Developing and Evaluating an Anomaly Detection System

ex. Aircraft engines motivating ex.

10000 good (normal) engines

20 flawed (anomalous) engines

Training set : 6000 good engines $(y=0)$

CV : 2000 good engines $(y=0)$ 10 anomalous $(y=1)$

Test: 2000 good engines $(y=0)$ 10 anomalous $(y=1)$

Algorithm evaluation

Fit model $p(x)$ on training set $\{x^{(1)}, \dots, x^{(m)}\}$

On a cv/test example x, predict

$$y = \begin{cases} 1 & \text{if } p(x) < \varepsilon \text{ (anomaly)} \\ 0 & \text{if } p(x) \geq \varepsilon \text{ (normal)} \end{cases}$$

skew data 인 경우, accuracy는 부적절

so, TP · FP · FN · TN

Precision / Recall

F_1-score

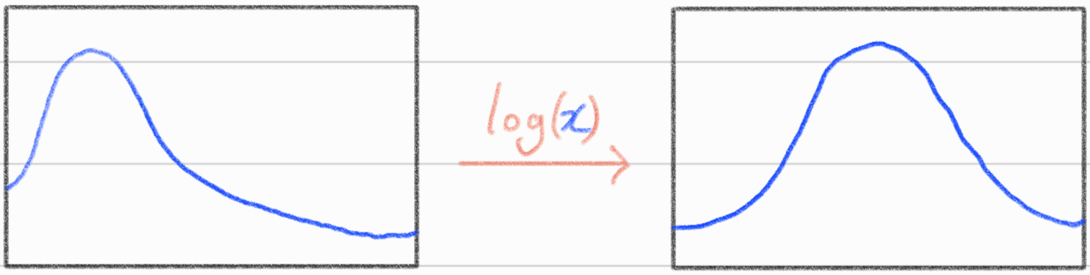
(can also use cross validation set to choose parameter ε)

Anomaly Detection vs. Supervised Learning

Anomaly Detection	Supervised Learning
- Very small number of positive examples	- Large number of positive and negative examples
- Large number of negative examples	- Enough positive examples for algorithm
- Many different "types" of anomaly	

Choosing What Features to Use

for Non-gaussian features



$x \rightarrow \log(x+c)$

Gaussian 형태로 변환

$x \rightarrow \sqrt{x}$

Error analysis for anomaly detection

Want $p(x)$ large for 0

$p(x)$ small for 1

Most common prob.: $p(x)$ is comparable for 0 and 1