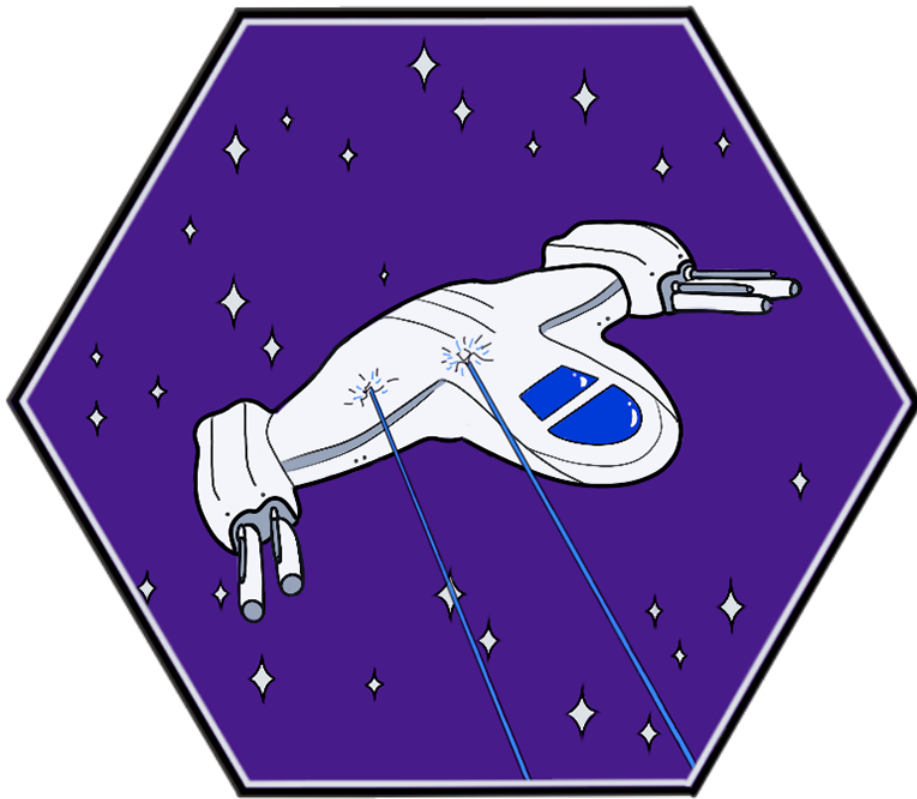


WORKBOOK 3

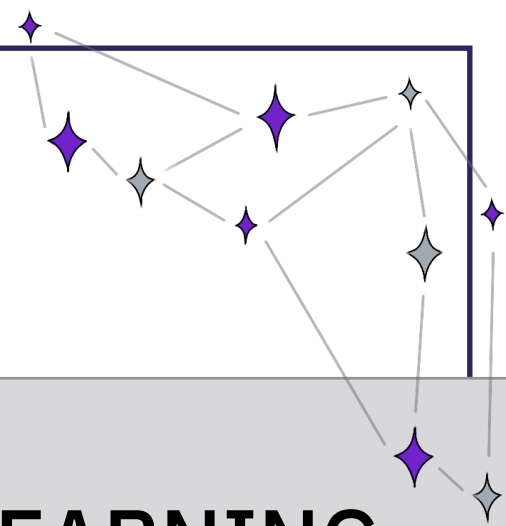
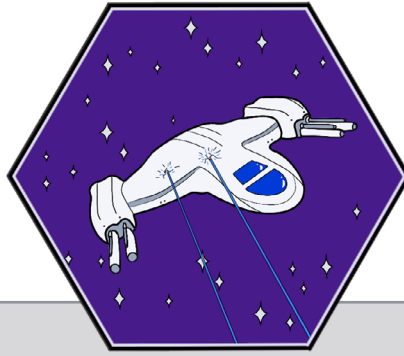
# Qiskit | Quantum Explorers

A SELF-PACED QUANTUM LEARNING JOURNEY



**Achievement:**  
**SPACE COMBATANT**

QUANTUM MACHINE LEARNING



# QUANTUM MACHINE LEARNING

## ACHIEVEMENT TO UNLOCK: SPACE COMBATANT

This is your first space battle. There are only two choices.  
You can win. Or you can be destroyed.

