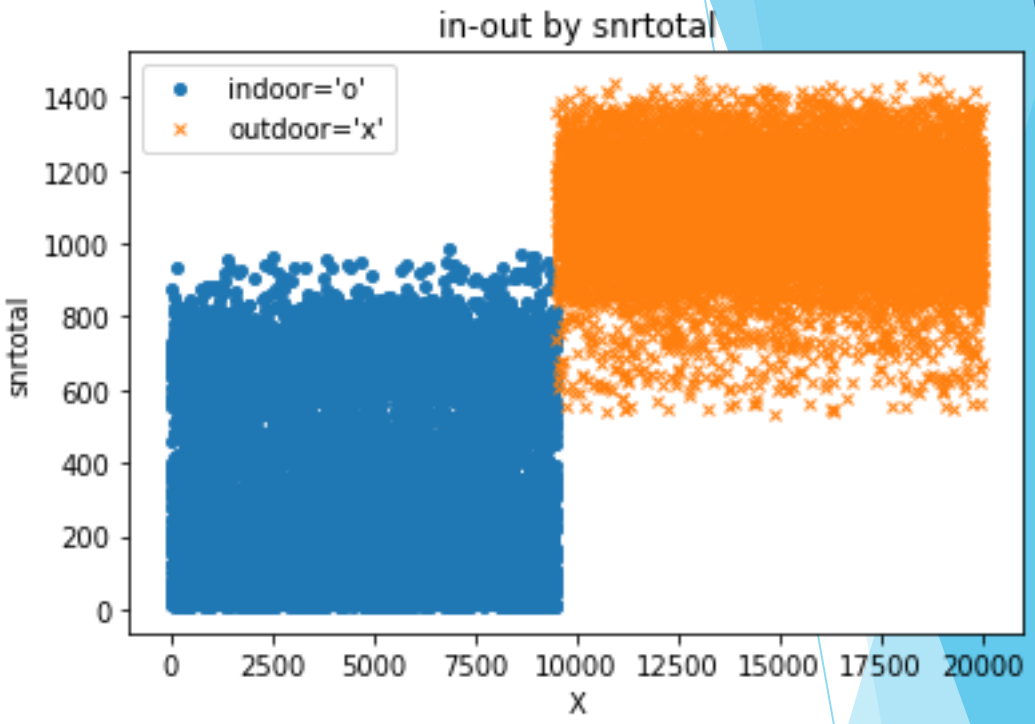


Testing data

特征 1 / feature 1
number: 手机将卫星用于定位的数量



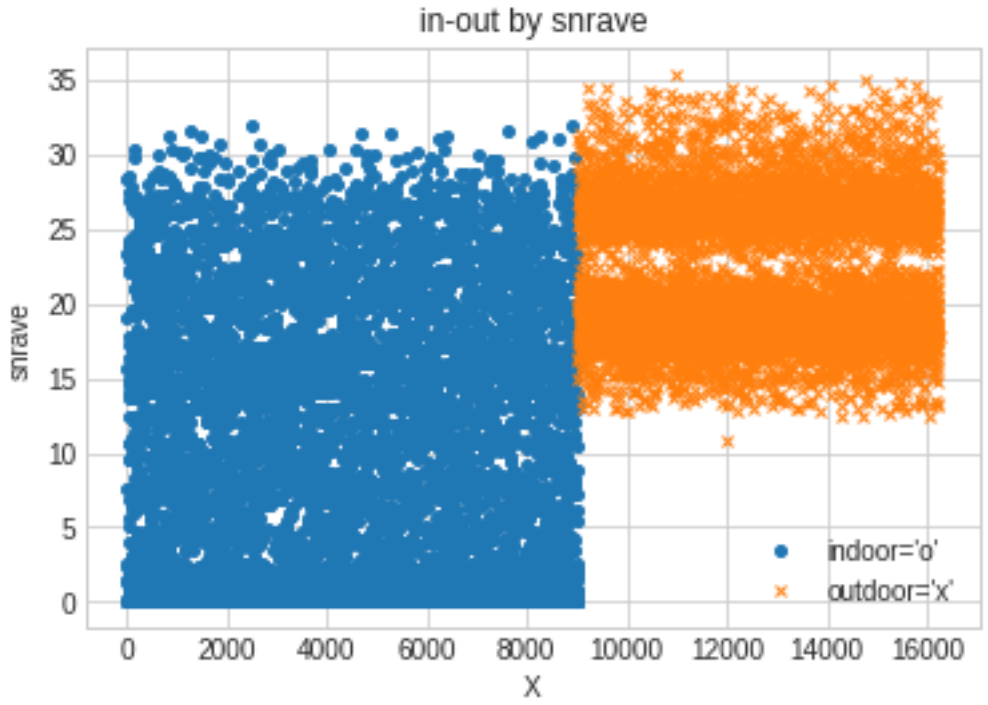
Training data



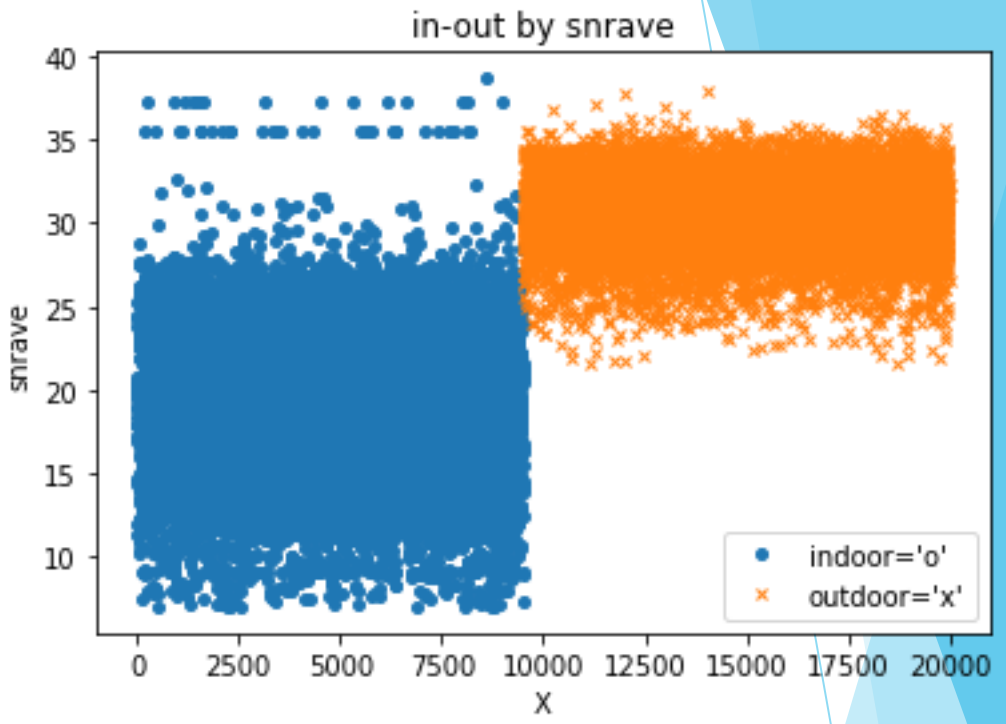
