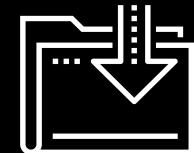


# Algorithmic Trading With Machine Learning

FinTech Boot Camp  
Lesson 14.3



# Class Objectives

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By the end of this lesson, you will be able to:



Build a machine learning model that takes in technical indicators and makes predictions about the daily direction of stock returns.



Evaluate the quality of that machine learning model, and improve model performance using scaling and resampling techniques.



Build training and testing datasets based on `DatetimeOffset` Pandas functionality.



Backtest a machine learning model to see how it would fare in terms of economic trading performance (i.e., cumulative percentage trading returns).



**WELCOME**

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# Algorithmic Trading with Machine Learning

# Algorithmic Trading with Machine Learning

In the previous lessons we:



Generated signals

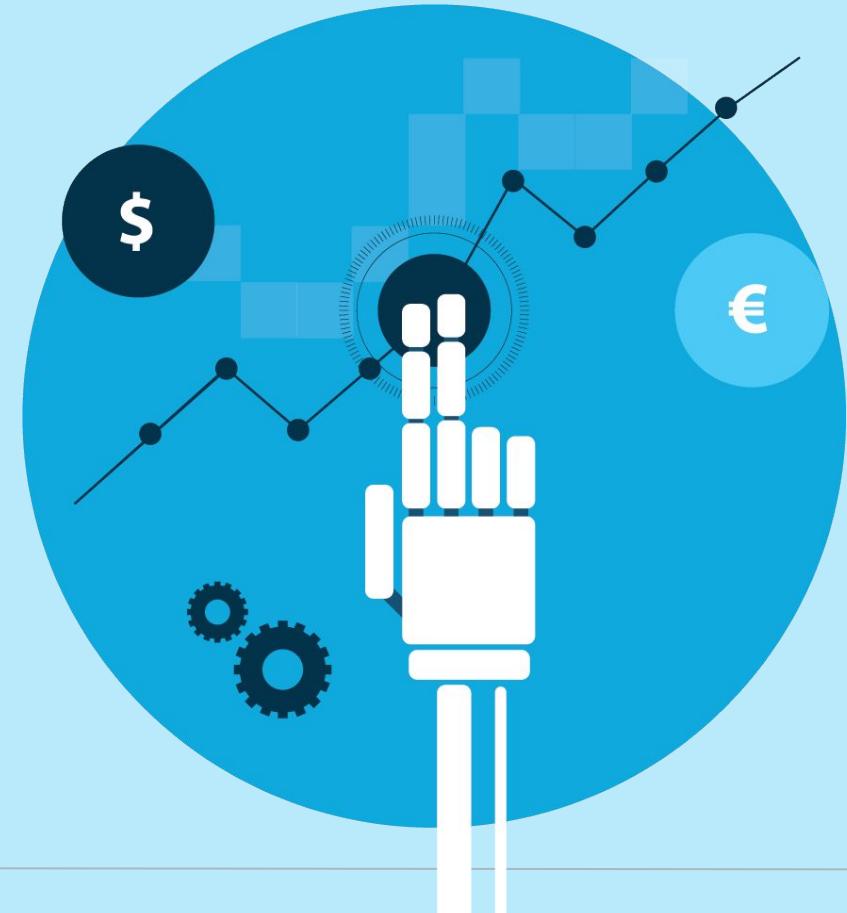


Backtested our trading strategies



Evaluated the results

Now, it's time to incorporate intelligence and automation into our trading strategies by using machine learning.





Based on your professional experience, and considering what we learned about machine learning in the course...

**What can be the advantages of using machine learning in algorithmic trading strategies?**

## Possible Answer

Computer systems driven by machine learning are disrupting the financial market.

They allow investors to manage and automatically trade assets in highly dynamic and volatile environments by reducing human errors or the emotional bias on making trading decisions.



## Possible Answer

Machine learning systems can evaluate multiple factors that influence investment decisions even more efficiently than humans—resulting in more accurate trading decisions.