You encounter a rogue band of sentient starships from some distant world. The ships' AI's seem to have abandoned their organic crew and taken to piracy. They surround your starship, demand you surrender your technology and valuables, or they will blast you to smithereens. It's up to you to save your crew.

(Share your battle plans in the [#space-exploration](#) channel on Discord. Evasive maneuvers? Photon cannons? Cloaking? Share your weapons and tactics!)

Complete this module to win your first space battle, and become a Space Combatant. Your crew is counting on you.

### IN THIS MODULE YOU WILL:

- Encode data into a quantum computer
- Understand supervised quantum machine learning - variational methods and QSVM
- Understand the concept of quantum kernels, feature maps and parameterised quantum circuits
- Use Qiskit's machine learning library



# SYLLABUS

## CHECKLIST OF TASKS TO COMPLETE AND MATERIALS TO LEARN

### Warm-up Activities

#### ■ Badge Kick-off - Quantum Machine Learning

- What is machine learning?
- Why should we care about quantum machine learning?
- Machine learning and quantum machine learning examples
- Introduction to Qiskit Machine Learning tools

Date: September 1, 2022 [[time](#)]

[[video recording link](#)] [[demo notebook link](#)] [[glossary](#)]

### Introduction to Classical Machine Learning

#### ■ VIDEO: Machine Learning Basics [[link](#)]

The core machine learning concepts that we will be exploring further within this module.

#### ■ VIDEO: Computer Scientist Explains Machine Learning in 5 Levels of Difficulty [[link](#)]

WIRED YouTube video featuring Hidden Door cofounder and CEO Hilary Mason



ONLINE VERSION OF SYLLABUS



# SYLLABUS (CONT'D)

## CHECKLIST OF TASKS TO COMPLETE AND MATERIALS TO LEARN

### ■ Main Activities

#### ■ **QISKIT COURSE: Introduction to Classical and Quantum Machine Learning** [\[link\]](#)

A brief introduction to classical and quantum machine learning.

#### ■ **VIDEO: Building a Quantum Classifier** [\[link\]](#)

Lecture from the QGSS 2021 by Amira Abbas explaining the core components to construct a quantum classifier.

#### ■ **VIDEO: Introduction to Qiskit Machine Learning Module** [\[link\]](#)

Demo of the Qiskit Machine Learning module by Anton Dekusar with code examples (Starting from timestamp 32:02.)

#### ■ **QISKIT COURSE: Quantum Machine Learning** [\[link\]](#)

Please complete from section PARAMETERIZED QUANTUM CIRCUITS up to and including section VARIATIONAL CLASSIFICATION.

#### ■ **VIDEO: Quantum Machine Learning— Programming on Quantum Computers** [\[link\]](#)

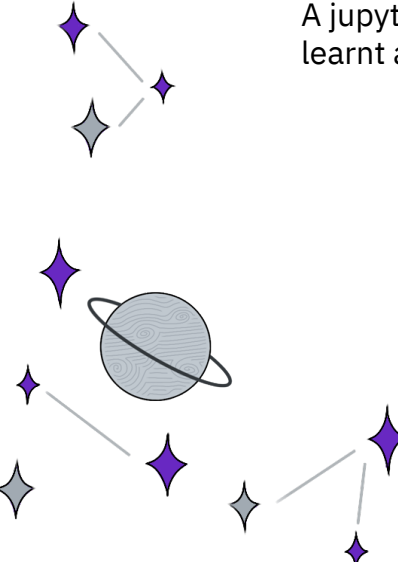
Coding with Qiskit S2E6 Video tutorial by Jin-Sung Kim on how to code up a Quantum Support Vector Machine.

#### ■ **QISKIT COURSE: Quantum feature maps and kernels** [\[link\]](#)

Explore quantum feature maps and kernels in detail and use them in a classification algorithm.

#### ■ **LAB: Introduction to Classical and Quantum Machine Learning** [\[link\]](#)

A jupyter notebook to practice the machine learning techniques you just learnt about.