Testing data

特征 2 / feature 2

snrtotal :所有能检测到卫星的信噪比总和



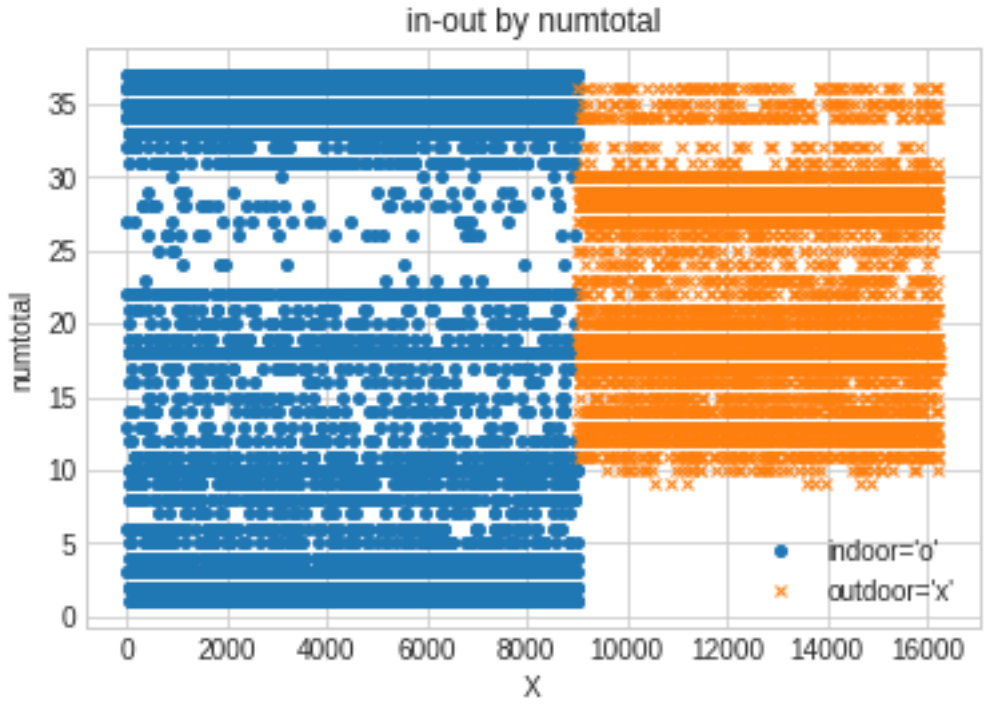
Training data



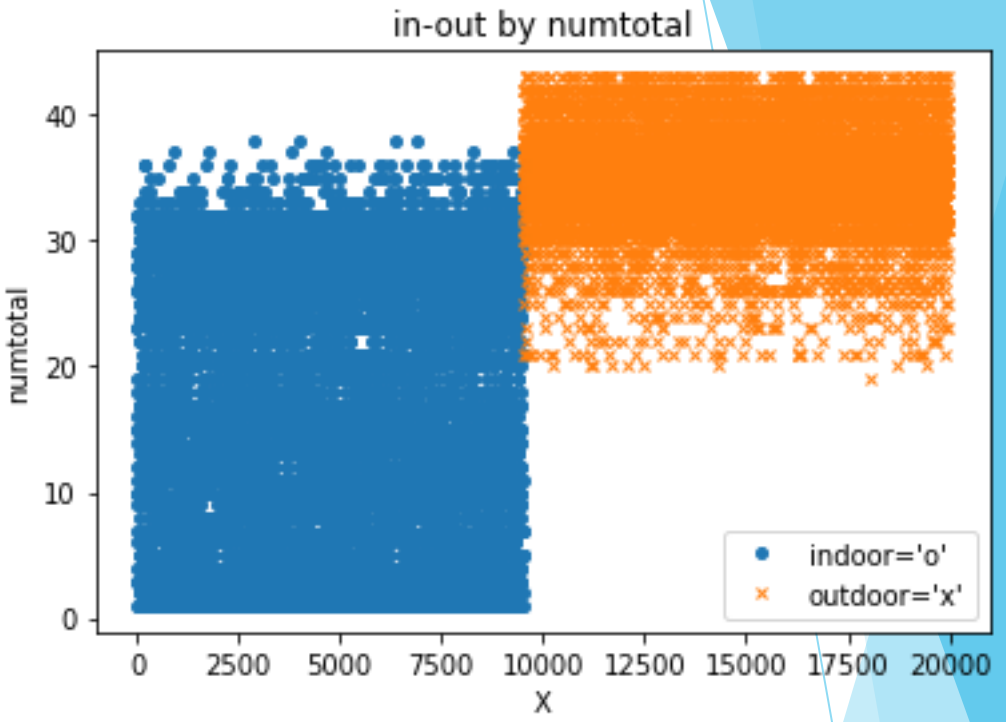
Testing data

特征 3 / feature 3