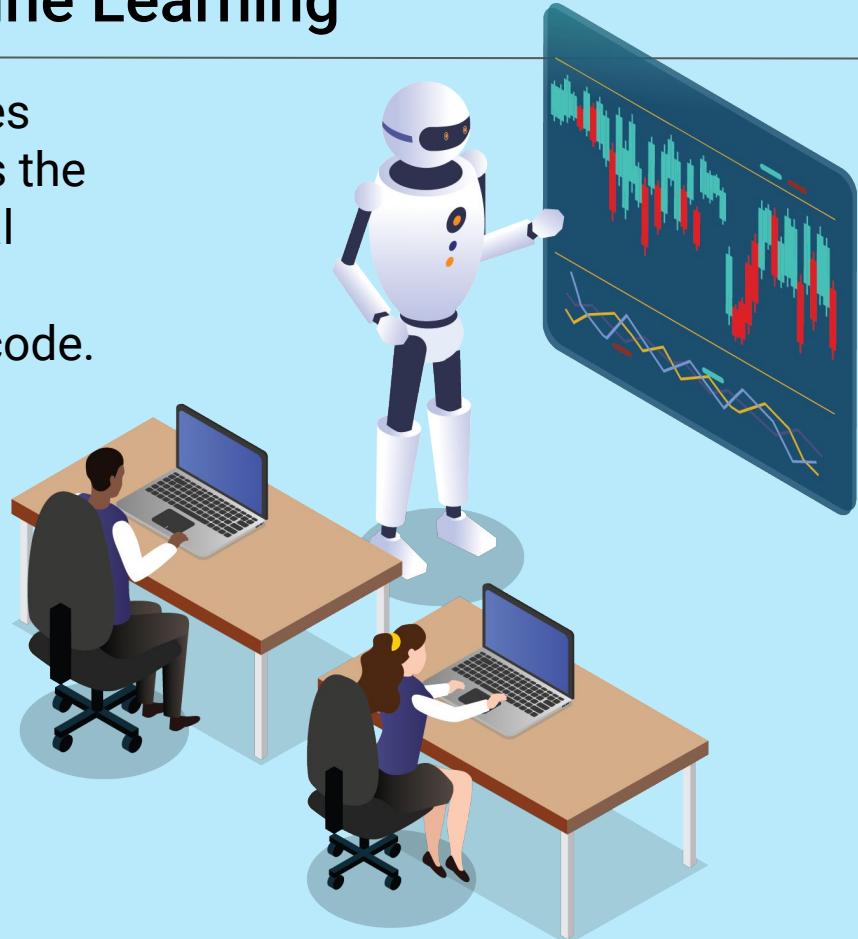


Additionally, machine learning systems can quickly analyze the data that generates the trade signals used to both enter and exit a trade at its most profitable price points.

# Algorithmic Trading with Machine Learning

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Using machine learning for trading requires combining a trader's experience to assess the performance of a model with the technical experience of a FinTech professional, who can translate a trading process into code.



The trading industry has not yet fully adopted machine learning.  
But, the industry is gradually accepting it.



This is because it's showing that it can generate more profitable trading strategies.

# Algorithmic Trading with Machine Learning

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The use of machine learning models makes trading decisions more efficient.



Once we find the right features and adapt the correct model, we can delegate the rest of the trading process to automation.



We can create new trading strategies more easily.



Machine learning algorithms work by getting as much predictive information as possible from each variable that the model includes.

