C-through

혁주팀

Jeong HJ / Min SK / Jeong YJ
Cho GH / Ju GY / Song YJ

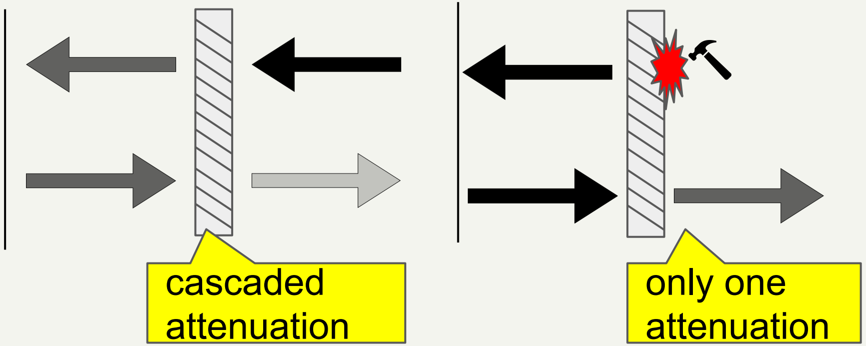
Motivation & Problem Definition

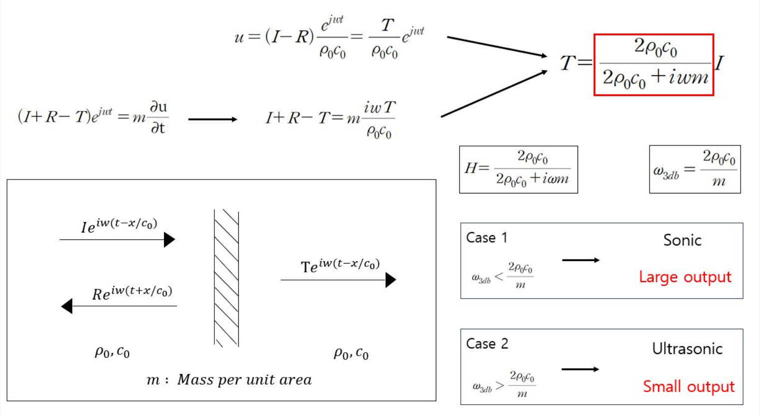
Detect presence & location

Existing Method vs Our Method

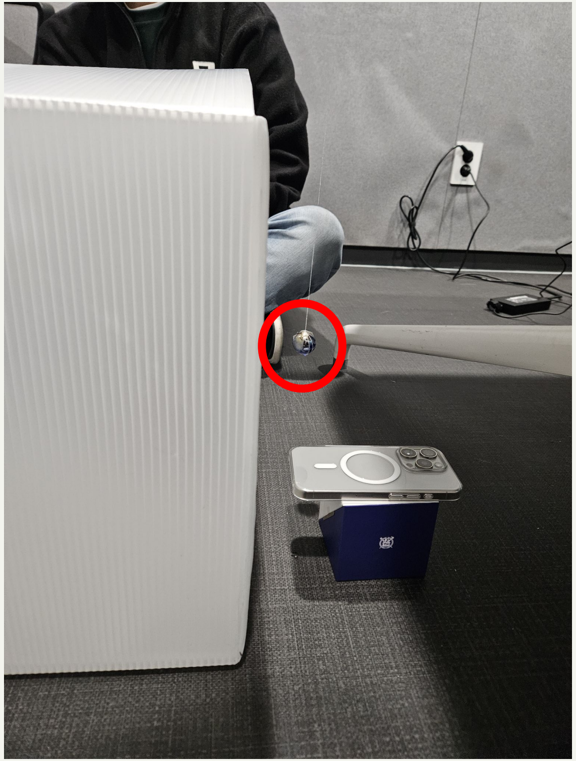
Ultrasonic Testing

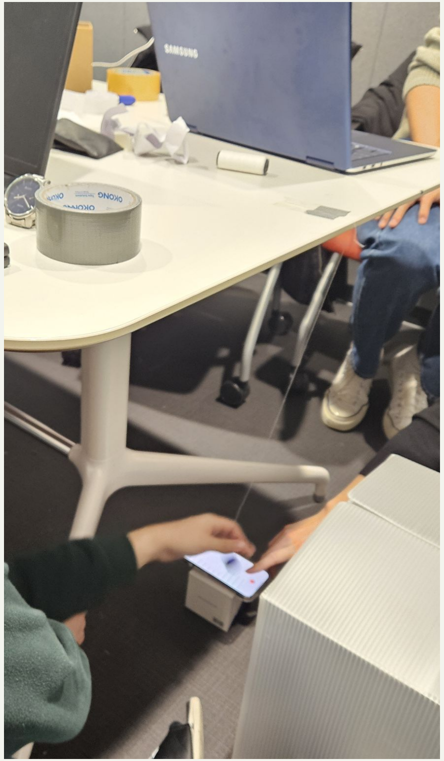
2 Advantages





Our Own Data Generation





- Box = room
- Phone = Acoustic sensor
- Use Different Objects
  → Train / Test data
- Pendulum-like structure
