PROJECT 9
UPDATE IGNIS DISCRIMINATOR

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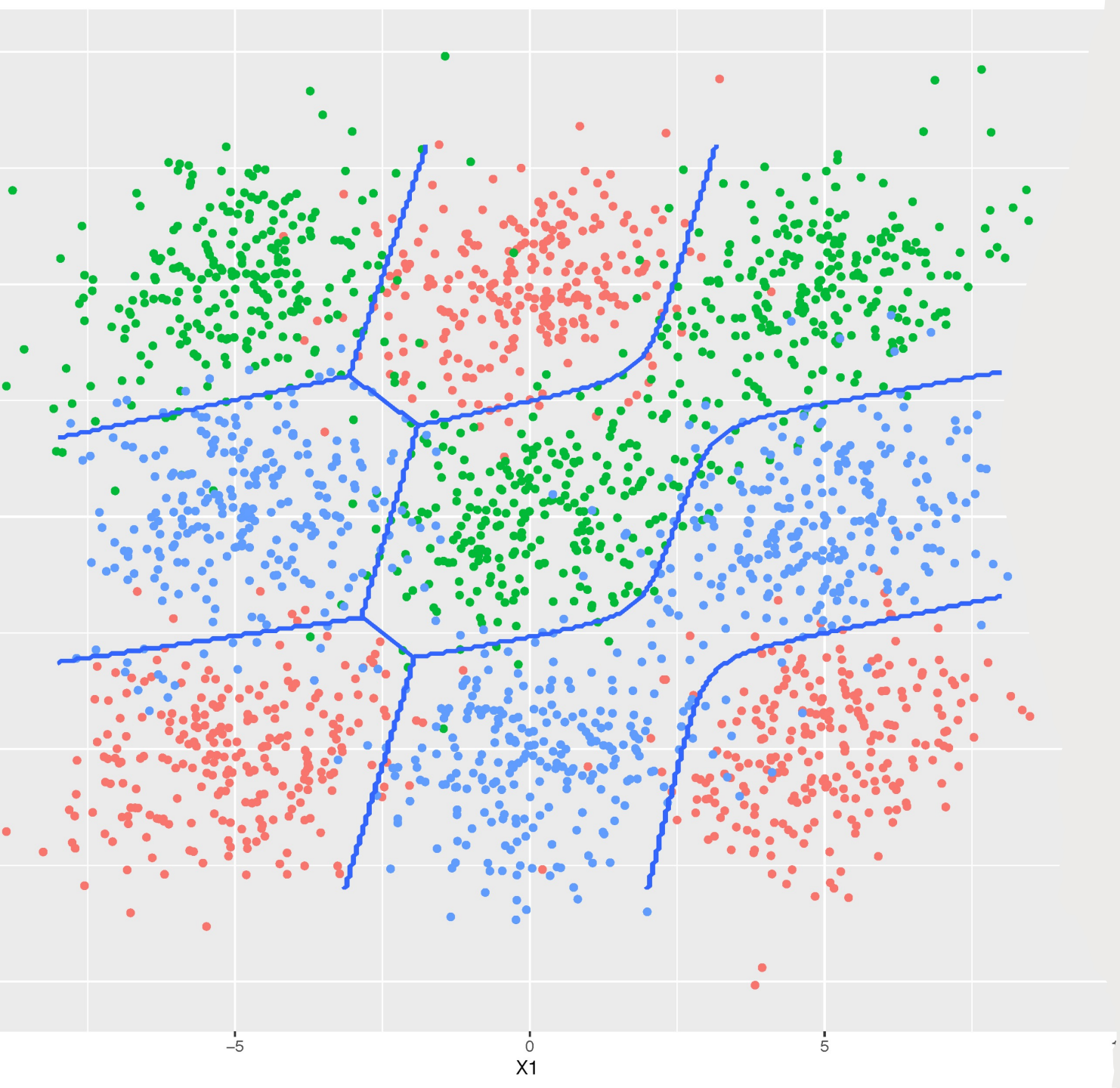


WHAT IS DISCRIMINATOR?

- Program that separates the distinct categories.
- In Quantum Computing, these categories are |0> and |1> states.

PROJECT INTRODUCTION

- Ignis library uses scikit-learn library to perform Linear Discriminant Analysis (LDA).
- Remove this sci-kit dependency to perform LDA and insert LDA code in Ignis.

WHY WE WANT TO DO THAT?

