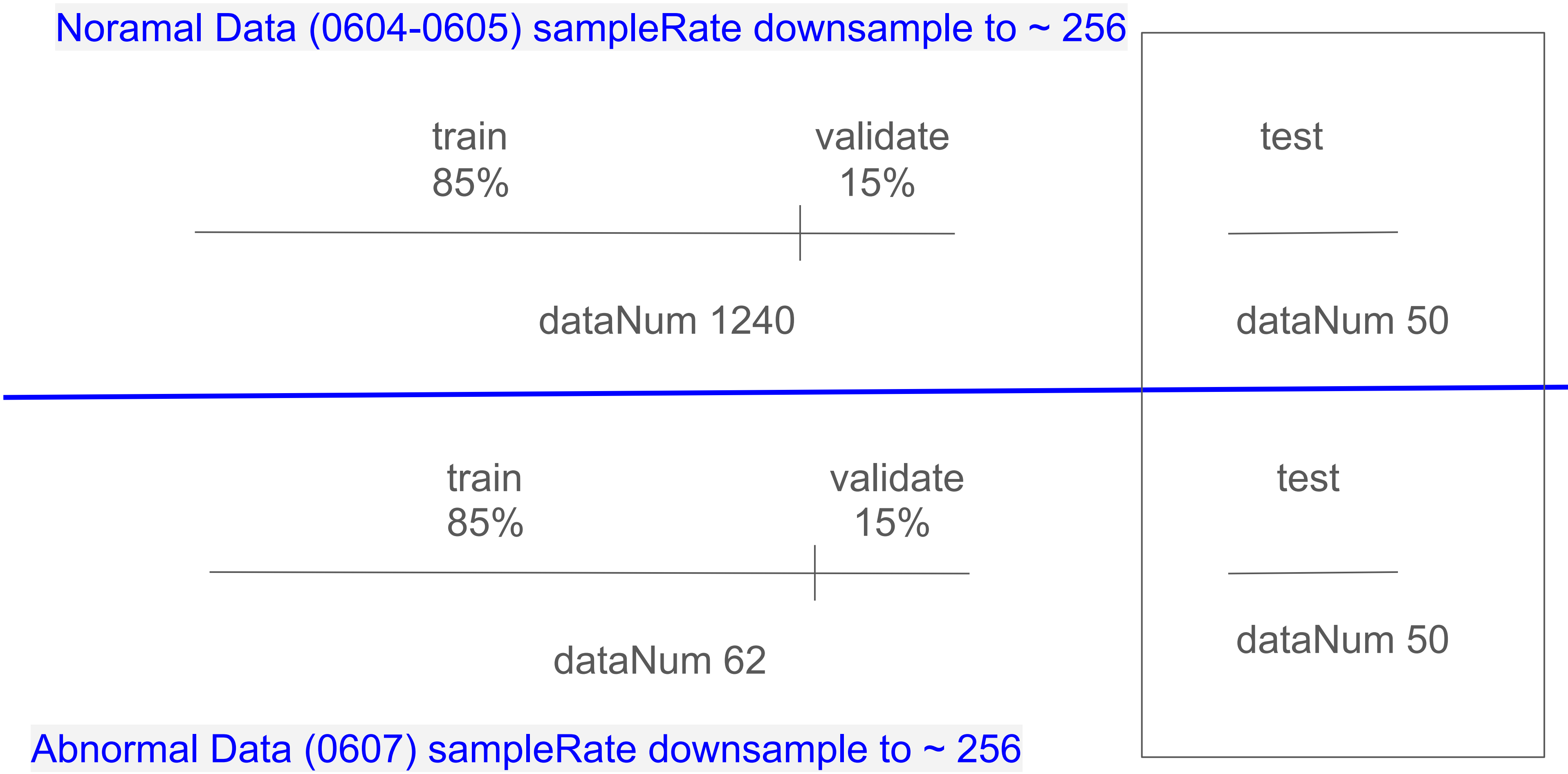
# training result

再平層

專題生 侯均頲



Noramal Data (0604-0605) sampleRate downsample to ~ 256

train
85%

validate
15%

dataNum 1240

test

dataNum 50

train
85%

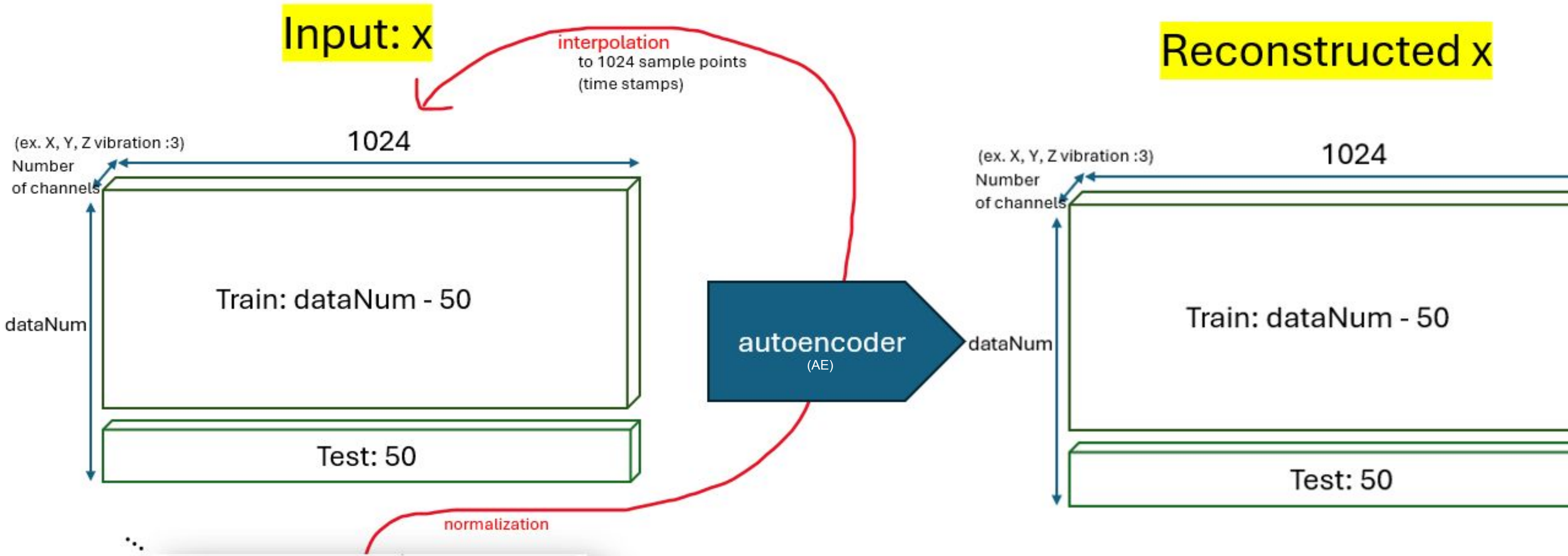
validate
15%

dataNum 62

test

dataNum 50

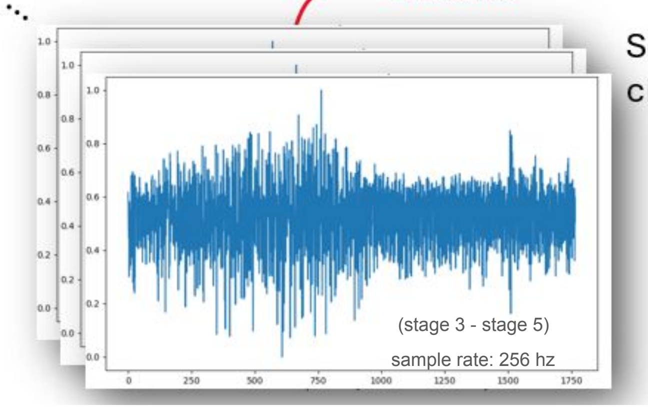
Abnormal Data (0607) sampleRate downsample to ~ 256