# Questions?

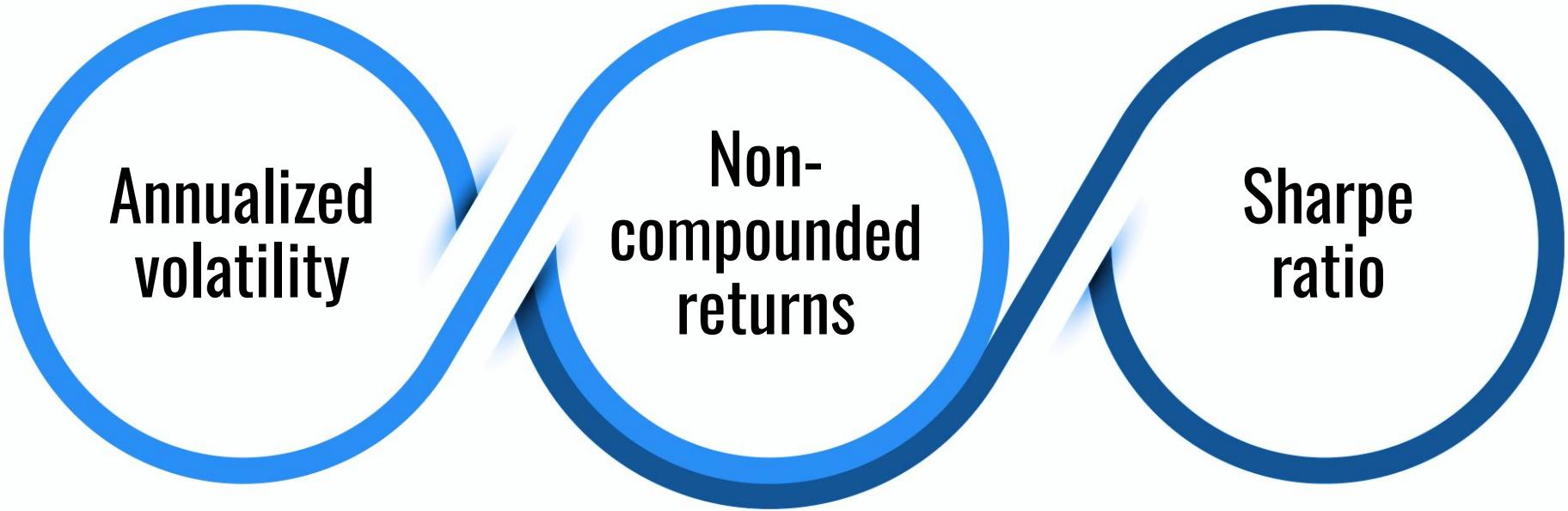


# Performance Metrics

# Performance Metrics

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You will learn how to use these performance metrics to assess the performance of an algorithmic trading strategy on options.



Annualized  
volatility

Non-  
compounded  
returns

Sharpe  
ratio

# Backtesting with Options

# Backtesting with Options

Backtesting and trading options is somewhat more complex than equities.

While options are derivatives that are based on equities, there are many more of them.

**There are more than 20,000 unique options trading on Google at any given time, for example.**



# Backtesting with Options

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The sheer number of options available as well as other factors, such as how much any single option moves in response to an equity, means that trading in them can get complicated quickly.

One way to simplify algorithmic options trading, however, is to backtest the **implied volatility** of a given stock.



The **implied volatility** is a standardized measure of the price of all the options currently trading on the stock.

# Implied Volatility

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In this class, we will use implied volatility to predict whether options on a stock will go up or down over the next day.





## Instructor Demonstration

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# Build a Simple Trading Algorithm

# Add Transaction Costs to a Backtest

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## Equities

Trading U.S. equities is close to costless these days, with most brokerages charging no commissions.



## Options

The same can't be said for trading options though, particularly when using an option broker that provides an API to do the trading.