- Scikit-learn is a bulky installation.
- Users have difficulty installing it.

WHERE IS SCIKIT-LEARN LDA IN IGNIS

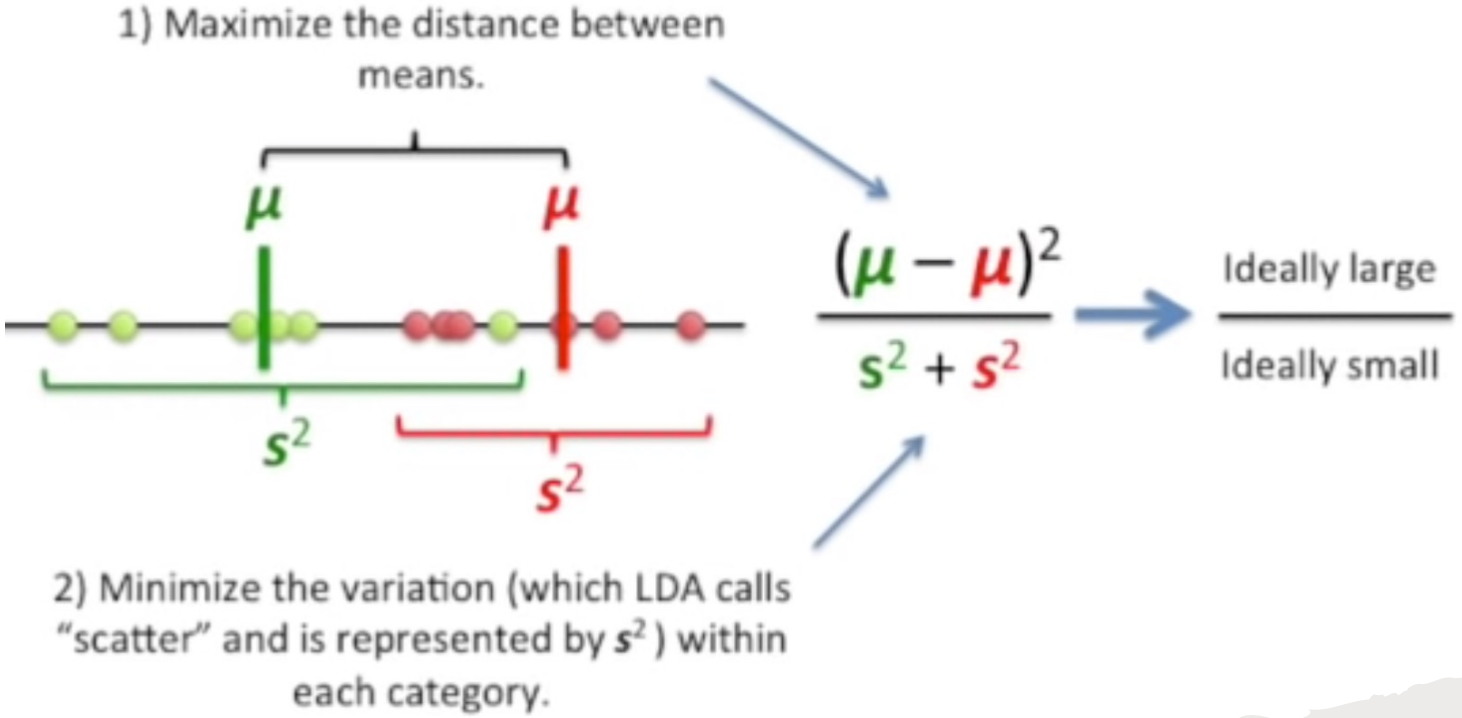
```
17  """
18  IQ Discriminator module to discriminate date in the IQ Plane.
19  """
20  from abc import abstractmethod
21  from typing import Union, List
22
23  import numpy as np
24
25  from qiskit.exceptions import QiskitError
26  from qiskit.ignis.measurement.discriminator.discriminators import \
27      BaseDiscriminationFitter
28  from qiskit.pulse import PulseError
29  from qiskit.result import Result
30  from qiskit.pulse.schedule import Schedule
31  try:
32      from matplotlib import pyplot as plt
33      HAS_MATPLOTLIB = True
34  except ImportError:
35      HAS_MATPLOTLIB = False
36
37  try:
38      from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
39      from sklearn.discriminant_analysis import QuadraticDiscriminantAnalysis
40      HAS_SKLEARN = True
41  except ImportError:
42      HAS_SKLEARN = False
43
44
45  class IQDiscriminationFitter(BaseDiscriminationFitter):
46      """
47      Abstract discriminator that implements the data formatting for IQ
```