Input: x

interpolation to 1024 sample points (time stamps)

Reconstructed x



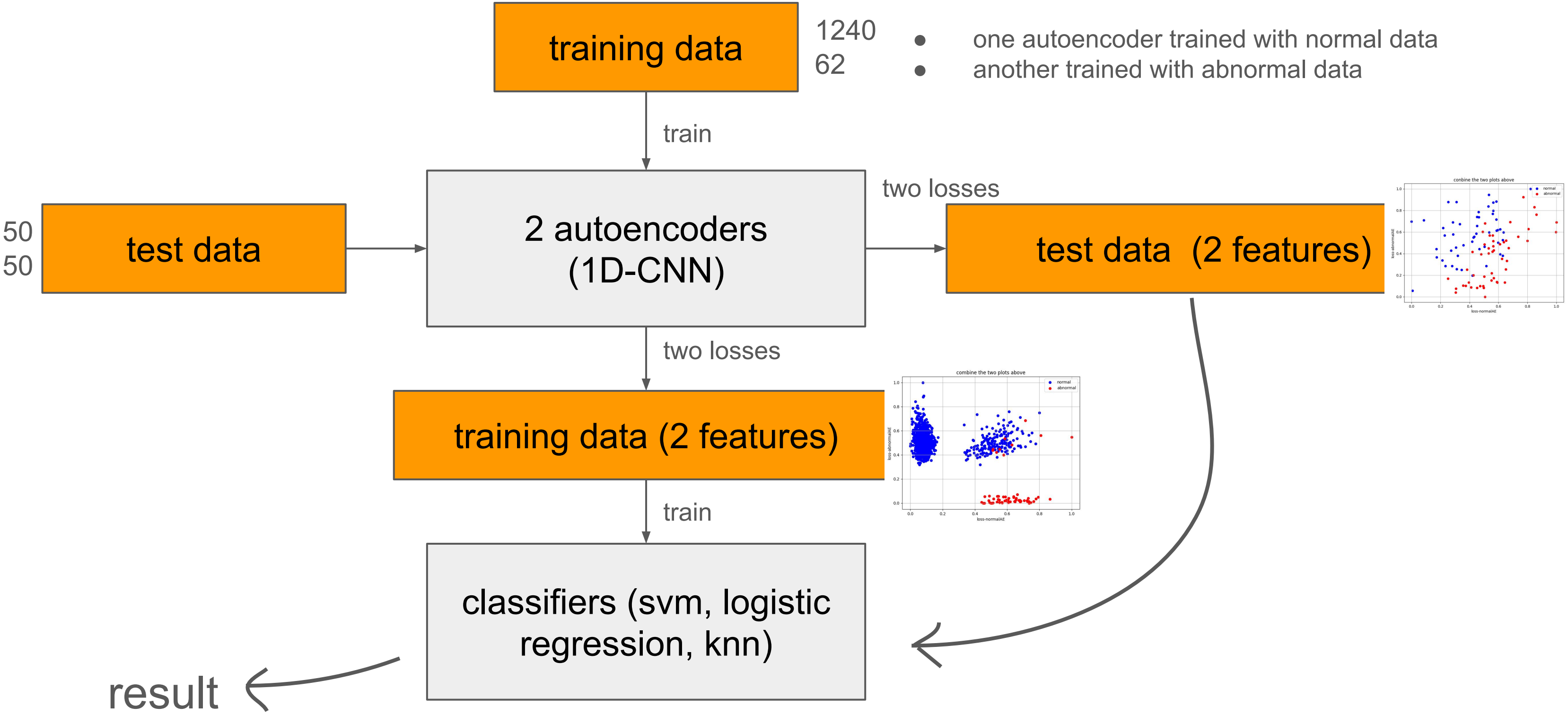
(stage 3 - stage 5)

sample rate: 256 hz

Selected channels

* First, I cut all data to the same length (I chose to align with the shortest one) in order to remove bias, as abnormal data tends to have a much longer duration

