

Introduction to classification

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Course objectives

- By the end of this module, you will be able to answer the following questions:
 - What is a classification task?
 - What are the ways to design classification algorithms?
 - What are the applications of classification algorithms?

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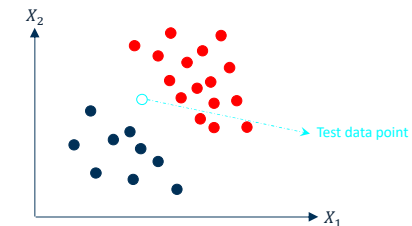


What is a classification task?

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What is a classification task?

- Suppose that you are asked to discriminate the test data point (red circle? or dark?)



- Classification is to predict a discrete value (i.e., label) associated with a feature vector

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What are the ways to design classification algorithms?

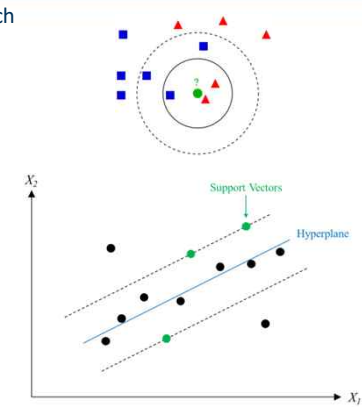
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Ways to design a classification algorithm

- Method 1: Geometric intuition-based approach
 - K-Nearest Neighbor (KNN) classifier
 - Support Vector Machine (SVM) classifier
 - ...
- Method 2: Probability-based approach
 - Naïve Bayes classifier
 - ...
- Method 3: Tree-based approach
 - Decision tree classifier
 - Random Forest (RF) classifier
 - ...
- Method 4: Neural network-based approach
 - Convolutional Neural Network (CNN) classifier
 - Multi-Layer Perceptron (MLP) classifier, ...



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What are the applications of classification algorithms?

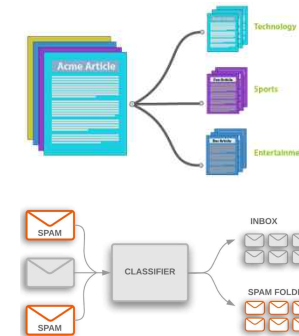
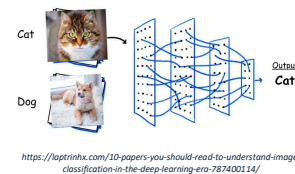
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Types of classification tasks

- Examples of classification problems may include:
 - Spam filtering
 - Image classification
 - Text classification
 - ...



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- Problem definition

- Leaking water pipes result in various unintended consequences such as property damage, potentially leading to increased indirect expenses



<https://judginsurance.com/water-leak-mitigation/>



<https://www.dunnireplumbing.ca/importance-investigating-detecting-water-leaks/>

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- Problem definition

- The workers spend almost six hours to identify locations where there is potentially water leak
 - They walk around the locations with a device used for measuring water leak related sound



<https://www.aihub.or.kr/aihubdata/data/view.do?currMenu=115&topMenu=100&aihubDataSe=realml&dataSetSn=138>

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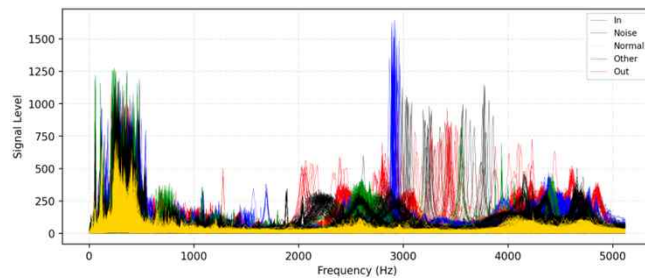


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- Problem definition

- Sensors are installed in some locations to continuously record frequency-associated information
- The workers visit the locations to check the types of water leakage and record label information
 - In, Out, Noise, Other, and Normal



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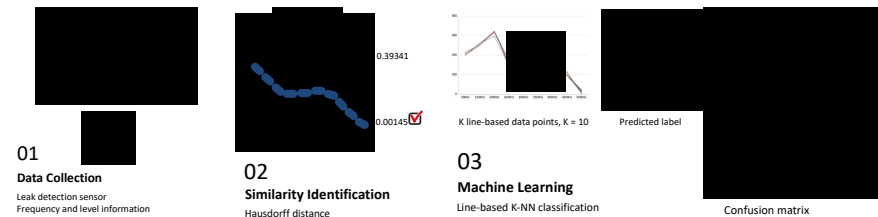


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- Proposed methodology

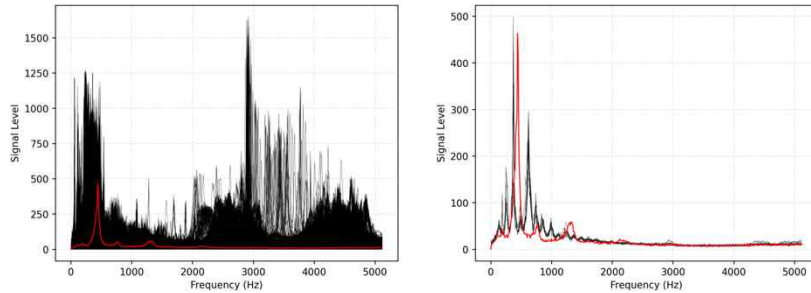
- The ESDL proposed the methodology called “Hausdorff distance-based classification algorithm”



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- Proposed methodology
 - K-NN based line classification with the concept of the Hausdorff distance

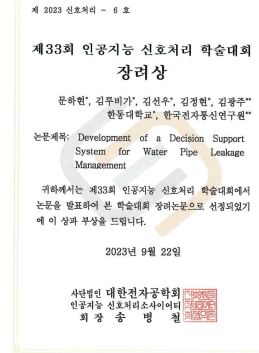
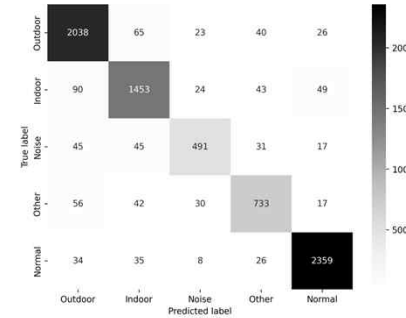


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- Results
 - Confusion matrix



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Course summary

- Throughout this module, you have learned:
 - What is a classification task?
 - What are the types of classification algorithms?
 - What are the applications of classification algorithms?

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THANK YOU

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