CODE THAT NEEDS TO BE REPLACED

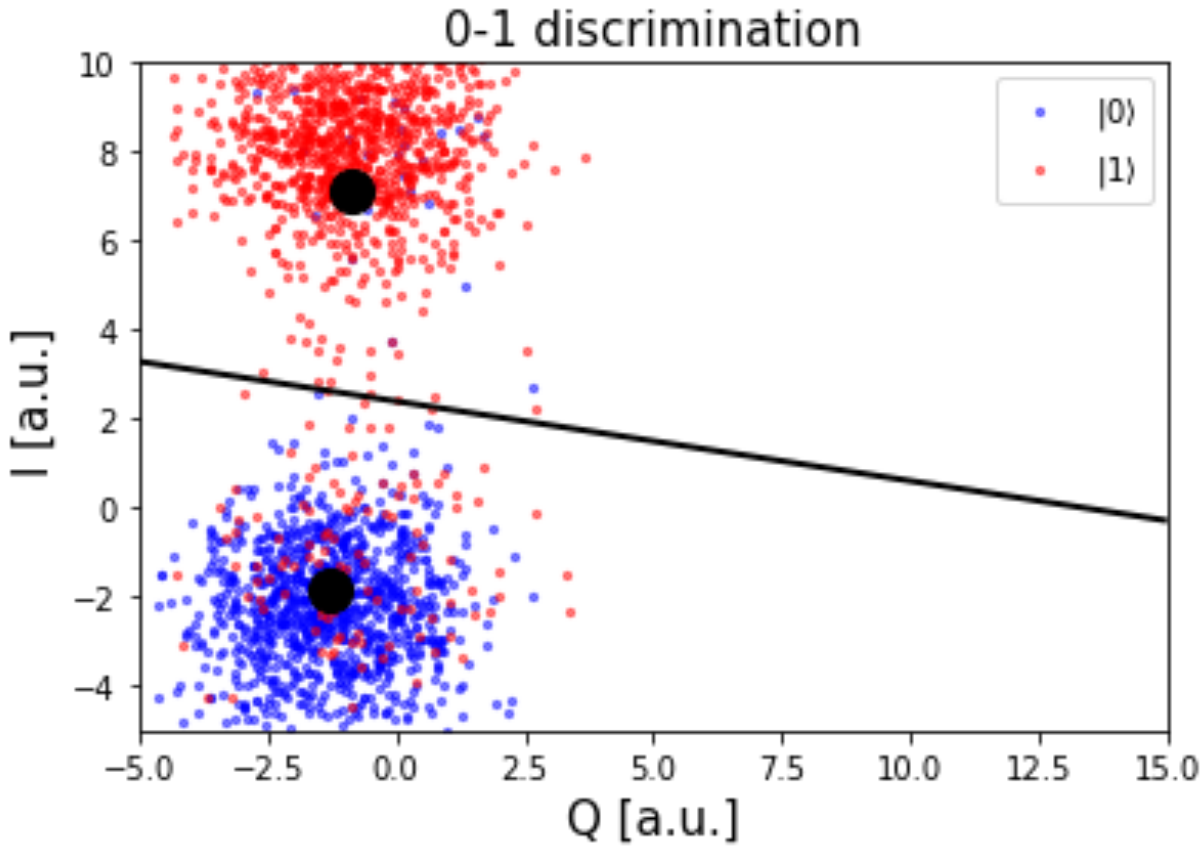
```
436         solver = discriminator_parameters.get('solver', 'svd')
437         shrink = discriminator_parameters.get('shrinkage', None)
438         store_cov = discriminator_parameters.get('store_covariance', False)
439         tol = discriminator_parameters.get('tol', 1.0e-4)
440         if not HAS_SKLEARN:
441             raise ImportError("To use the LinearIQDiscriminator class "
442                               "scikit-learn needs to be installed. This can "
443                               "be done with 'pip install scikit-learn'")
444         self._lda = LinearDiscriminantAnalysis(solver=solver, shrinkage=shrink,
445                                                store_covariance=store_cov,
446                                                tol=tol)
447
```

LDA CALCULATION

- The LDA calculation will be implemented using numpy
- LDA creates a new axis that satisfies these two conditions:



IDEAL LDA RESULT



THANK YOU