snrave :所有能检测到卫星的信噪比的平均值



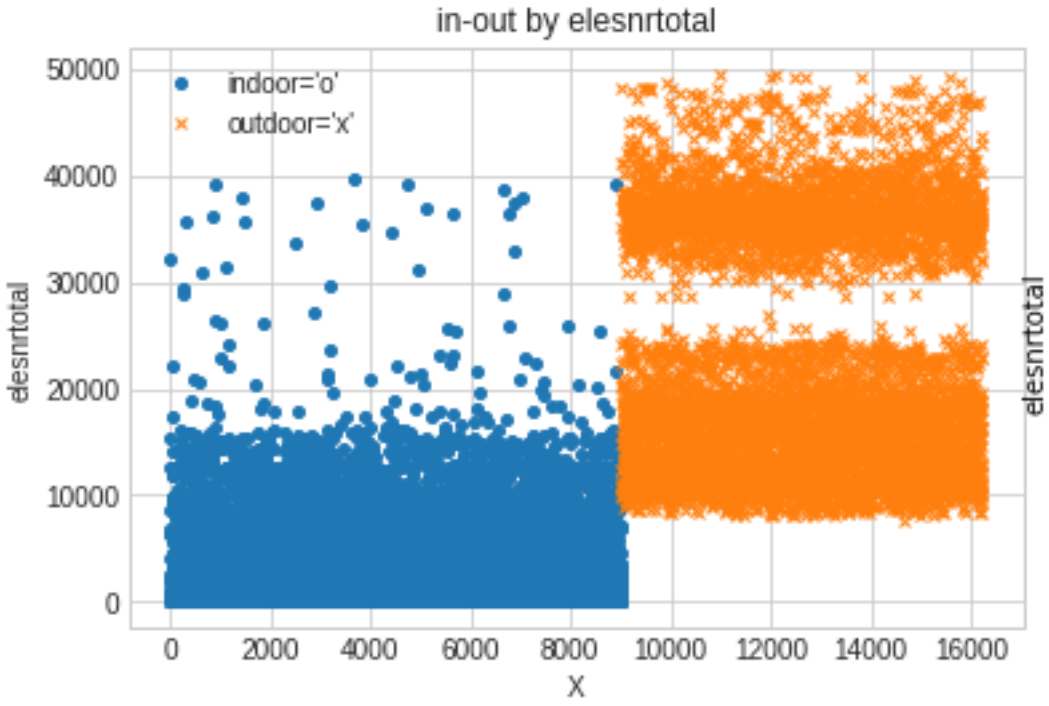
Training data



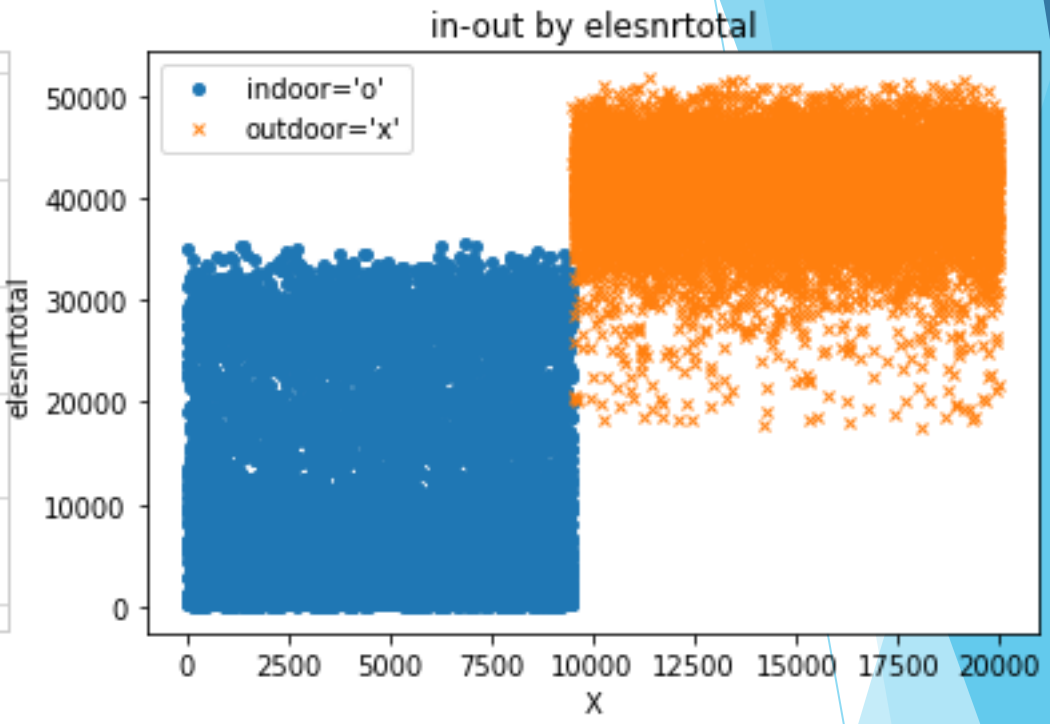
Testing data

特征 4 / feature 4

numtotal：当前手机所能检测的所有卫星数量 (包括信号强度低的卫星)