  → constant impact

Our Own Data Generation

label	object location	0/1/2 : empty/near/far
experimental variable	impact height	0/1 : higher/lower
# of experiments		100 times per same condition
data augmentation	add random noise	x 2
total # of dataset		3x2x100x2 = 1200

Our Own Dataset

Train Set

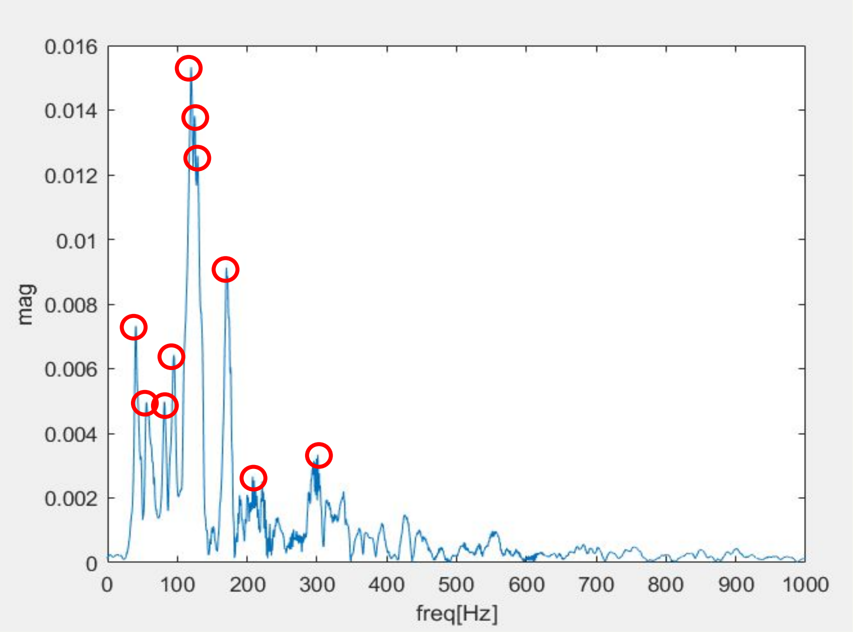
- 1200 m4a file
- Sound Feature(csv)
- information(label, impact)

Test Set

- 384 m4a file
- Sound Feature(csv)
- information(label, impact)