# pipeline



training data

1240
62

- one autoencoder trained with normal data
- another trained with abnormal data

train

50
50

test data

2 autoencoders (1D-CNN)

two losses

test data (2 features)

two losses

training data (2 features)

train

classifiers (svm, logistic regression, knn)

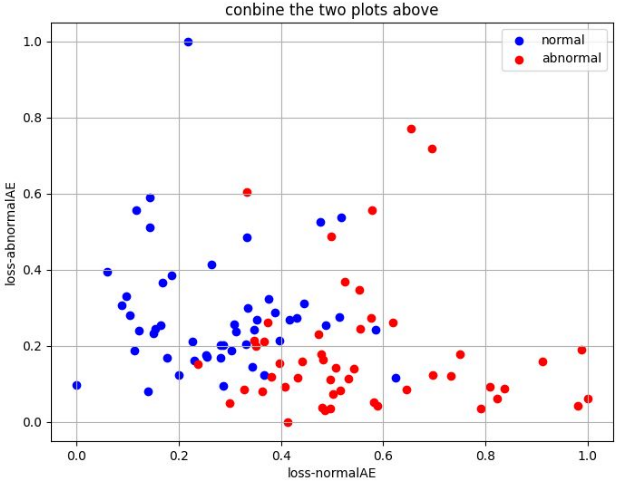
result

横軸 - loss (AE trained by nornmal data)
縦軸 - loss (AE trained by abnormal data)

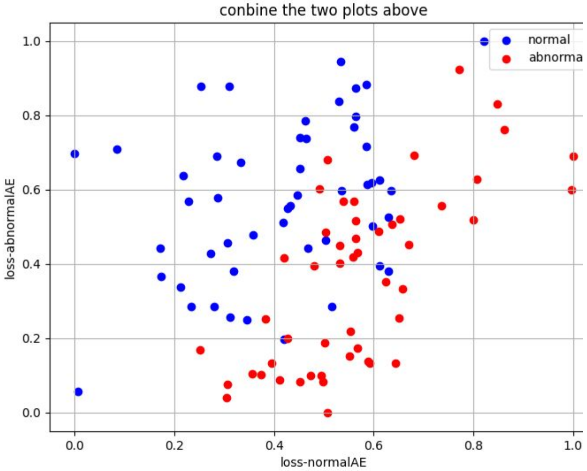
50 blue dots (normal)
50 red dots (abnormal)

channel 0
(amp)

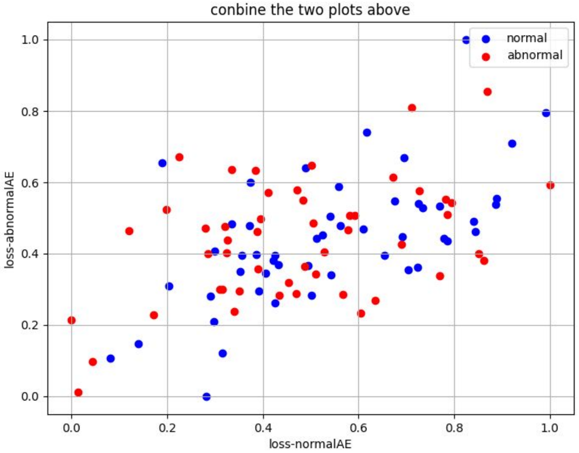
(select channel 0 to train the autoencoders)



channel 1,2,3
(door xyz)



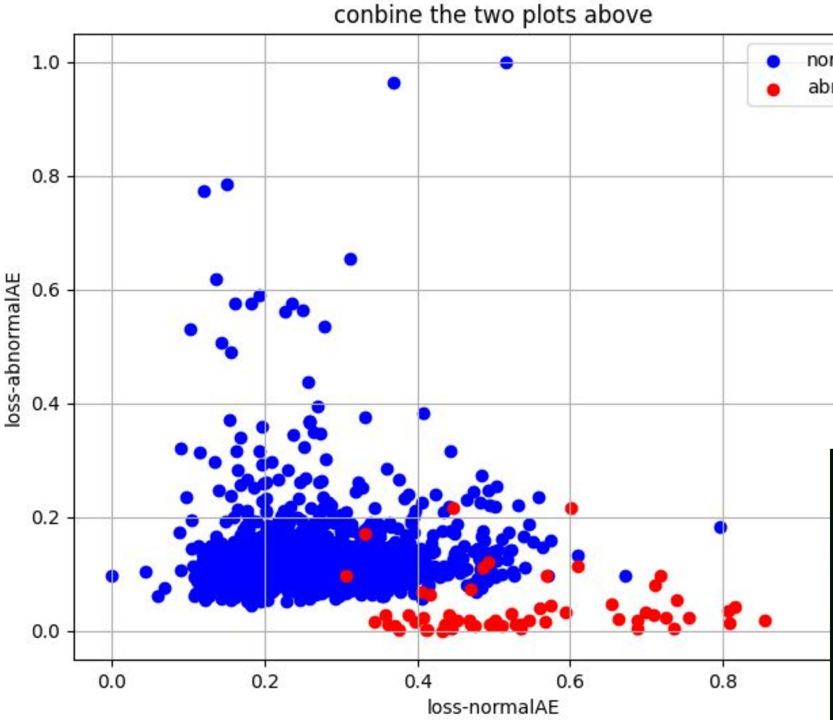
channel 4,5,6
(car xyz)



