

Smartfall System with Transfer Learning

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Introduction

- Goal is to build an accurate fall detection system with LSTM model
- LSTM was tested with meta sensors data
- Data performed poorly on the system, had scarce fall data
- Wanted to improve meta sensor's performance on the system via relabeling and other fine-tuning

Methods

Data Relabeling

- Meta sensor dataset was manually relabeled in Excel
- Peaks were labeled as falls while remaining data points were labeled as ADL (activities of daily life)
- Extra noise was trimmed out of dataset
- Meta sensor data was collected at 2g and each fall was marked as a 2 sec interval

Data Normalization

- Generic data was collected at 1g
- Meta sensor data was collected at 2g, then normalized by scaling all axes' data by 0.5x
- Pre-trained generic model was transferred and tested on meta sensor data

Transfer Learning

- Pre-trained model was a model built with generic and real adl data
- Dense layer of the LSTM was retrained, rest of the model was frozen

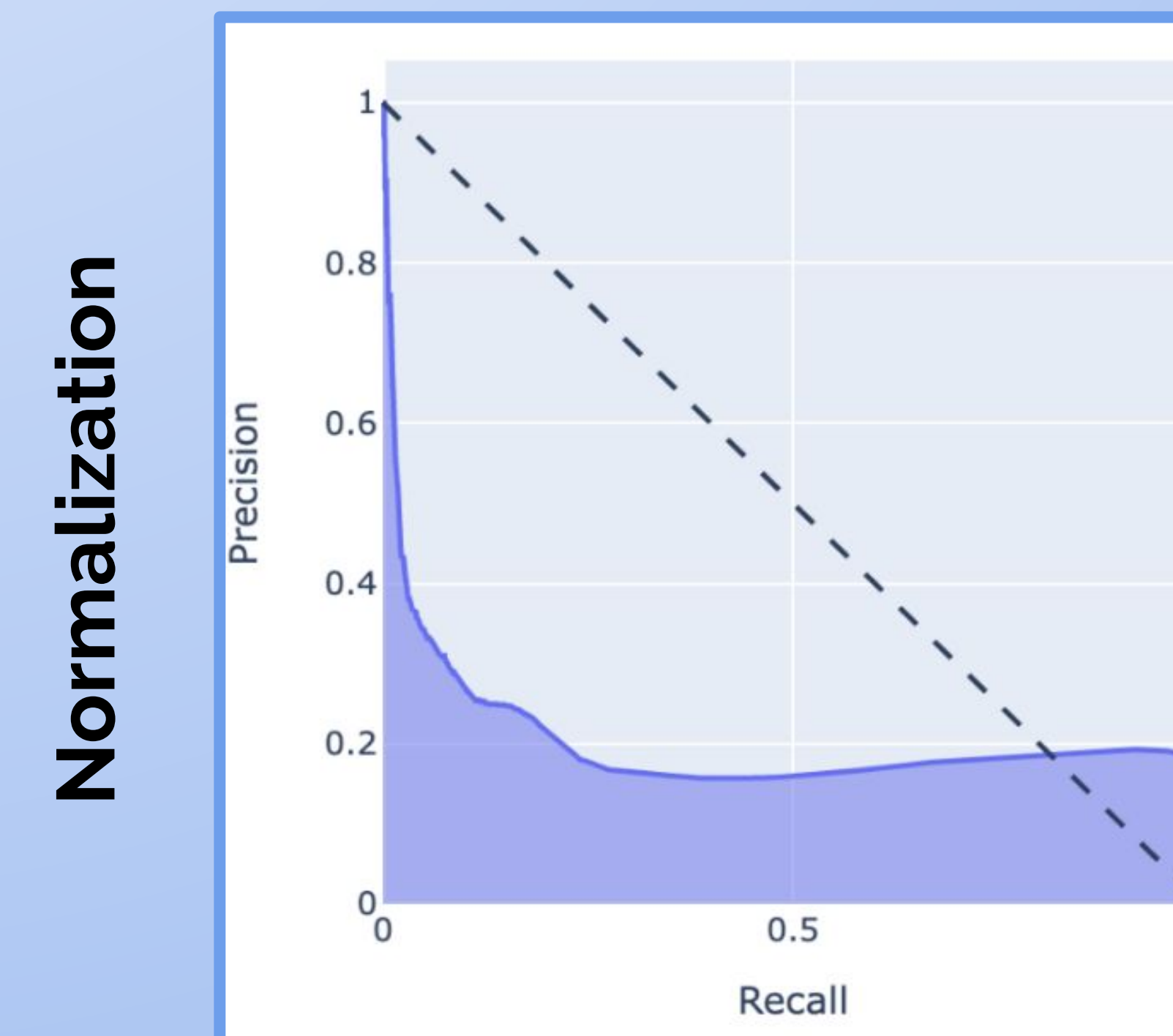
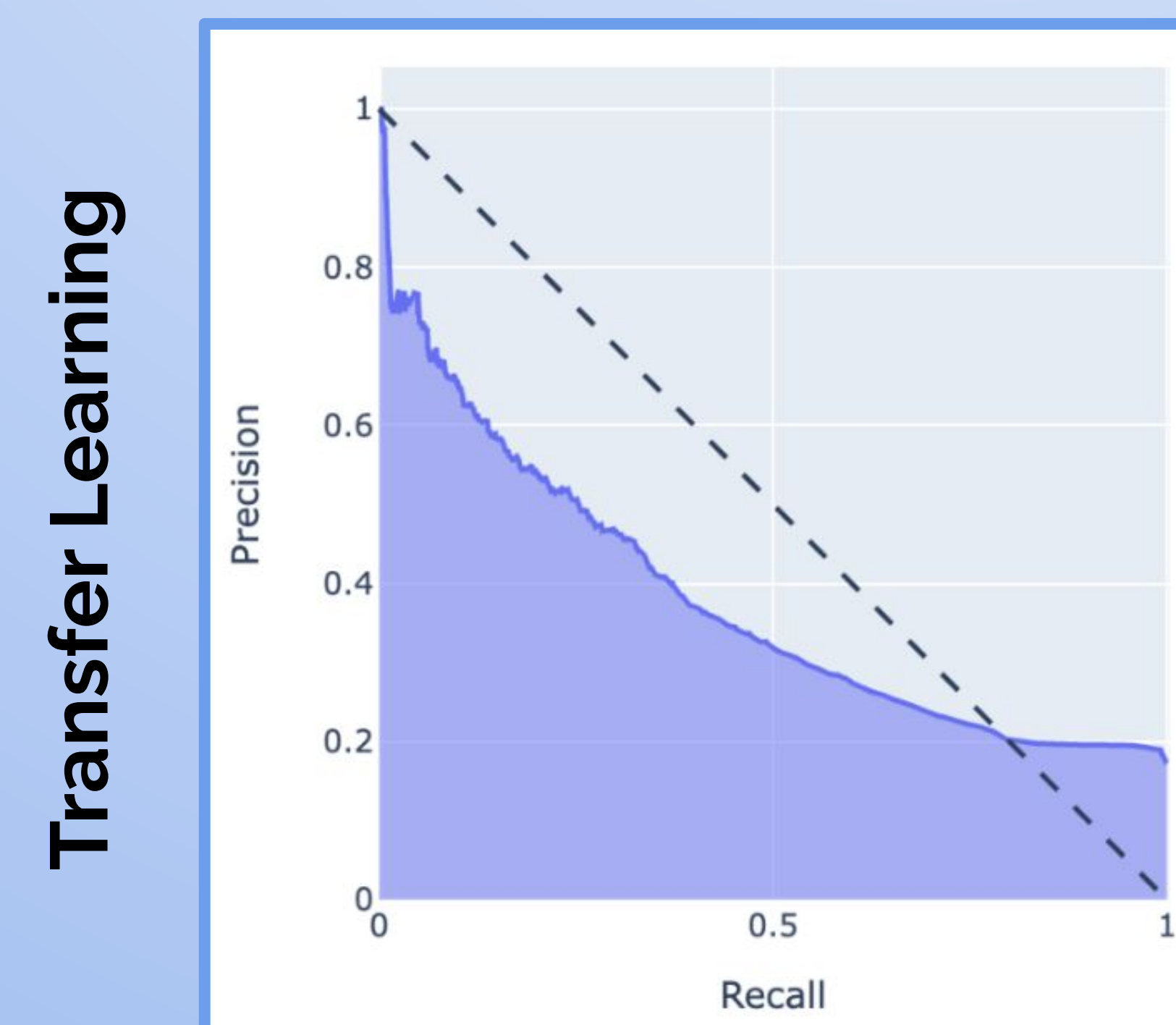
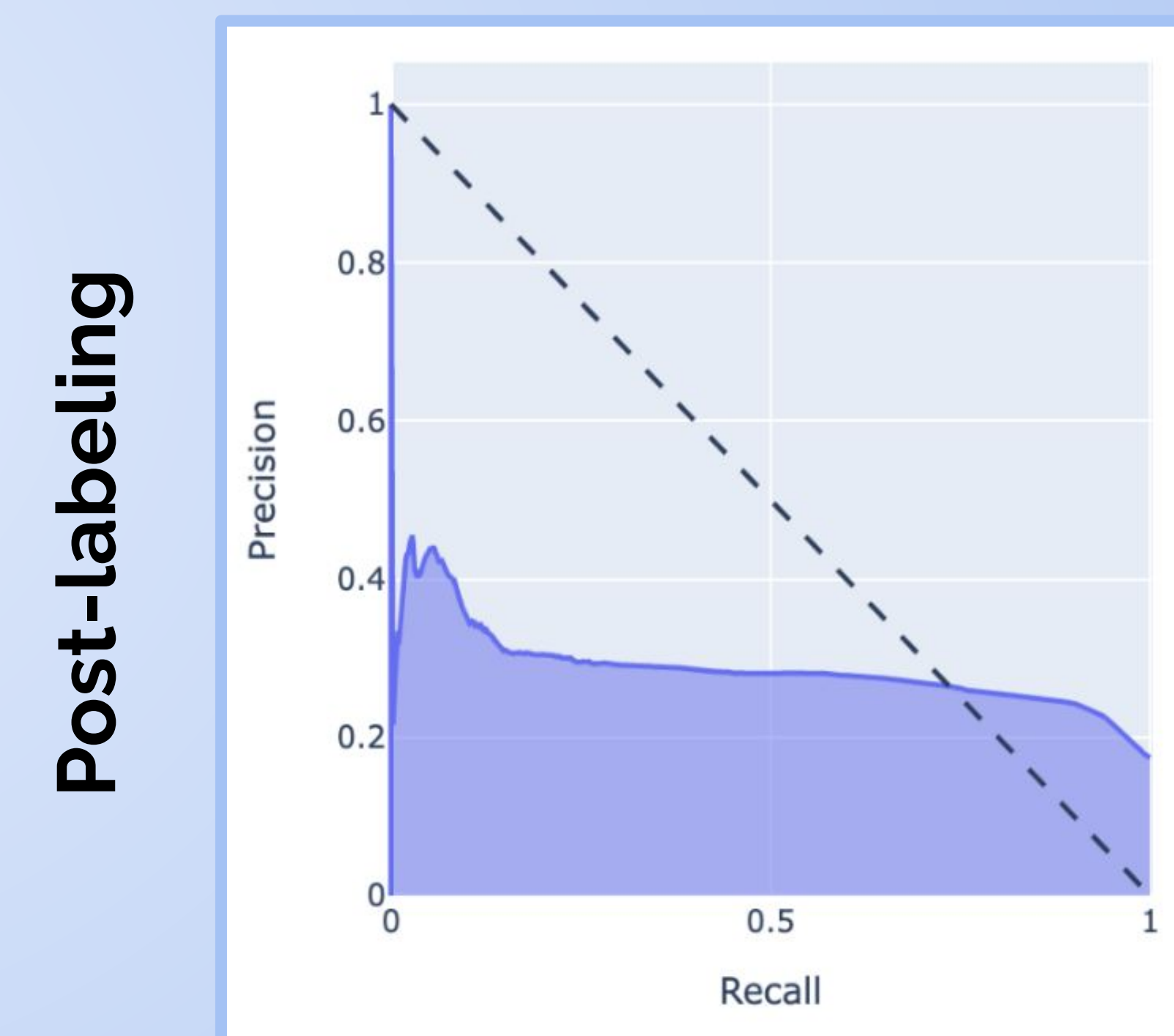
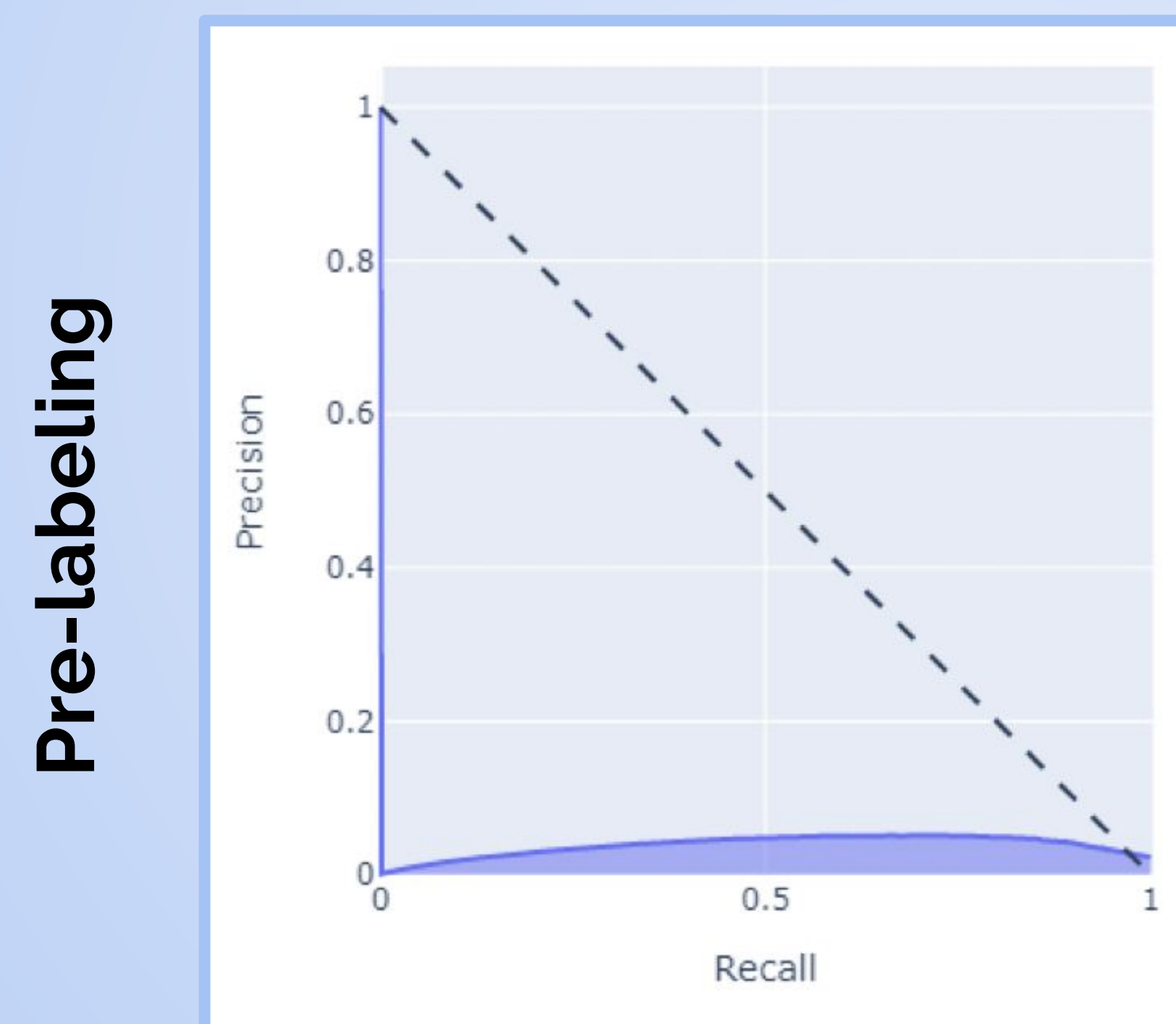
Experiments

- Newly-labeled meta sensors data was used to train and test on LSTM model
- Transfer learning was done using newly-labeled data and tested on left and right wrist data
- Normalized data was tested for transfer learning
- Results for newly-labeled data and transfer learning were measured with PR curves
- Normalized results were measured with F1 scores

Hypothesis

- Re-labeling meta sensors data correctly will improve the data's performance on fall system
- Applying transfer learning for left and right wrist data will also result in better fall prediction

LSTM Meta Sensor Results



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- Ian Roquebert - basis for code/models



Normalization Results

Experiment	F1 Score
LSTM	0.4413
Transfer Learning	0.3571
Normalized	0.3896

* all F1 scores are rounded to 4 digits and averaged between 10 trials

Discussion

- Correctly re-labeling meta sensors data improved performance overall, but still far from desired result
- Transfer learning performance was lower than expected
- Low results were likely due to factors such as datasets not aligning
- Good data processing does help improve system performance

Next Steps

- Investigate potential causes of lower F1 score:
 - Data points offset by timestamp between left and right meta sensor data
 - Axes of sensor data mismatched between left and right wrist
 - Test and train sets should be disaggregated for each fall type