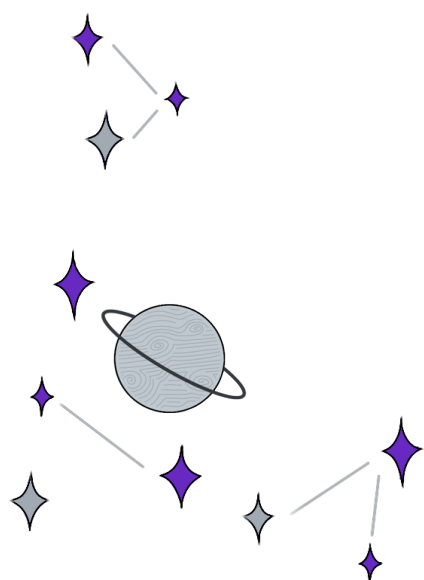




# ADVANCED SYLLABUS

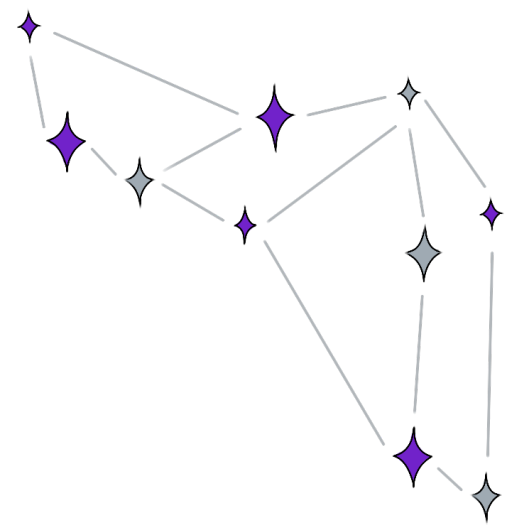
## OPTIONAL ADVANCED ADDITIONAL MATERIALS

- **QISKIT COURSE: Unsupervised Learning** [\[link\]](#)  
Introduction to unsupervised learning.
- **VIDEO: Quantum Neural Networks Simplified** [\[link\]](#)  
Video introducing classical neural networks and quantum neural networks by Sundarappan Kathiresan.
- **VIDEO: Are quantum neural networks actually relevant?** [\[link\]](#)  
Video by Amira Abbas about the potential of quantum neural networks and what they have to offer.
- **TUTORIAL: Quantum neural networks** [\[link\]](#)  
Jupyter notebook demonstrating the different generic quantum neural network implementations provided in Qiskit Machine Learning.
- **TUTORIAL: Neural Network Classifier & Regressor** [\[link\]](#)  
Jupyter notebook tutorial showing how the NeuralNetworkClassifier and NeuralNetworkRegressor are used.
- **QISKIT COURSE: Quantum Generative Adversarial Networks** [\[link\]](#)  
In depth tutorial of quantum generative adversarial networks.
- **LAB: Introduction to Quantum Neural Network Techniques** [\[link\]](#)  
Jupyter notebook to use the Qiskit machine learning modules for neural networks and quantum generative adversarial networks to train models.



# RESOURCES

## SUPPLEMENTARY MATERIAL



### Study Material

■ **VIDEO: Essence of Linear Algebra** [\[link\]](#)

A great video series walk-through of linear algebra by 3brown1blue with helpful graphical visualizations.

■ **COURSE: Introduction to machine learning - Udacity MOOC** [\[link\]](#)

An introductory machine learning MOOC (massive open online course) by Udacity, stepping you through the fundamental concepts of machine learning.

■ **COURSE: Qiskit Global Summer School 2021** [\[link\]](#)

The QGSS 2021 was focused on quantum machine learning starting from classical machine learning techniques to advanced technique.

# QUIZ

READY TO TEST YOUR KNOWLEDGE AND UNLOCK YOUR ACHIEVEMENT?

ONLINE QUIZ



# PASSED?

Congratulations!

Share your achievement in the [#level-up](#) channel on Discord.

Did you remember to fill out the level-up form and download your badge after you passed the quiz?

If not, we've provided the links below! Keep the password revealed at the end of the quiz ready.

Note: The password is the same for both the level-up form and the Badge file.

A dark purple rectangular button with the text "LEVEL-UP FORM" in white, uppercase letters. It has a subtle 3D effect with a grey shadow on the right and bottom.A dark purple rectangular button with the text "BADGE DOWNLOAD" in white, uppercase letters. It has a subtle 3D effect with a grey shadow on the right and bottom.

Keep an eye on the [#announcements](#) channel for details about the next modules and Badge achievements.

# NOTES