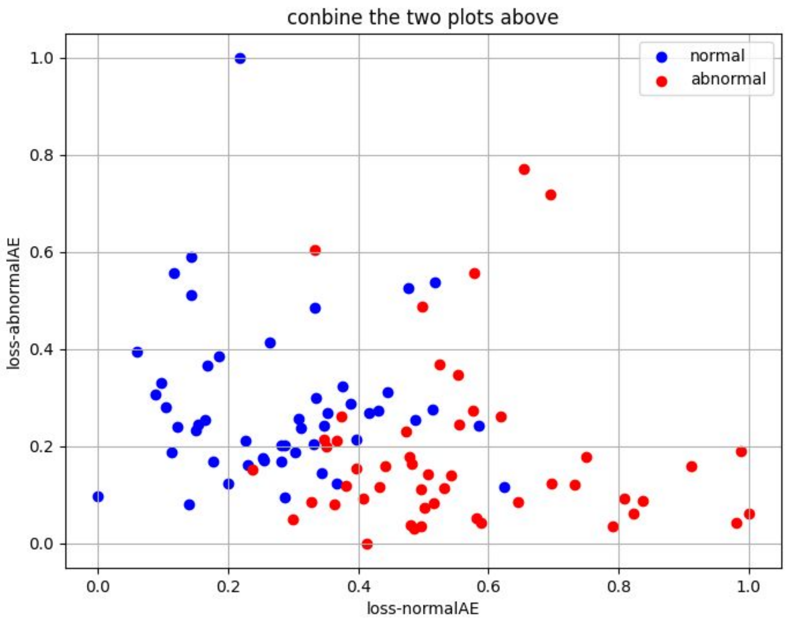
* kind of verify channel 4,5,6 are not informative

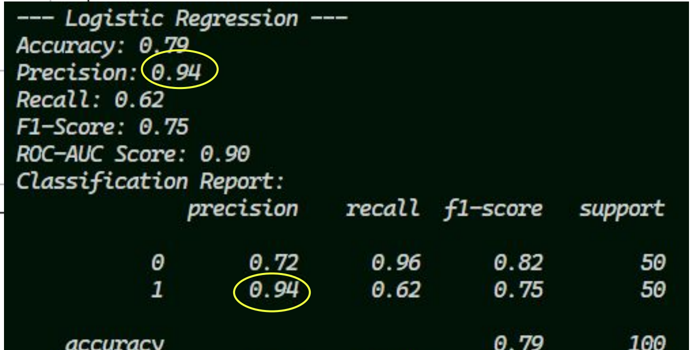
# amp result (select channel 0)

train


conbine the two plots above

test


conbine the two plots above

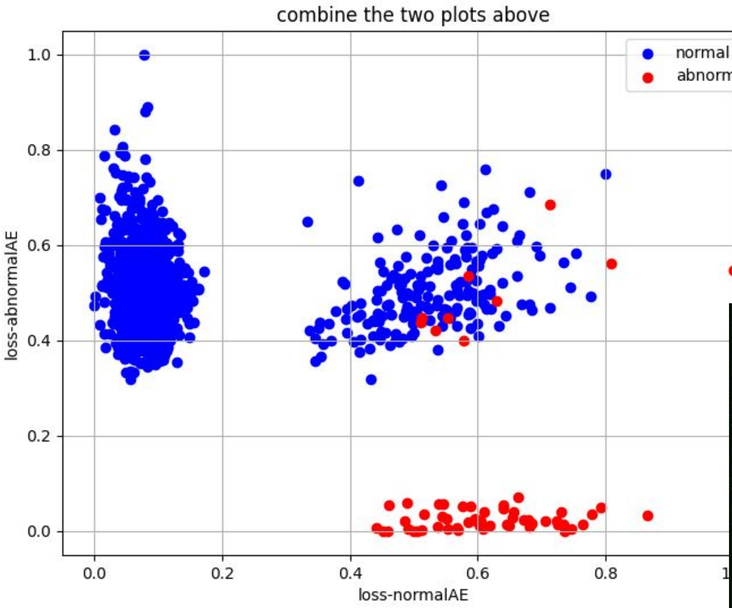


```
--- Logistic Regression ---
Accuracy: 0.79
Precision: 0.94
Recall: 0.62
F1-Score: 0.75
ROC-AUC Score: 0.90
Classification Report:
              precision    recall  f1-score   support

           0       0.72      0.96      0.82        50
           1       0.94      0.62      0.75        50

    accuracy                           0.79       100
```