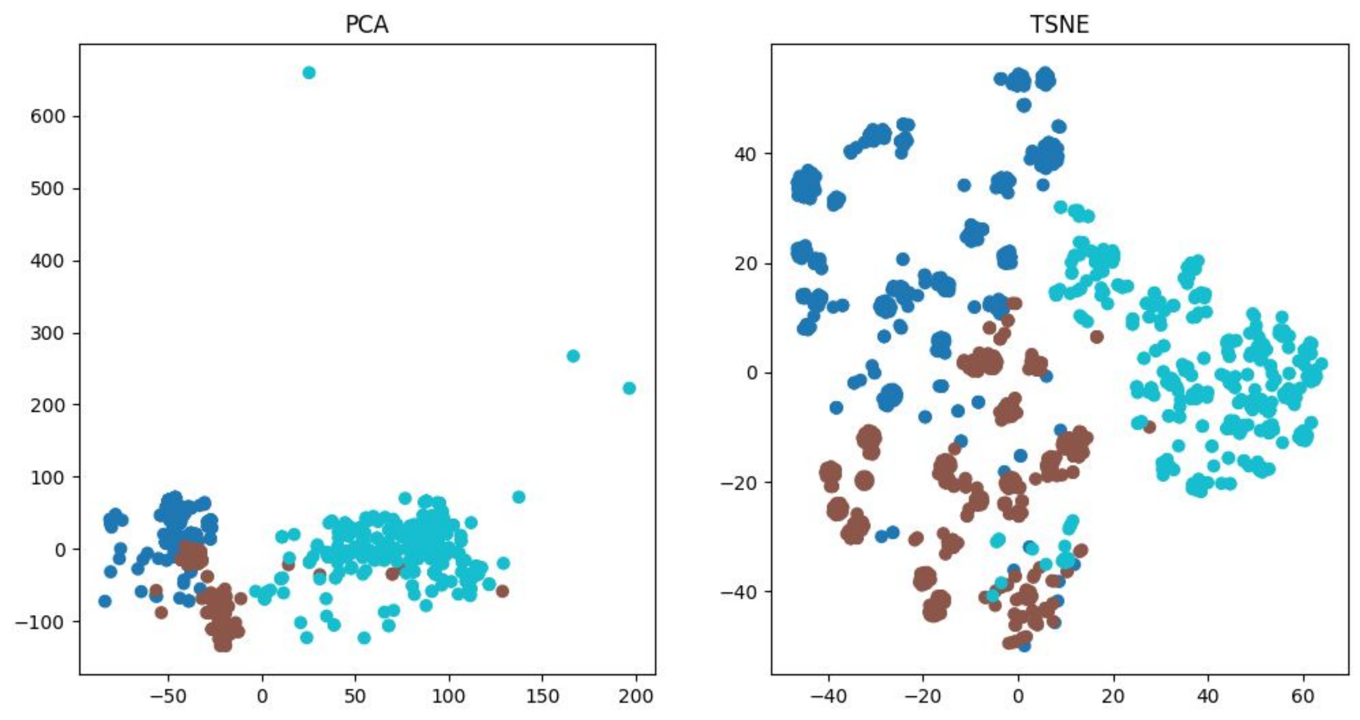
Feature Extraction

Feature Extraction 1 : Top 20 Peaks

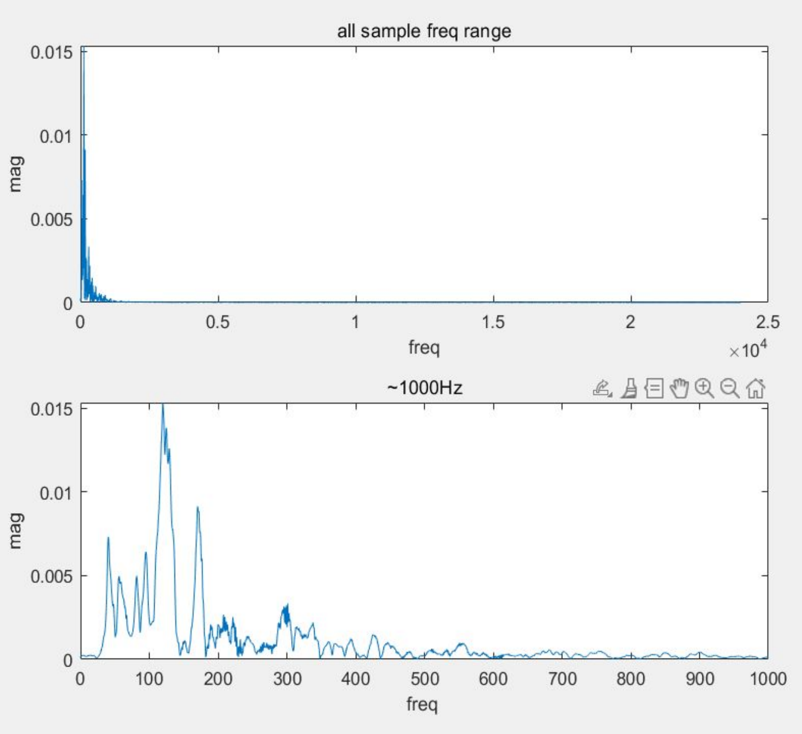


Top 20 peak = (f1, m1), ..., (f20, m20)
Feature = [f1, m1, f2, m2, ... f20, m20]