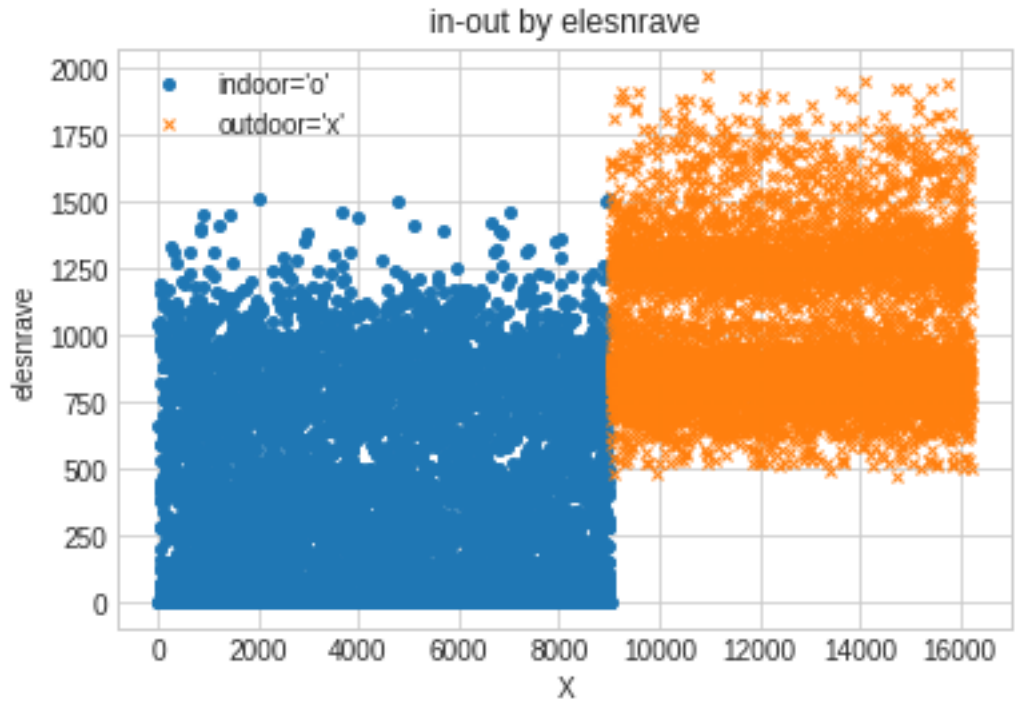
Training data



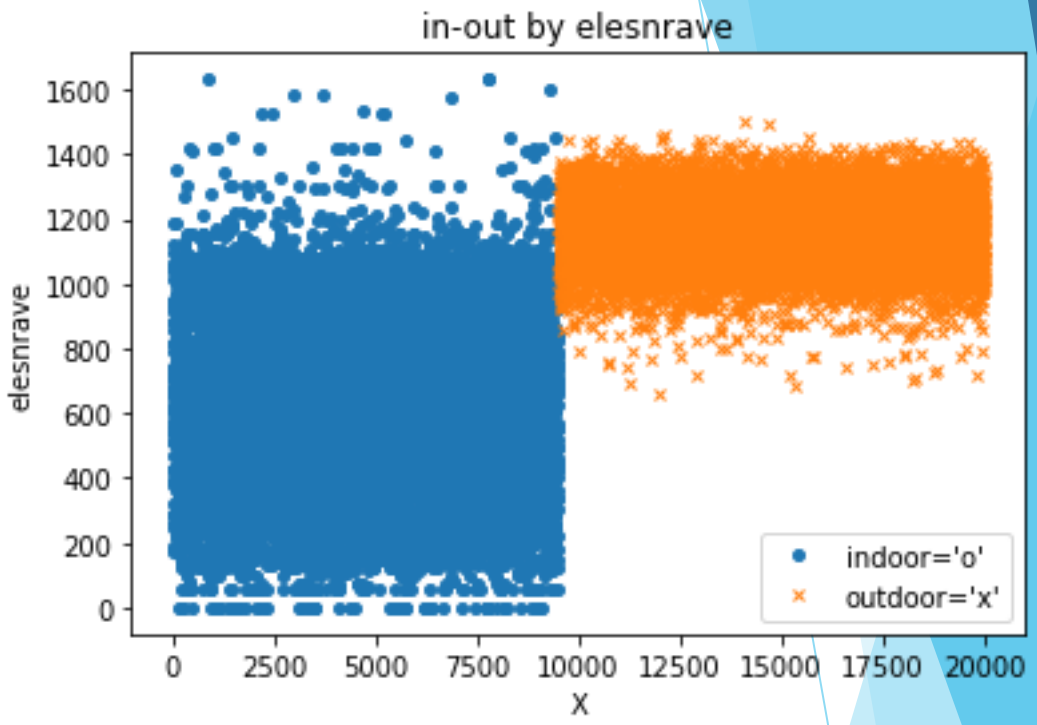
Testing data

特征 5 / feature 5

elesnrtotal :所有能检测到卫星的俯仰角和信噪比 乘积的总和



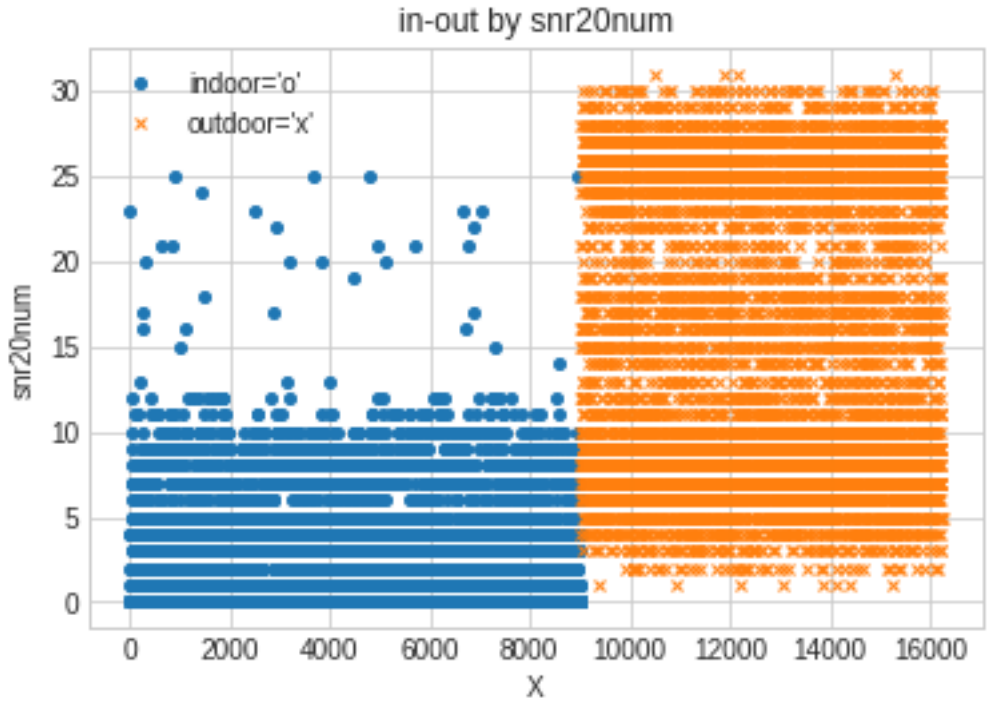
Training data



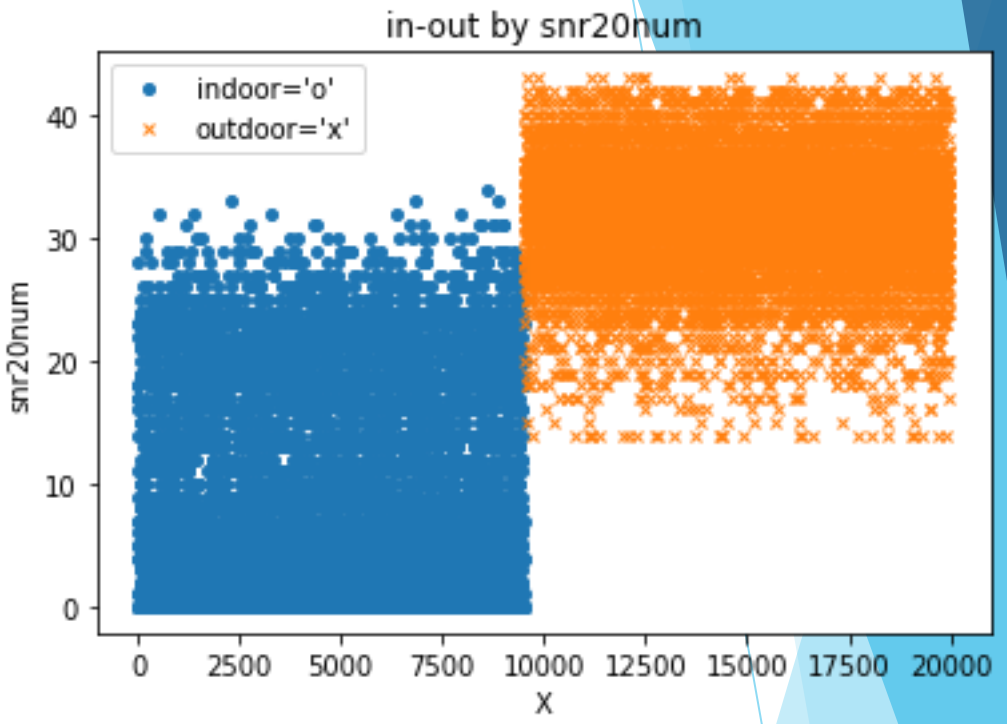