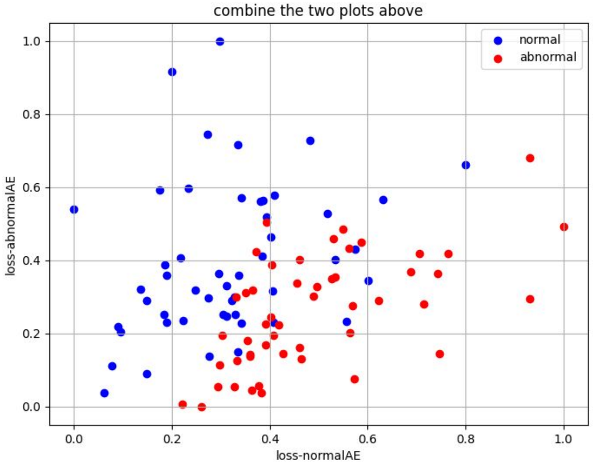
0: normal
1: abnormal

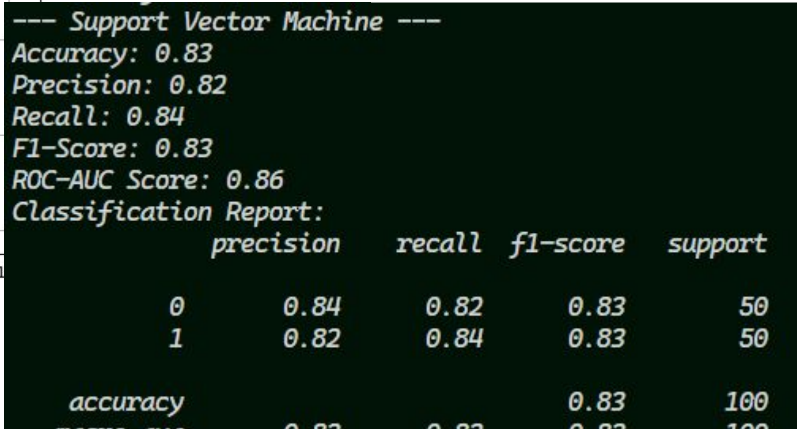
# door vibration result (select channel 1, 2, 3)

train



test





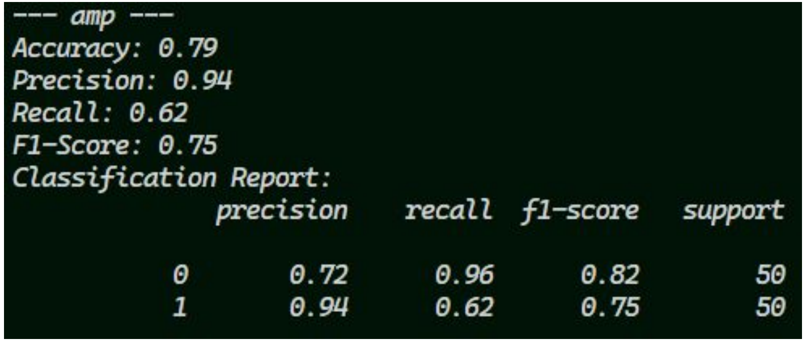
```
--- Support Vector Machine ---
Accuracy: 0.83
Precision: 0.82
Recall: 0.84
F1-Score: 0.83
ROC-AUC Score: 0.86
Classification Report:
              precision    recall  f1-score   support

           0       0.84      0.82      0.83        50
           1       0.82      0.84      0.83        50

    accuracy                           0.83       100
```

0: normal
1: abnormal

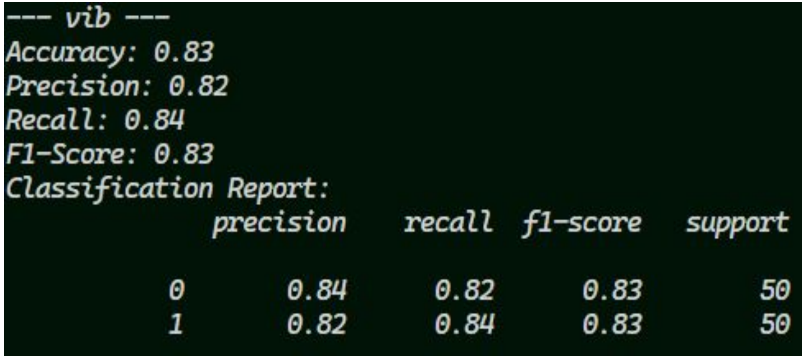
best channels selections: vibration[1,2,3], amp[0]

(selections like [0,1,2,3]  [2,3] or [0,2,3] only got 0.7 accuracy or lower)

(tested by the same training and testing set)

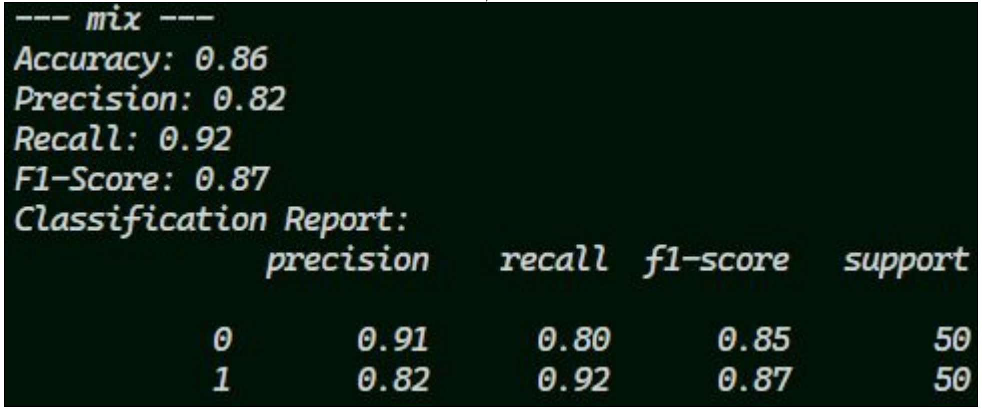


```
--- amp ---
Accuracy: 0.79
Precision: 0.94
Recall: 0.62
F1-Score: 0.75
Classification Report:
              precision    recall  f1-score   support

           0       0.72      0.96      0.82        50
           1       0.94      0.62      0.75        50
```



```
--- vib ---
Accuracy: 0.83
Precision: 0.82
Recall: 0.84
F1-Score: 0.83
Classification Report:
              precision    recall  f1-score   support

           0       0.84      0.82      0.83        50
           1       0.82      0.84      0.83        50
```

