# Classification metrics optimization: Logloss and accuracy

# Classification metrics optimization

- Logloss
- Accuracy
- AUC
- (Quadratic weighted) Kappa

# Logloss 분류 문제에서 MSE처럼 쓰기 좋은 지표

$$\text{LogLoss} = -\frac{1}{N}\sum_{i=1}^{N} y_i \log(\hat{y}_i) + (1 - y_i)\log(1 - \hat{y}_i)$$

How do you optimize it?

Just run the right model!
(or calibrate others)

# Logloss

- **Tree-based**

  > `XGBoost, LightGBM`
  >
  > ~~`sklearn.RandomForestClassifier`~~

- **Linear models**

  > `sklearn.<>Regression`
  >
  > `sklearn.SGDRegressor`
  >
  > `Vowpal Wabbit`

- **Neural nets**

  > `PyTorch, Keras, TF,` etc.

*Synonyms: Logistic loss*

Read the docs!

# Logloss

분류기에서 계산한 확률과 실제 데이터의 확률이 다를 수 있음, 왜?

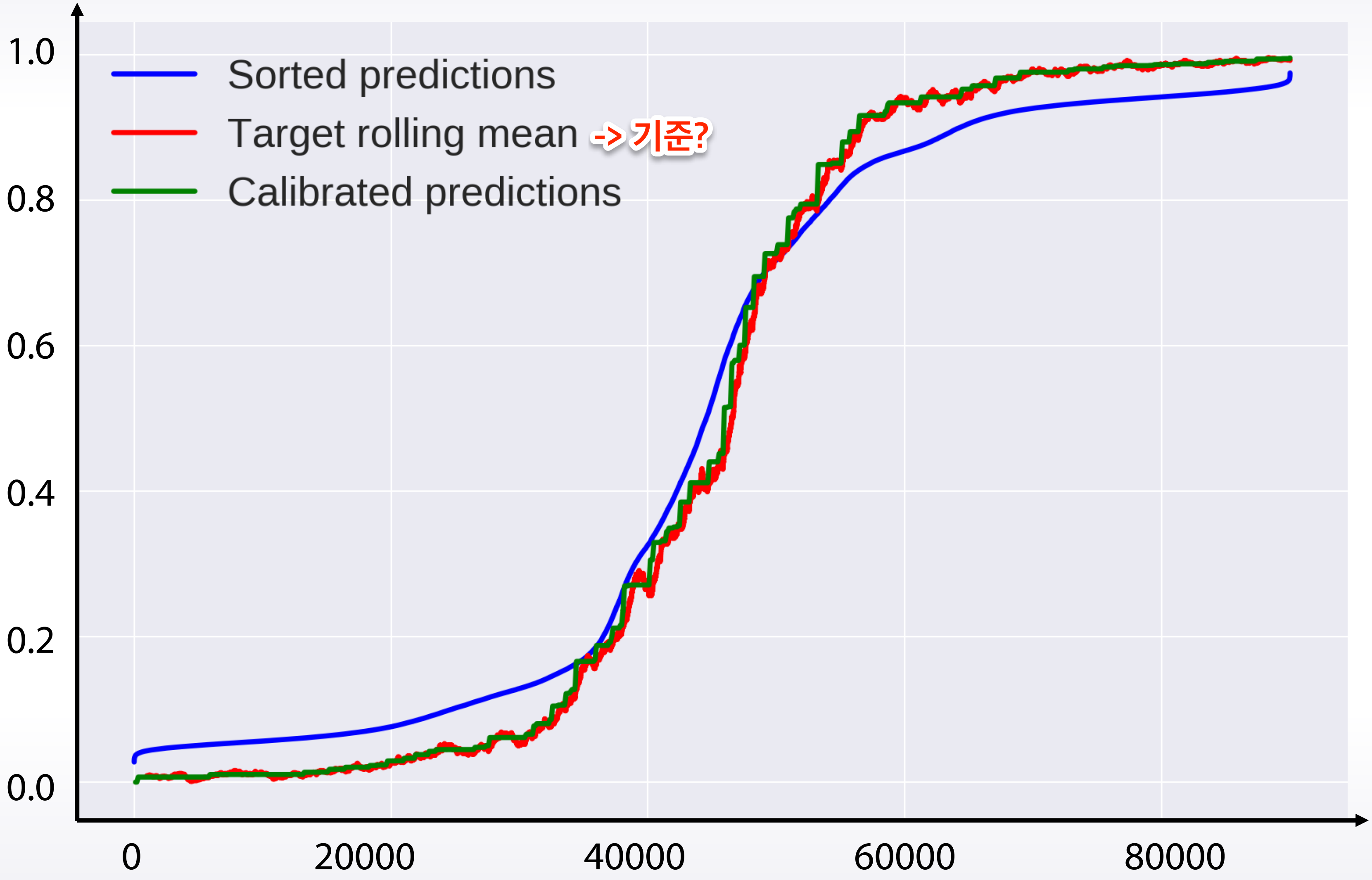
## Correct probabilities:

- Take all objects with score e.g. ~ 0.8
  - 80% of them of class 1
  - 20% of them class 0

## Incorrect probabilities:

- Take all objects with score e.g. ~ 0.8
  - 50% of them of class 1
  - 50% of them of class 0

# Probability calibration 보정하면 좋다



-> 기준?