Feature Extraction 1 : Top 20 Peak Result

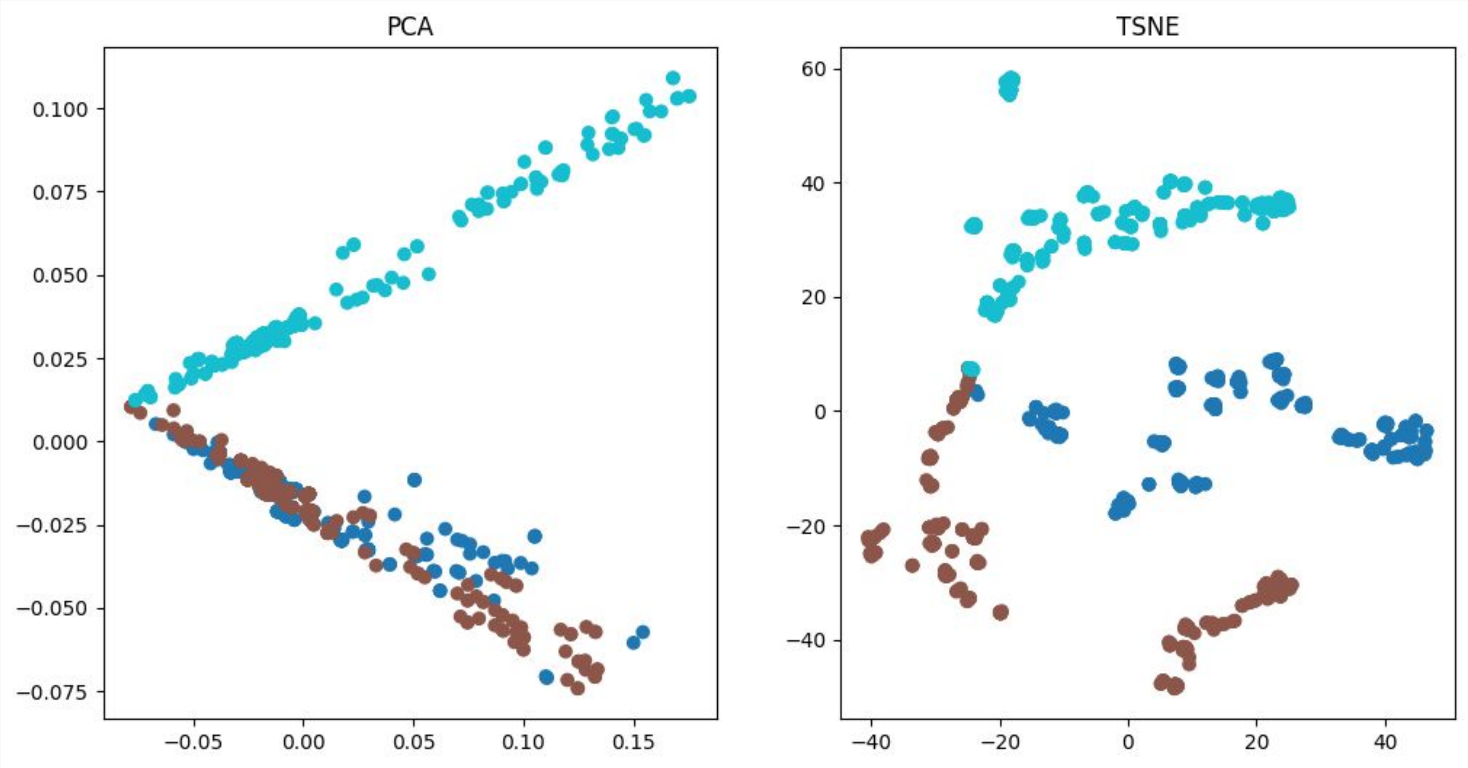


Feature Extraction 2 : Clipping result



0~1000 Hz = (1Hz, m1), (2Hz, m2),..., (1000Hz, m20)
Feature =[m1, m2, m3, ... , m1000]