OR
operation



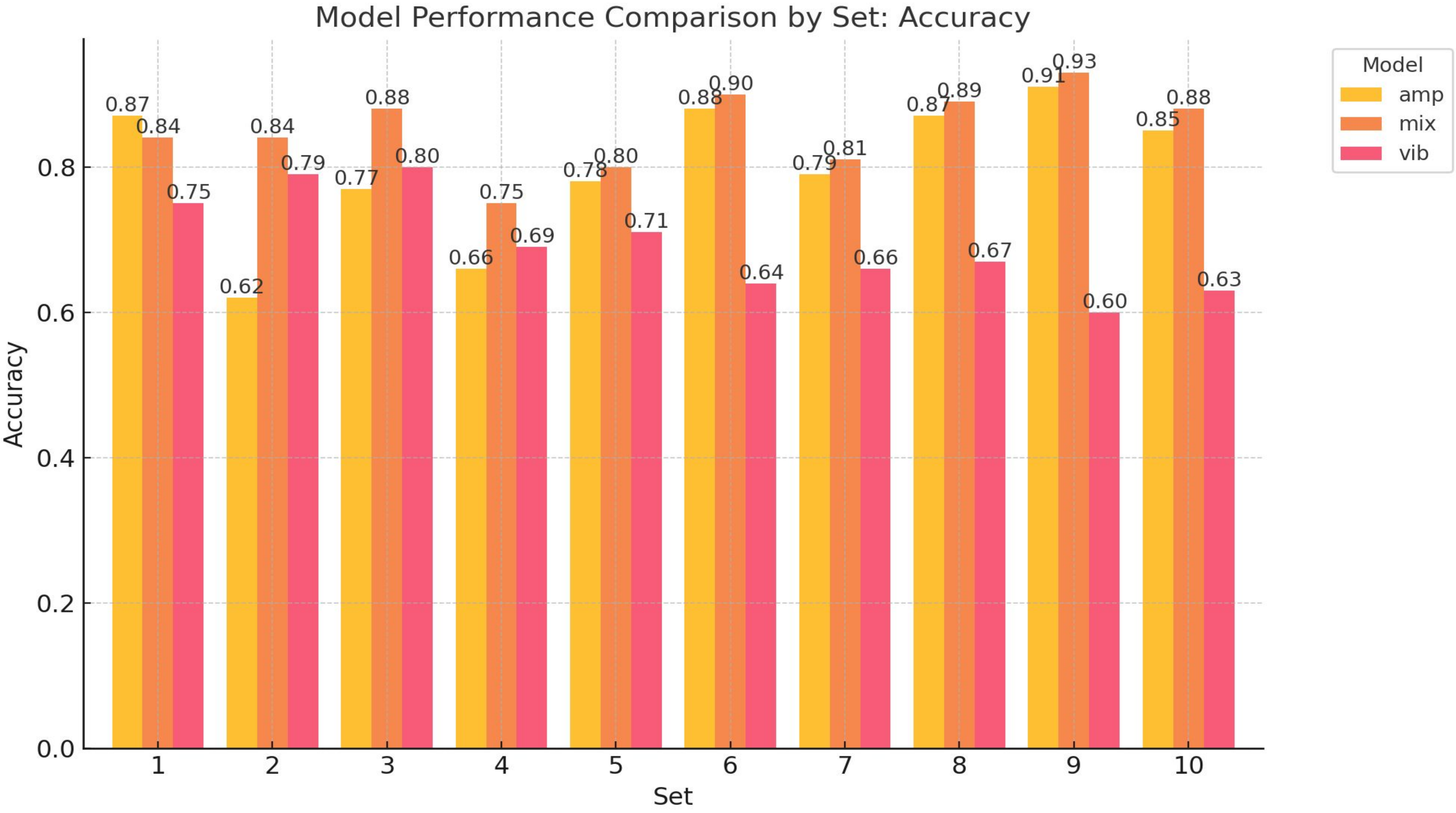
```
--- mix ---
Accuracy: 0.86
Precision: 0.82
Recall: 0.92
F1-Score: 0.87
Classification Report:
              precision    recall  f1-score   support

           0       0.91      0.80      0.85        50
           1       0.82      0.92      0.87        50
```

