CIS 678 – Machine Learning

Predictive modeling: Classification Metrics and Imbalanced Data

Classification Matrices

- Accuray

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Classification Matrices

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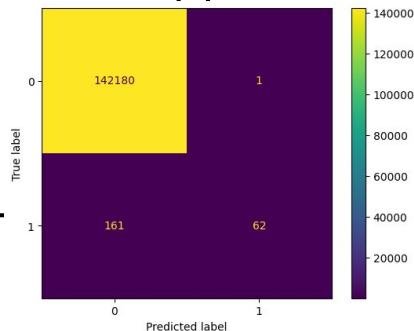$$\text{Accuracy} = \frac{\text{Nb of correct predictions}}{\text{Nb of (correct + incorrect) predictions}}$$

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- Not always
- Let's analyze the confusion matrix of our credit card fraud detection notebook
  - Accuray metric can be catastrophic


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      y_pred = clf.predict(X_test)
      # The mean squared error
      print("accuracy: %.5f" % accuracy_score(y_test, y_pred))

      accuracy: 0.99886
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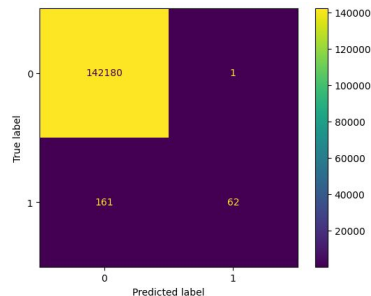# Classification Matrices

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- Is accuracy a good metric?
- Not always
- Let's analyze the confusion matrix of our credit card fraud detection notebook
  - Accuray metric can be catastrophic
- What other metrics we may use?

Classification Matrices

- Accuray

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$
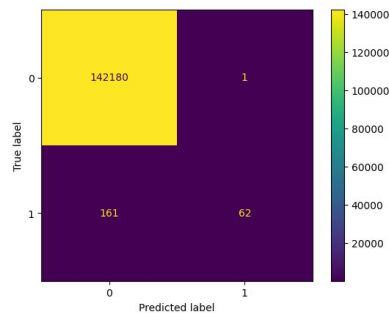


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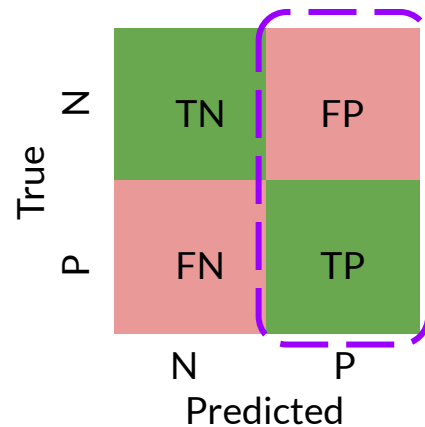|	Predicted	
True N	TN	FP
P	FN	TP
	N	P

Other important classification metrics

- Precision (also called **Positive Predictive Value)**
- Recall (also called **Sensitivity)**
- F1 Score

Metrics

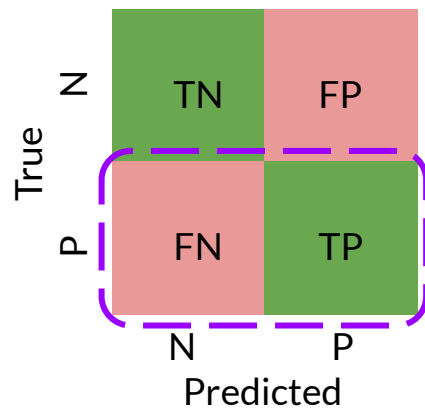- Precision (also called **Positive Predictive Value**)

$$\text{Precision} = \frac{TP}{TP + FP}$$
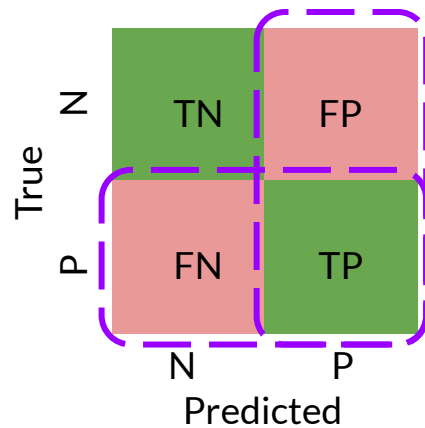
Metrics