Feature Extraction 2 : Clip 0~1000 Hz

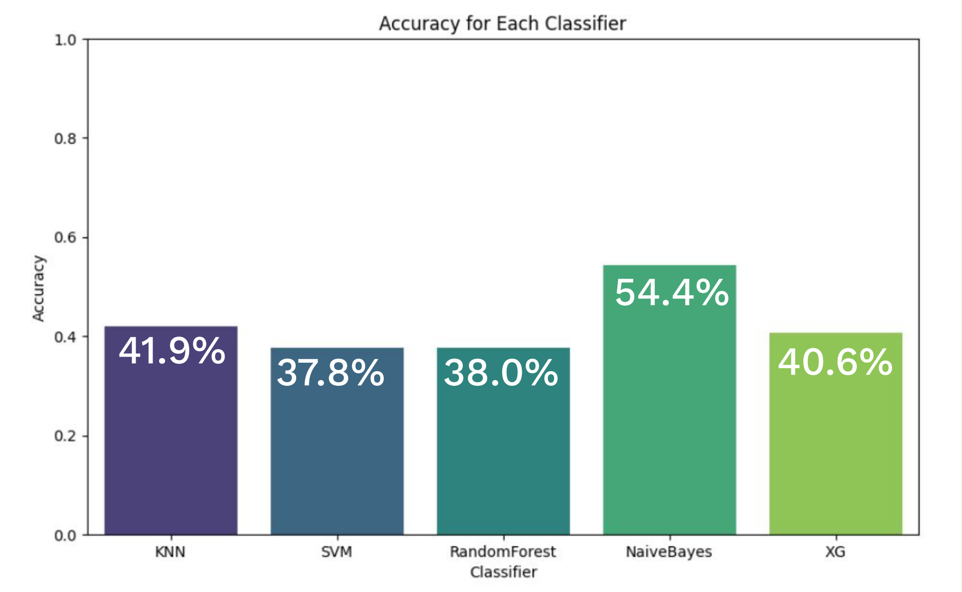


Classification

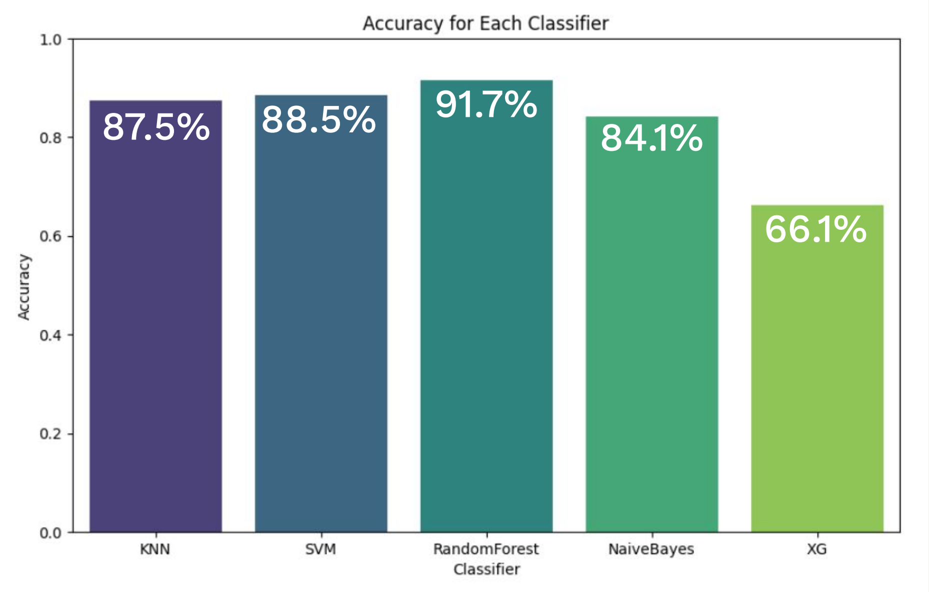
Classification methods (and principles)

1) kNN - w/o Training (Like our Time Attack)
2) SVM - Nonlinear, High Dimension
3) RandomForest - Ensemble(bagging)
4) Naïve Bayes - i.i.d independency assuption
5) XGboost - Ensemble(boosting)