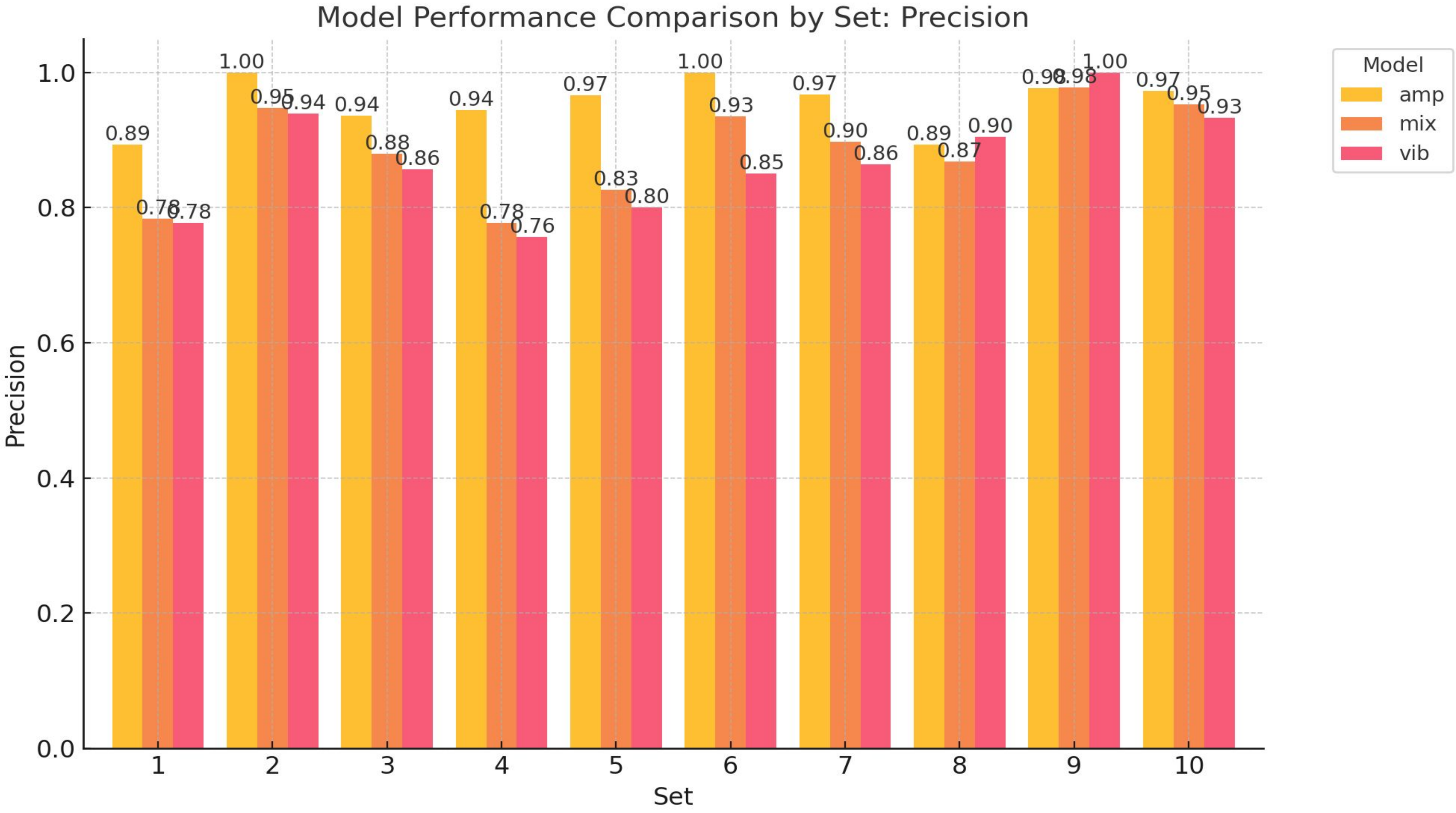
for example:
amp predict: [1, 0, 1, 0 ,0]
vib predict:   [ 0, 0, 0 ,1, 0]
mix would be [1, 0, 1, 1 ,0]
(like bitwise OR)

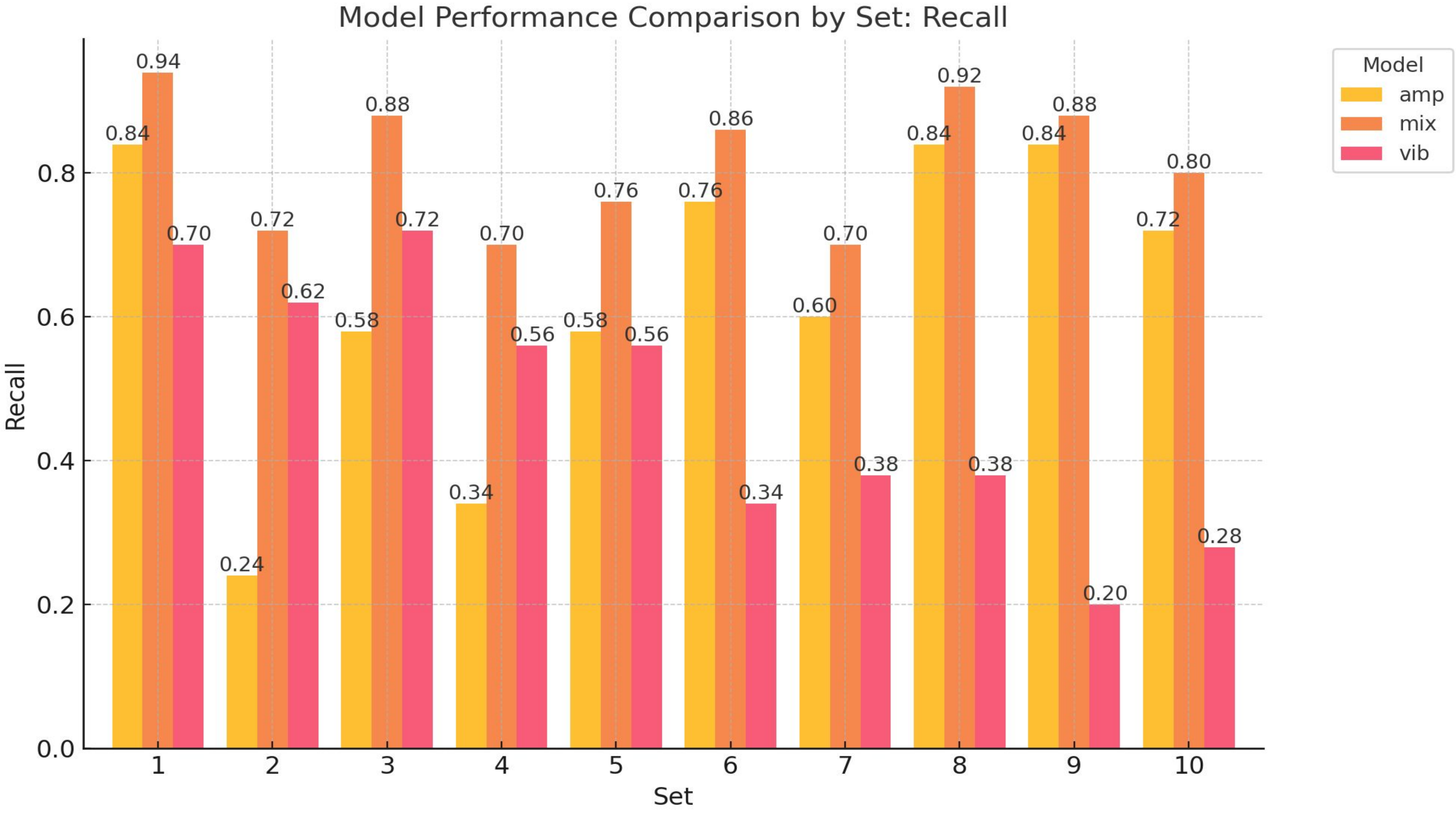
- ‘Mix’ sacrifices a bit of precision to improve recall.