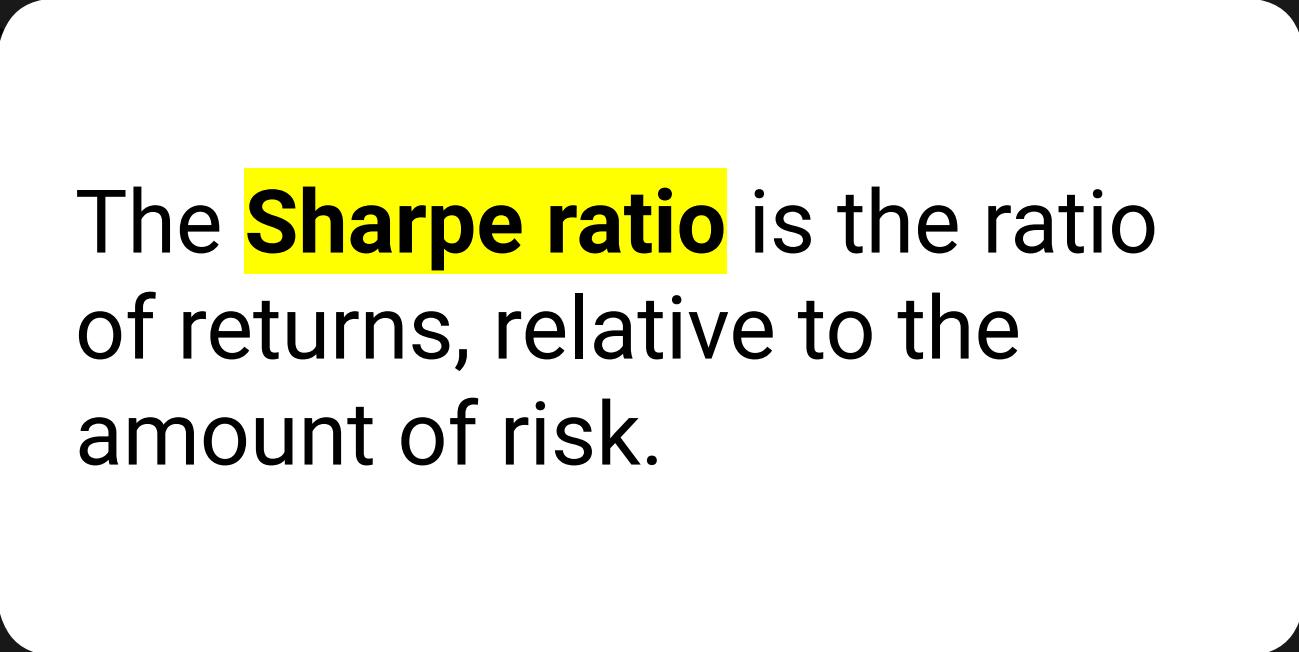


## Instructor Demonstration

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### Add Transaction Costs to a Backtest

# Other Performance Metrics



The **Sharpe ratio** is the ratio of returns, relative to the amount of risk.



## Instructor Demonstration

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### Sharpe Ratio



# Activity: Evaluating Algorithmic Strategy Performance

In this activity, you will utilize the various performance metrics to consider the performance and investment tradeoffs to various algorithmic strategies.

Suggested Time:

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15 Minutes



Time's Up! Let's Review.

# Questions?





## Instructor Demonstration

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Data Preparation for a  
Machine Learning Trading Strategy



Regardless of whether we use a machine learning model in our trading strategy, we should always prepare our data.

# Data Preparation for a Machine Learning Trading Strategy

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We can get financial data from an enterprise resource planning (ERP) system in the form of a CSV file or a database connection. We can also retrieve data from APIs, like the Alpaca API, as you learned before.



# Data Preparation for a Machine Learning Trading Strategy

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We will use supervised machine learning for our trading algorithms.



Supervised machine learning models require us to define a set of features ( $X$ ) that will predict a target variable ( $y$ ).



Because we'll build a trading algorithm that's powered by machine learning, our features and target sets will use technical analysis indicators for the stocks that we want to trade.

# Questions?





# Activity: Preparing Data for a Machine Learning Trading Strategy

In this activity, you will prepare training and testing data for fitting a machine learning-powered trading algorithm.

Suggested Time:

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15 Minutes



Time's Up! Let's Review.