Testing data

特征 6 / feature 6

elesnrave :所有能检测到卫星的俯仰角和信噪比 乘积的平均值



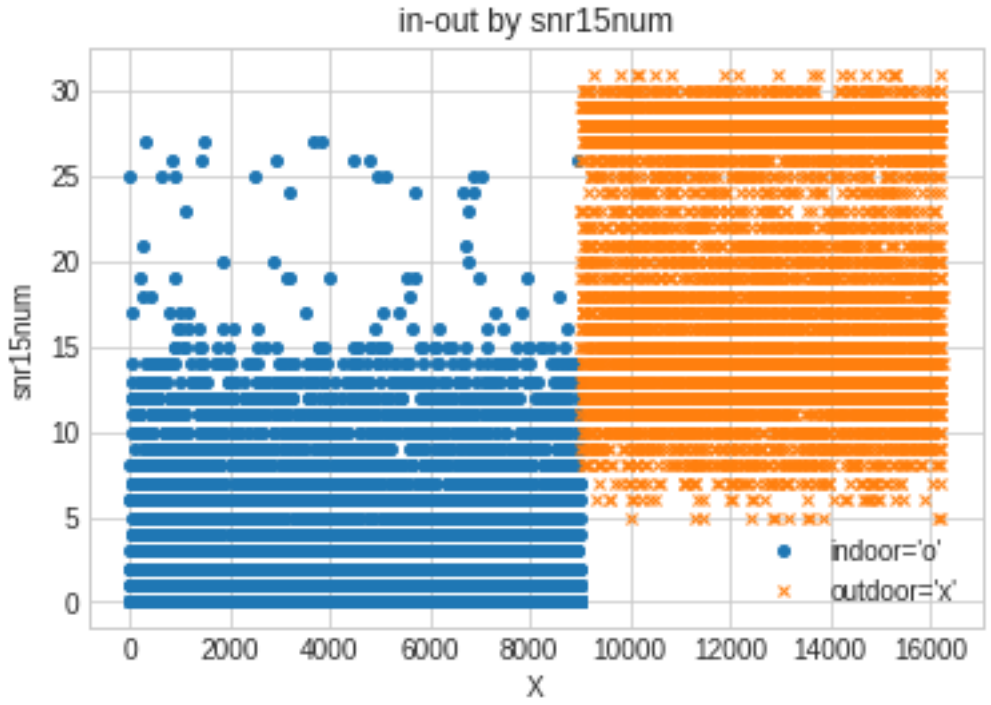
Training data



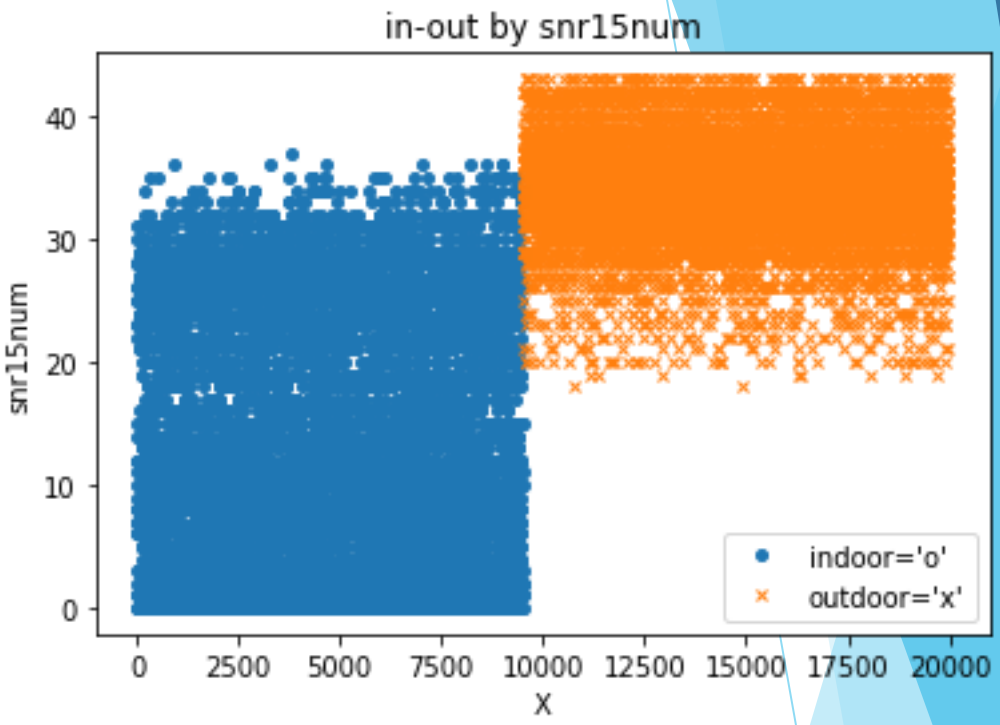
Testing data

特征 7 / feature 7

snr20num：手机检测到信噪比大于等于 20 的卫星 数量



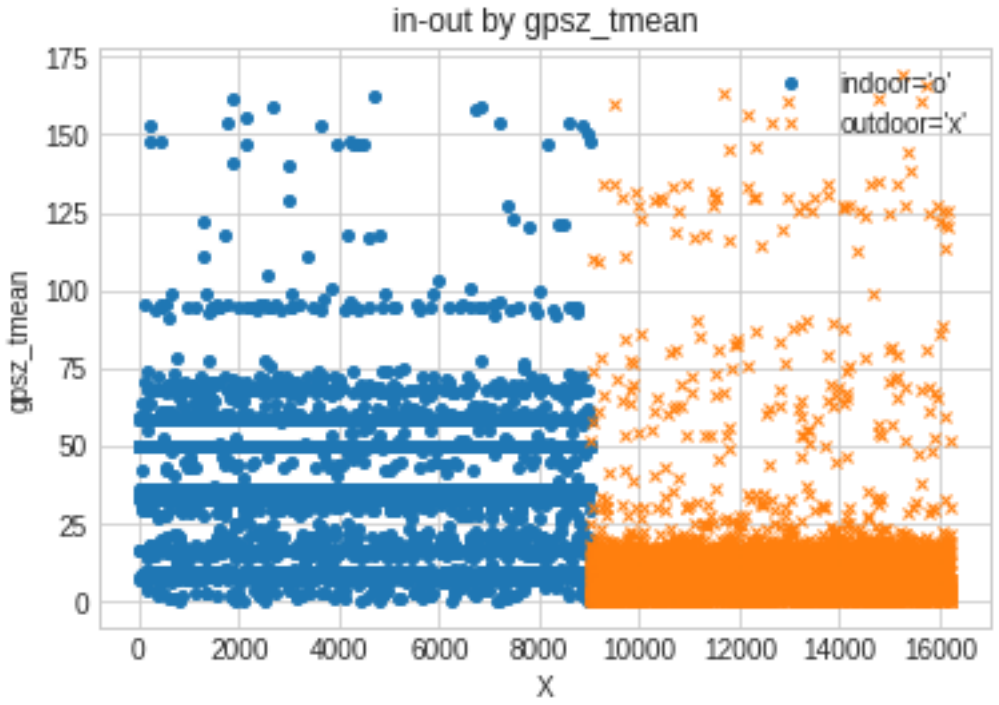