- Recall (also called **Sensitivity**)

$$Recall = \frac{TP}{TP + FN}$$

Metrics

- F1 Score

$$\text{F1 Score} = \frac{2 * \text{precision} * \text{recall}}{\text{precision} + \text{recall}}$$

Data Imbalance Problem

- Demonstration through a practical example
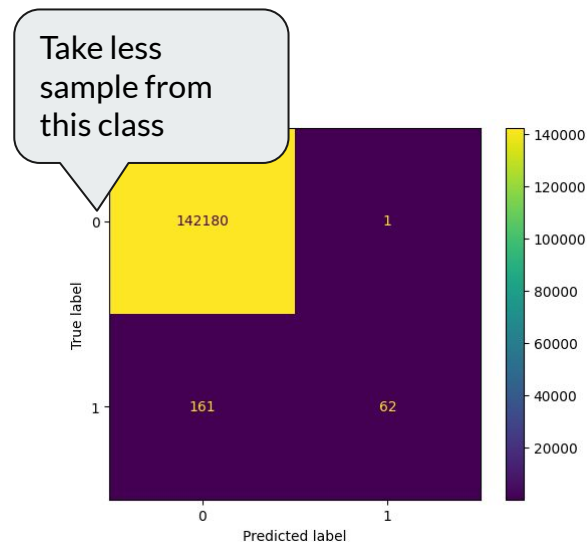 - [CC fraud detection](#)

Data Imbalance Problem

- How to deal with Data Imbalance Problems
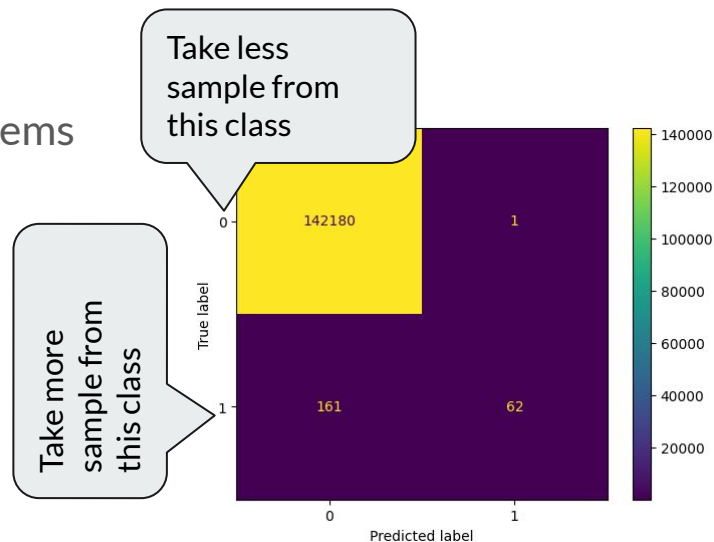 - Through Sampling Bias

Data Imbalance Problem

- How to deal with Data Imbalance Problems
  - Through Sampling Bias
    - Undersampling
    - Oversampling

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  - Redefining model (loss function for an example)
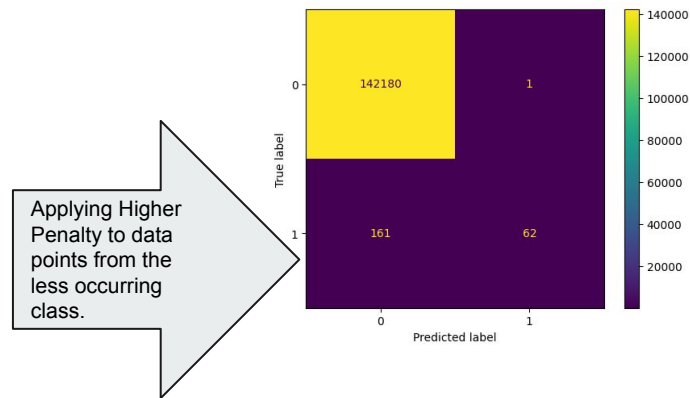
Data Imbalance Problem

- How to deal with Data Imbalance Problems
  - Through Sampling Bias
    - Undersampling
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Applying Higher Penalty to data points from the less occurring class.

QA