0: normal
1: abnormal

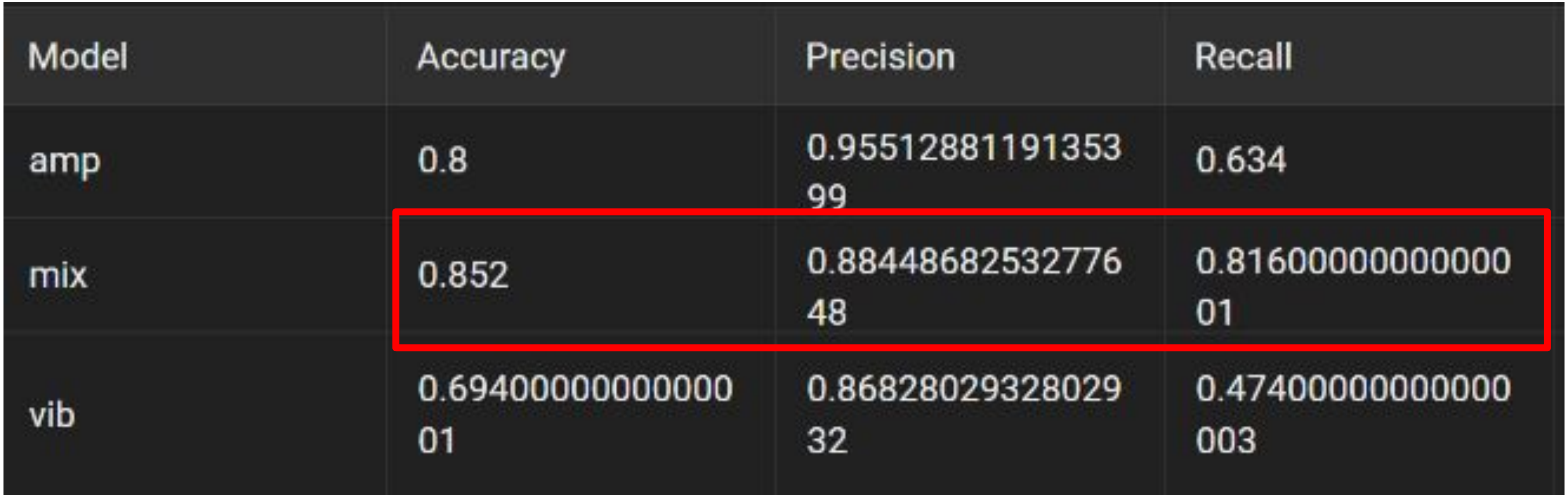
The following results are from 10 full pipeline tests, with the train/test data shuffled for each iteration (cross-validation).


Model Performance Comparison by Set: Accuracy
Accuracy
Set
0.0
0.2
0.4
0.6
0.8
1
2
3
4
5
6
7
8
9
10
Model
amp
mix
vib
0.87
0.84
0.75
0.62
0.84
0.79
0.77
0.88
0.80
0.66
0.75
0.69
0.78
0.80
0.71
0.88
0.90
0.64
0.79
0.81
0.66
0.87
0.89
0.67
0.91
0.93
0.60
0.85
0.88
0.63


Model Performance Comparison by Set: Precision
Precision
Set
0.0
0.2
0.4
0.6
0.8
1.0
1
2
3
4
5
6
7
8
9
10
Model
amp
mix
vib
0.89
0.78
0.78
1.00
0.95
0.94
0.94
0.88
0.86
0.94
0.78
0.76
0.97
0.83
0.80
1.00
0.93
0.85
0.97
0.90
0.86
0.89
0.87
0.90
0.98
0.98
1.00
0.97
0.95
0.93


Model Performance Comparison by Set: Recall
Model
amp
mix
vib
Recall
0.0
0.2
0.4
0.6
0.8
Set
1
2
3
4
5
6
7
8
9
10
0.84
0.94
0.70
0.24
0.72
0.62
0.58
0.88
0.72
0.34
0.70
0.56
0.58
0.76
0.56
0.76
0.86
0.34
0.60
0.70
0.38
0.84
0.92
0.38
0.84
0.88
0.20
0.72
0.80
0.28

# averages result



| Model | Accuracy | Precision | Recall |
|---|---|---|---|
| amp | 0.8 | 0.9551288119135399 | 0.634 |
| mix | 0.852 | 0.8844868253277648 | 0.8160000000000001 |
| vib | 0.6940000000000001 | 0.8682802932802932 | 0.4740000000000003 |