Test Result & Evaluation



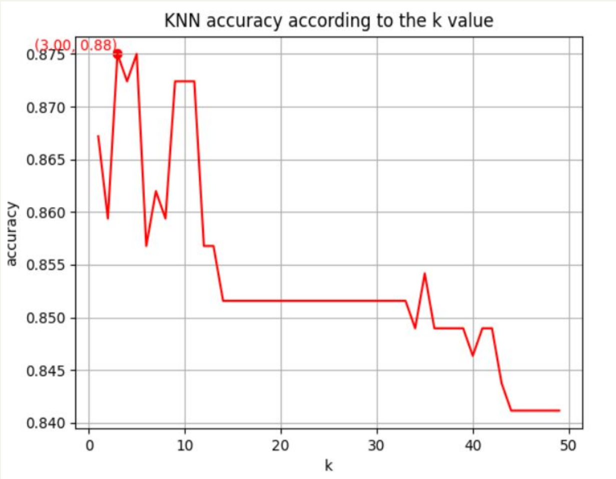
<Top 20 Peaks>



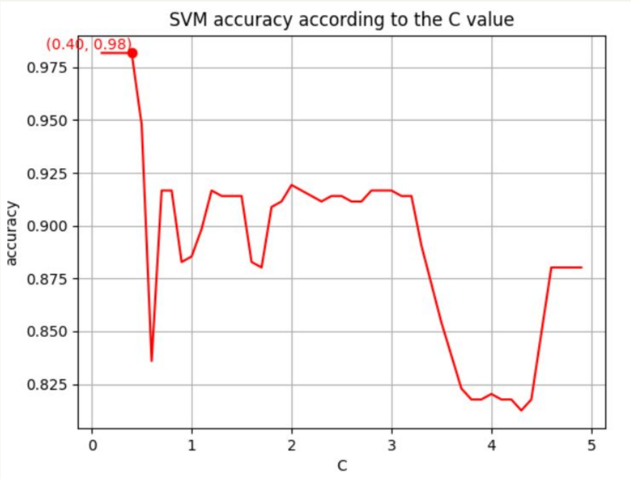
<clipping result >

Hyper Parameter Tuning

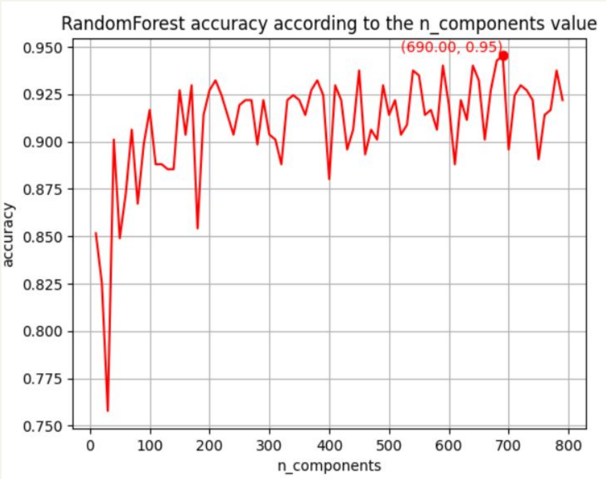
kNN



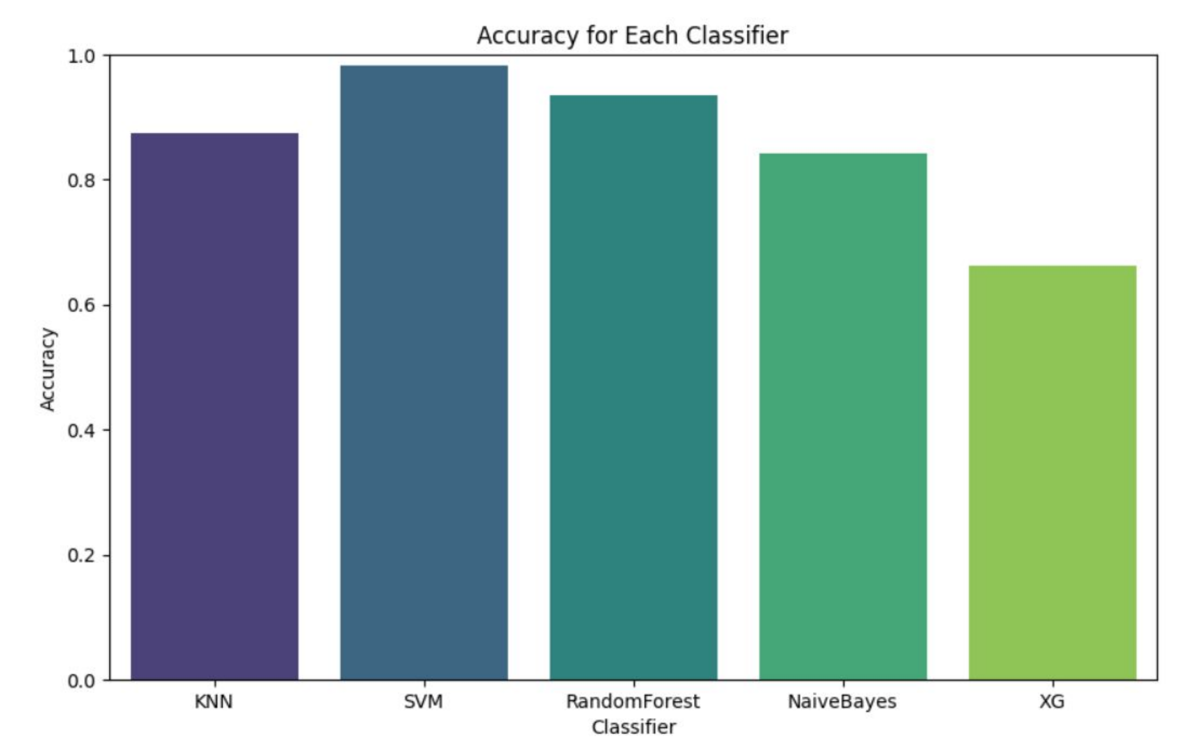
SVM



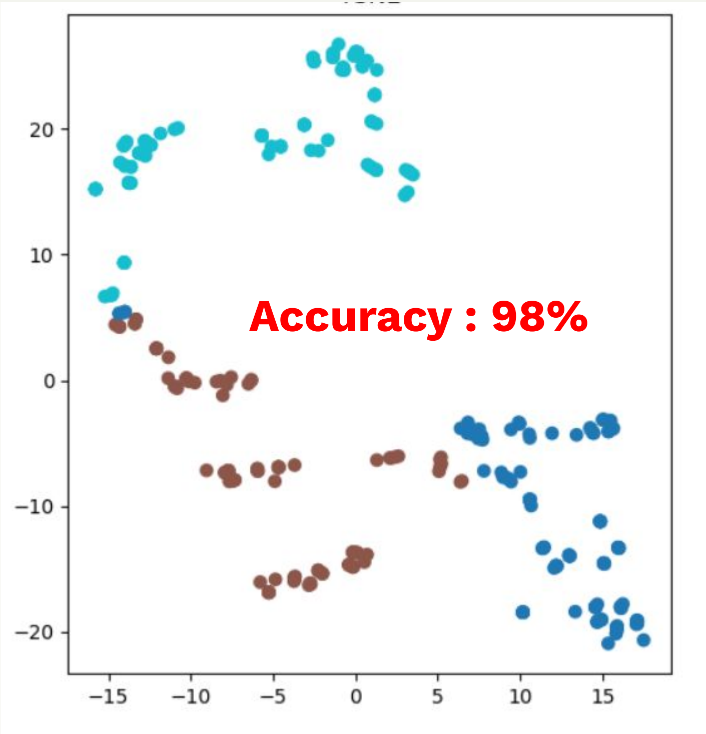
Random forest



Hyper Parameter Tuning



Discussion



Best Accuracy with

Clipping feature extraction
SVM w/ C=0.4, kernel trick

Why??

1. SVM is strong to nonlinear data
2. Clipping method can preserve more information(1000-dim) than peak method(40-dim)

Future Work & Expectation

More precise impact method

Better performance acoustic sensor

more training data

+

Our feature extraction & classification method

or enhanced methods

=

Can estimate 3D location(XYZ) in real world

Role Distribution

Name	Data generation	Pre-processing (file conversion, fft, augmentation)	Feature extraction	Classification
Jeong HJ *Presenter				
Min SK				
Jeong YJ				
Cho GH				
Ju GY				
Song YJ				

Thank You