# Probability calibration

logistic 외에 svm, decision tree에서도 예측 확률을 돌려주는 방법들이 있음
확률로 바꾼 것을 여러번 cross validation하여 보정함(sklearn.calibration의 CalibratedClassifierCV)

- Platt scaling
  - Just fit Logistic Regression to your predictions (like in stacking)

classifier(ex: SVM)의 output을 확률로 변환
로지스틱 공식이랑 비슷, 시그모이드 형태에 적합

- Isotonic regression
  - Just fit Isotonic Regression to your predictions (like in stacking)

monotinic regression, non-parametric model

- Stacking
  - Just fit XGBoost or neural net to your predictions

# Accuracy

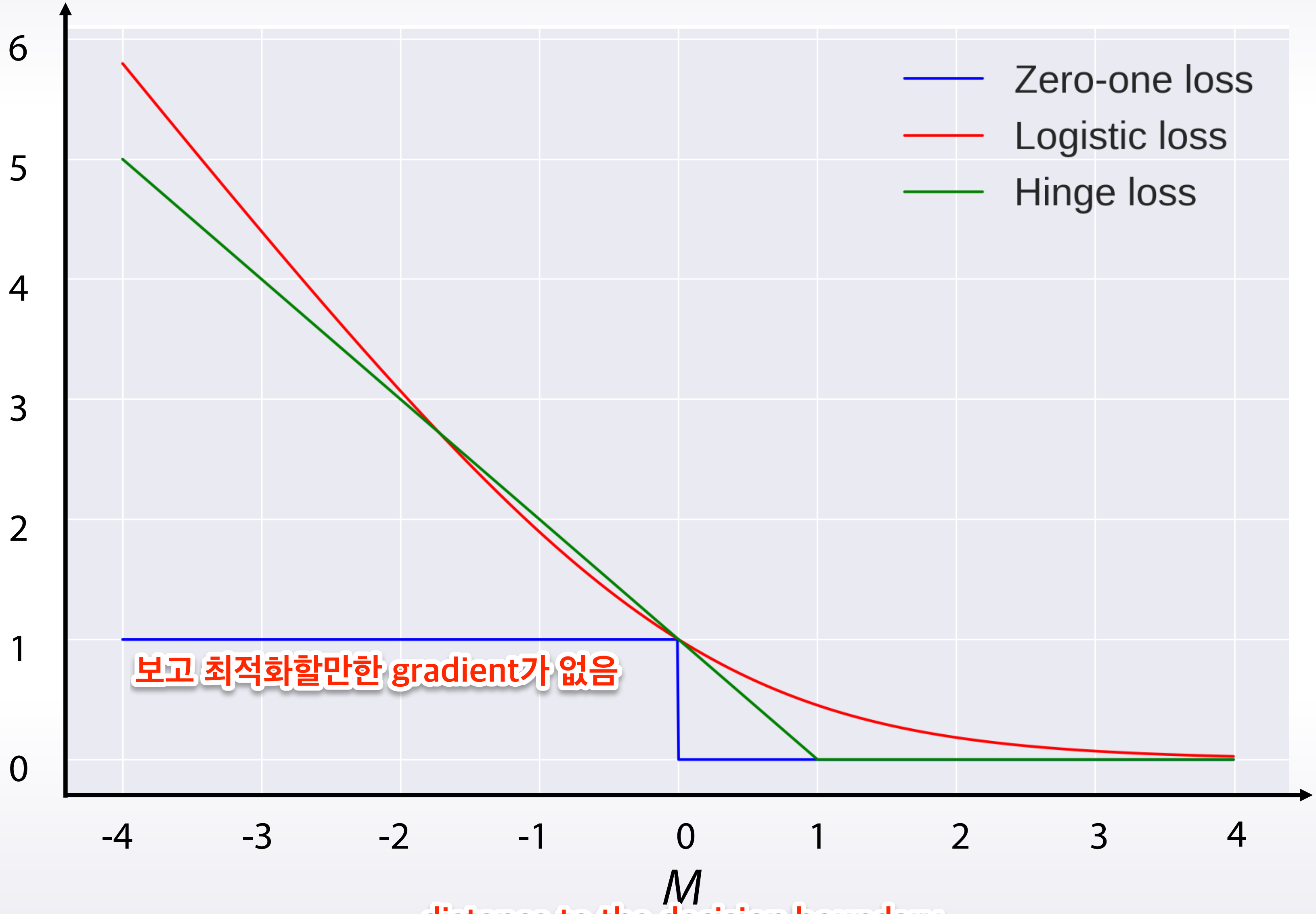
$$\text{Accuracy} = \frac{1}{N}\sum_{i=1}^{N}[\hat{y}_i = y_i]$$

How do you optimize it?

Fit any metric and tune treshold!

# Accuracy

Accuracy를 최적화하기 어려운 이유



loss

보고 최적화할만한 gradient가 없음

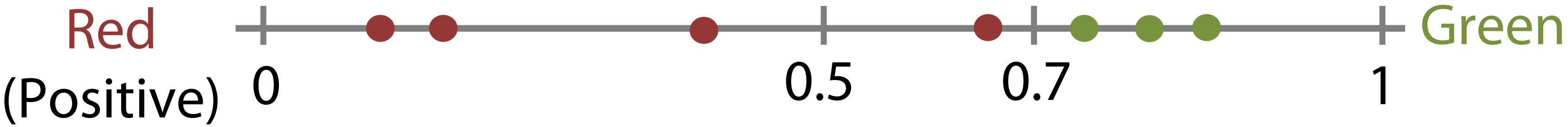
distance to the decision boundary

<- 잘못분류 0 -> 옳은분류

# Accuracy

loss fucntion 신경쓰지 말고 여러번 grid search해라

$$\text{Accuracy} = \frac{1}{N}\sum_{i=1}^{N}[[f(x) > b] = y_i]$$



$$b = 0.5 \quad \Rightarrow \quad \text{Accuracy} = \frac{6}{7}$$

$$b = 0.7 \quad \Rightarrow \quad \text{Accuracy} = 1$$

# Conclusion

- Logloss
- Accuracy
- AUC
- (Quadratic weighted) Kappa