# Questions?



*Break*





## Instructor Demonstration

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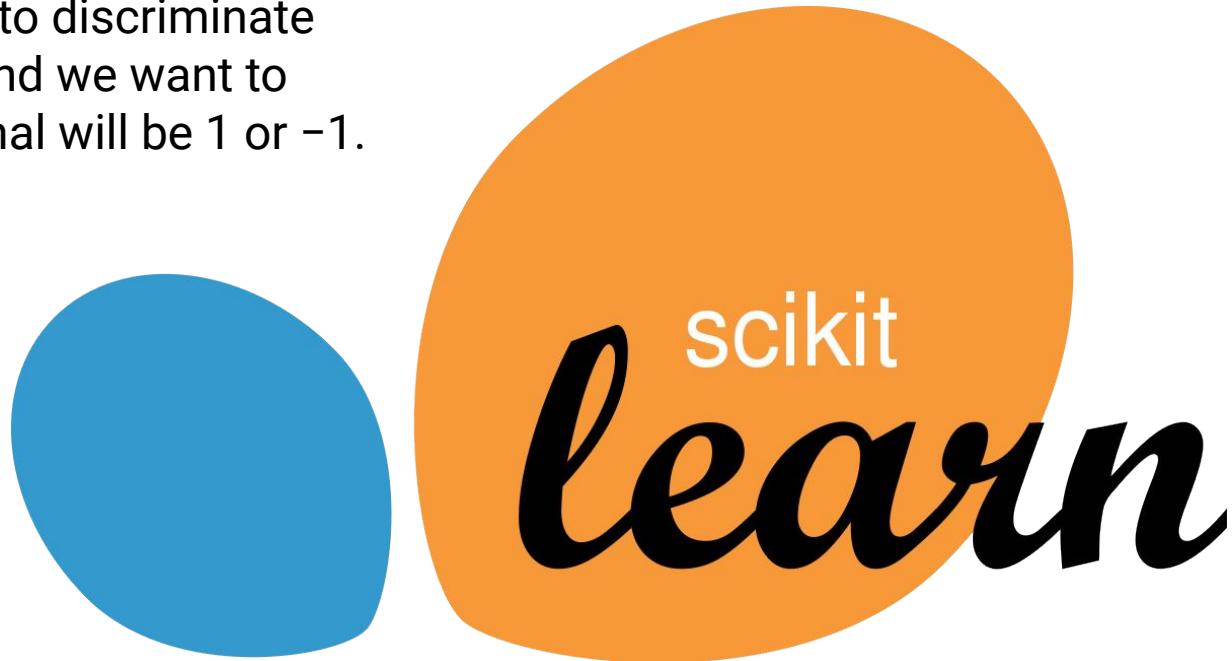
Use Machine Learning in a Trading Strategy

# Use Machine Learning in a Trading Strategy

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For this demonstration, we'll use the support vector machine (SVM) learning method from SKLearn, and its `svc` classifier model.

The reason is its ability to discriminate between two classes, and we want to predict whether the signal will be 1 or -1.





# Activity: Using a New Machine Learning Classifier for Algorithmic Trading

In this activity, you will evaluate how our earlier trading strategy behaves when it uses a different machine learning classification model.

Suggested Time:

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30 Minutes



Time's Up! Let's Review.



A graphic featuring three large, rounded speech bubbles arranged horizontally. The first bubble is blue and contains the word "Share". The second bubble is teal and contains the word "your". The third bubble is yellow and contains the word "answers". All three words are in a bold, sans-serif font. The background is a light gray with a subtle, low-poly geometric pattern.

Share  
your  
answers

# Conclusion

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Using machine learning models in trading algorithms increases your flexibility for both developing and backtesting their trading strategies.



Machine learning models can better adapt to complex data and rapidly evolving situations than humans can.



You can now use the tools that you've learned to evaluate the performance of different machine learning models for the same trading strategy.



You can then determine which model works best for the provided set of data.

# Questions?





## Instructor Demonstration

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# Going Live with Algo Trading



What we learned in this demo is just an illustration to get them started, but there's a lot more that we can do to improve it.

# Next Steps

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If you are interested in going further in algorithmic trading, it's strongly recommended that you learn and work out the bugs on a paper (not real money) portfolio first.

At [Alpaca](#), it's easy and quick to sign up for such a virtual portfolio and begin testing various ML trading strategies out.

## API for Stock Trading

Trade with algorithms, connect with apps,  
build services — all with commission-free  
stock trading API

Sign up for free

# Questions?



*The  
End*