Training data



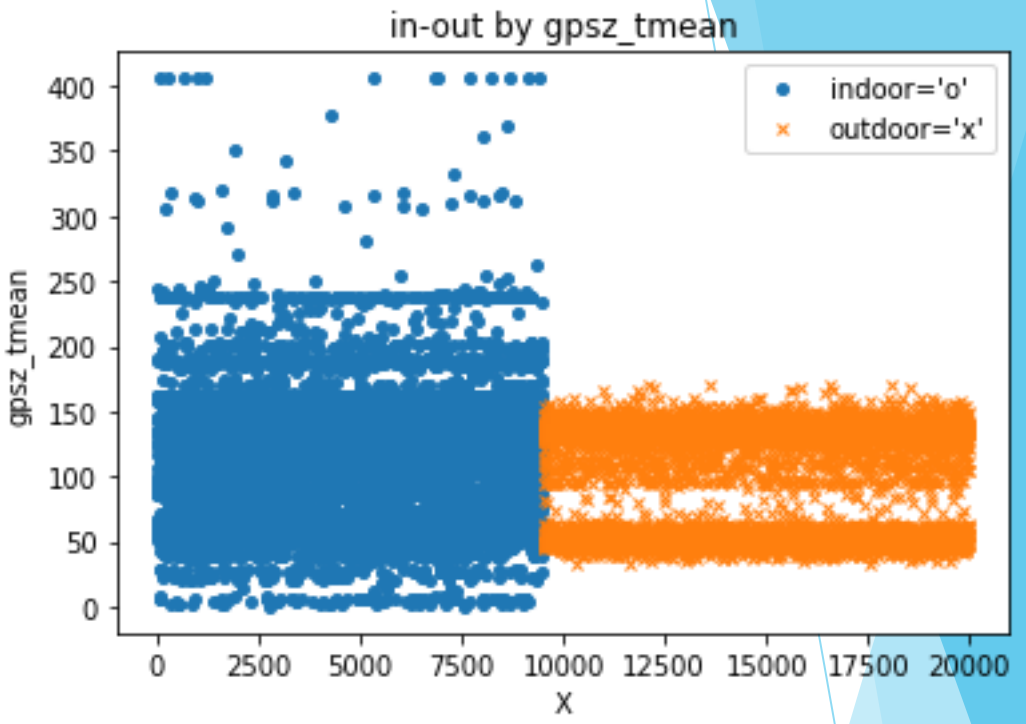
Testing data

特征 8 / feature 8

snr15num :手机检测到信噪比大于等于 15 的卫星 数量



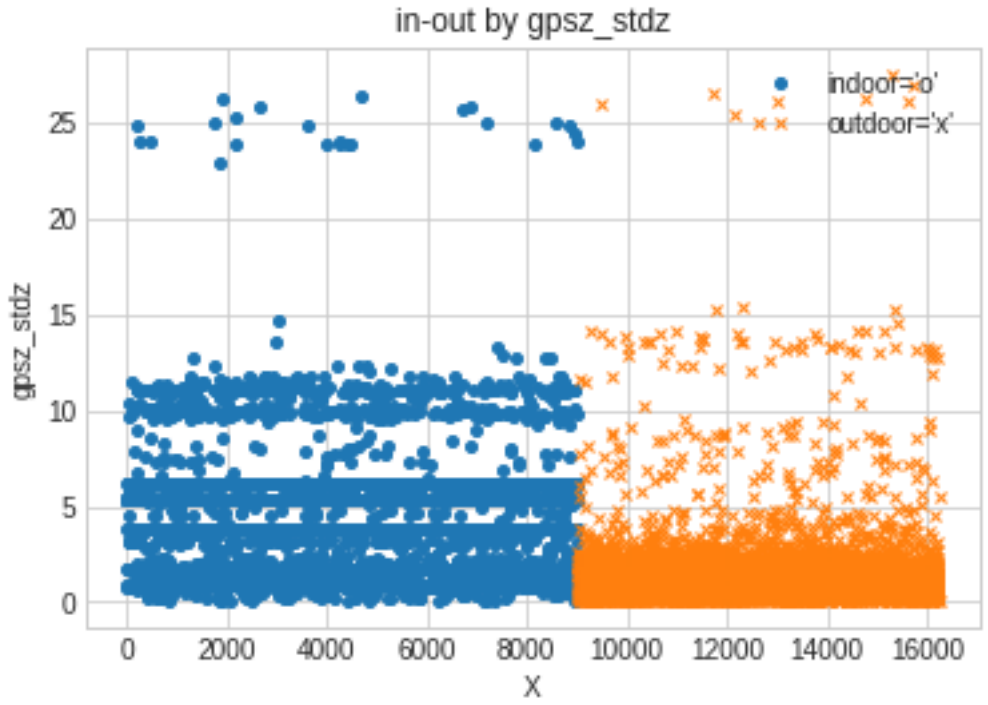
Training data



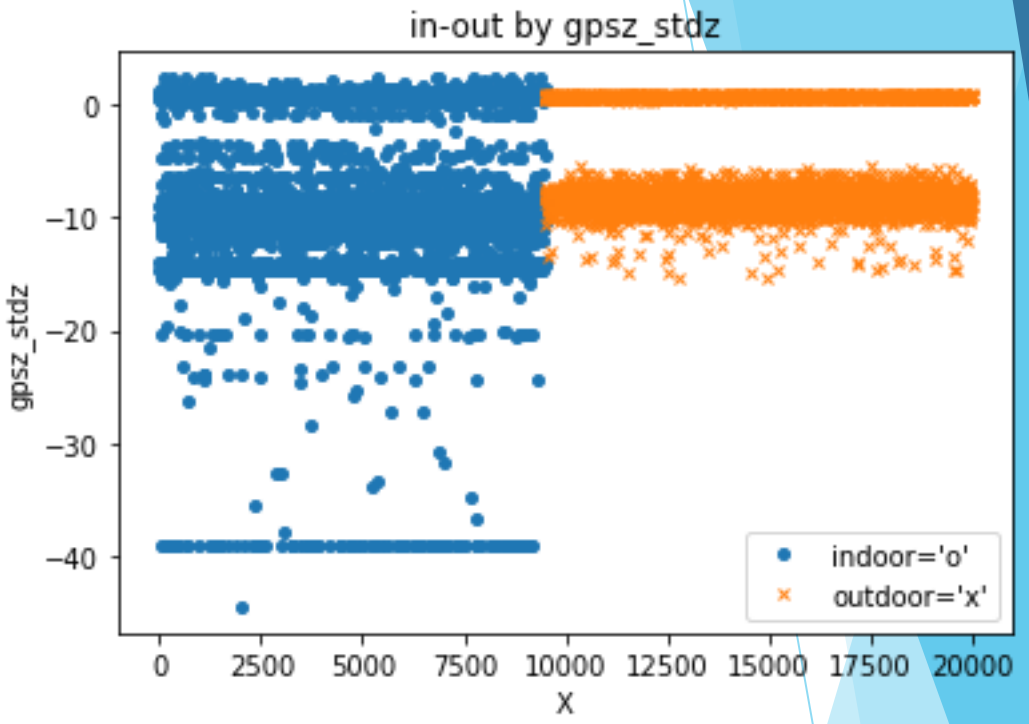
Testing data

特征 9 / feature 9

gpsz_tmean：当前位置的 GPS 海拔高度与手机测试 海拔高度差的绝对值



Training data

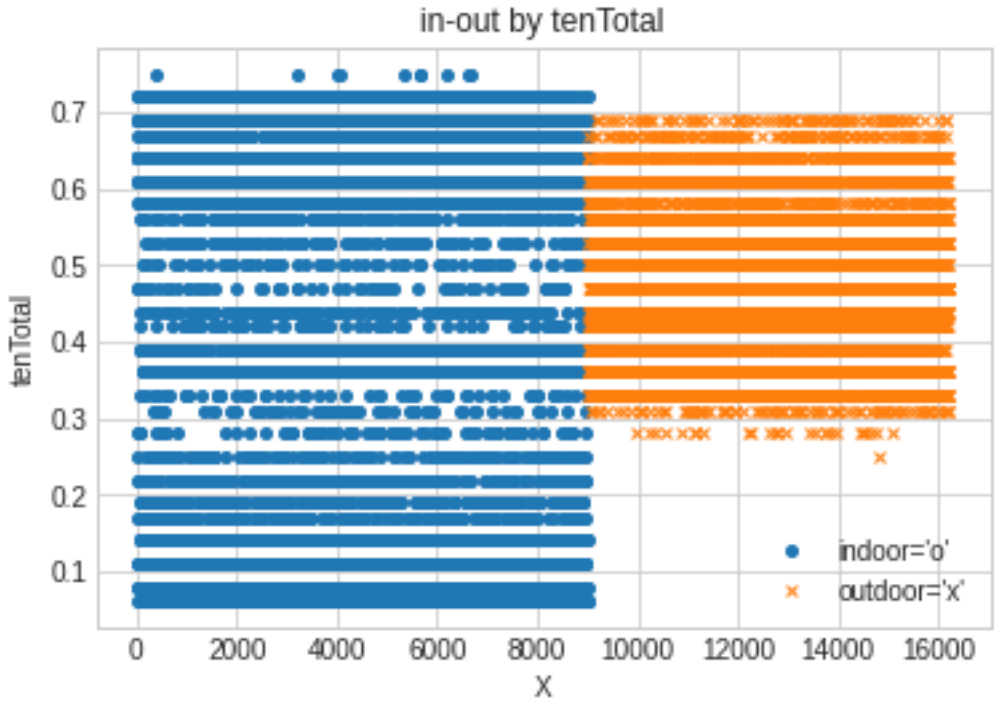


Testing data

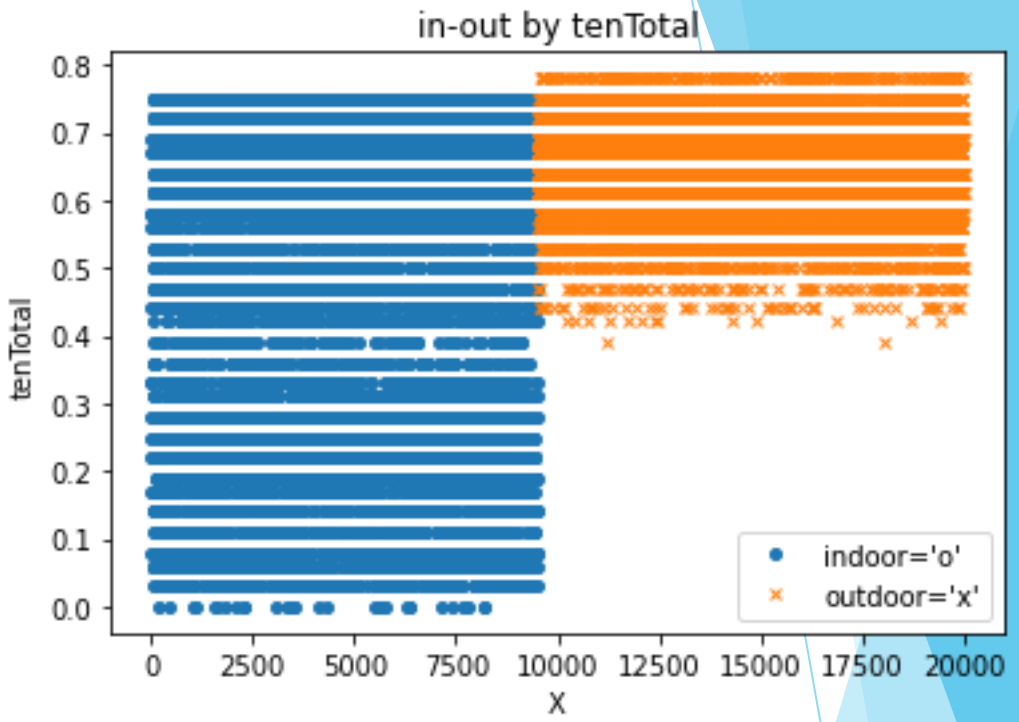
gpsz_stdz 特征处理明显不一致， 所以后面去掉这个特征

特征 10 / feature 10

gpsz_stdz：当前位置的 GPS 海拔高度与手机测试 海拔高度差的绝对值是否小于标准差 (0 or 1)



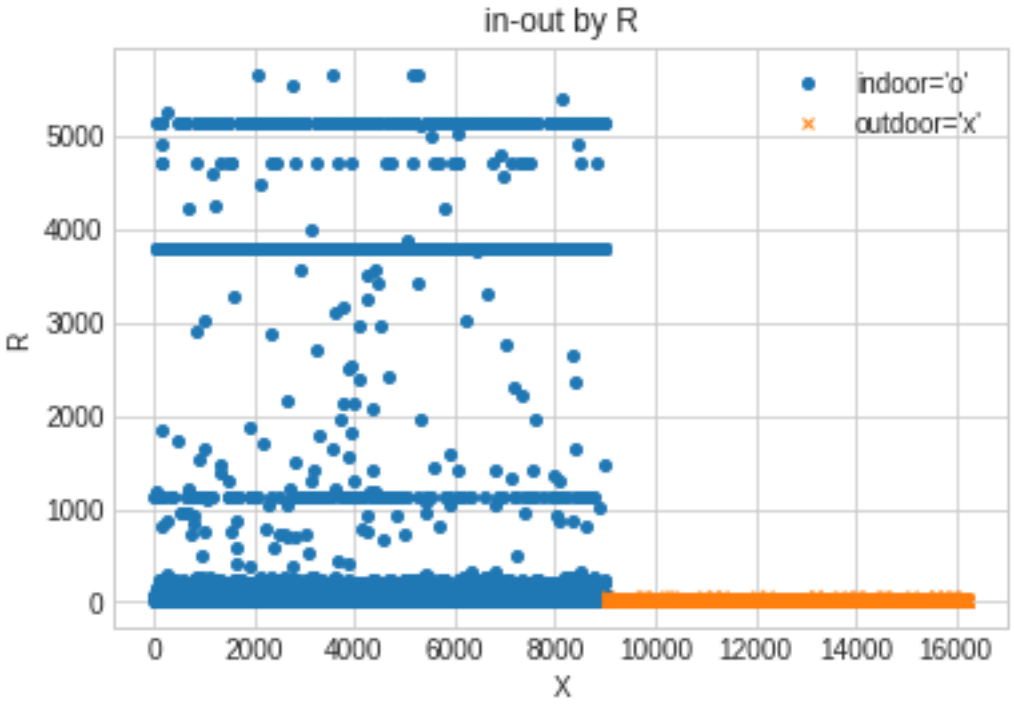
Training data



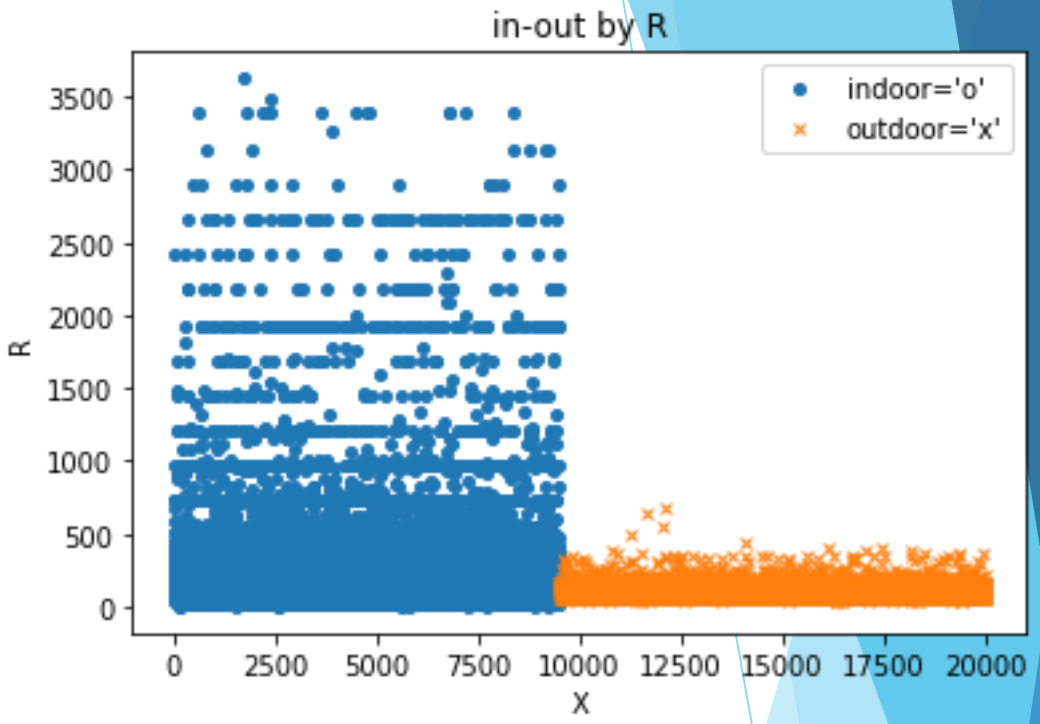
Testing data

特征 11 / feature 11

tenTotal :将 360° 分为 36 份(10°)，包含卫星的份数总和与 36 之比



Training data



Testing data

特征 12 / feature 12
R :GPS 预测误差半径

模型 调试 try different models

- 特征个数减少 reduce training features from 12 to 11, 8.
- 参数调整 parameters adjustments.

采集的训练数据集 zhuyining

采集的测试数据集 guihan

去掉 gpsz_stdz, 用 11 个特征， 4个子模型， 深度6

地铁室外跑

```
(963, 13)
(963, 11) (963,)
0.993959938366718 0.4818276220145379
              precision    recall  f1-score   support

      indoor       0.00      0.00      0.00         0
     outdoor       1.00      0.48      0.65       963

    accuracy                           0.48       963
   macro avg       0.50      0.24      0.33       963
weighted avg       1.00      0.48      0.65       963
```

地铁站内

```
(2809, 13)
(2809, 11) (2809,)
0.993959938366718 0.33855464578141686
              precision    recall  f1-score   support

      indoor       1.00      0.34      0.51      2809
     outdoor       0.00      0.00      0.00         0

    accuracy                           0.34      2809
   macro avg       0.50      0.17      0.25      2809
weighted avg       1.00      0.34      0.51      2809
```

其他
(删掉 地铁室外跑& 地铁站内)

```
(19990, 13)
(19990, 11) (19990,)
0.993959938366718 0.9173586793396699
              precision    recall  f1-score   support

      indoor       0.98      0.85      0.91      9502
     outdoor       0.88      0.98      0.93     10488

    accuracy                           0.92     19990
   macro avg       0.93      0.91      0.92     19990
weighted avg       0.92      0.92      0.92     19990
```

采集的训练数据集 zhuyining

采集的测试数据集 guihan

去掉 gpsz_stdz，用 11 个特征， 4个子模型， 深度6

用 12 个特征， 4个子模型， 深度10

地铁室外跑

	precision	recall	f1-score	support
indoor	0.00	0.00	0.00	0
outdoor	1.00	0.48	0.65	963
accuracy			0.48	963
macro avg	0.50	0.24	0.33	963
weighted avg	1.00	0.48	0.65	963

	precision	recall	f1-score	suppor
indoor	0.00	0.00	0.00	
outdoor	1.00	0.26	0.41	96
accuracy			0.26	96
macro avg	0.50	0.13	0.21	96
weighted avg	1.00	0.26	0.41	96

地铁站内

	precision	recall	f1-score	support
indoor	1.00	0.34	0.51	2809
outdoor	0.00	0.00	0.00	0
accuracy			0.34	2809
macro avg	0.50	0.17	0.25	2809
weighted avg	1.00	0.34	0.51	2809

	precision	recall	f1-score	suppor
indoor	1.00	0.38	0.55	280
outdoor	0.00	0.00	0.00	
accuracy			0.38	280
macro avg	0.50	0.19	0.28	280
weighted avg	1.00	0.38	0.55	280

其他

	precision	recall	f1-score	support
indoor	0.98	0.85	0.91	9502
outdoor	0.88	0.98	0.93	10488
accuracy			0.92	19990
macro avg	0.93	0.91	0.92	19990
weighted avg	0.92	0.92	0.92	19990

	precision	recall	f1-score	suppo
indoor	0.97	0.91	0.94	95
outdoor	0.92	0.98	0.95	104
accuracy			0.95	199
macro avg	0.95	0.94	0.94	199
weighted avg	0.95	0.95	0.94	199

Reference

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Thank you!