

# RESTOCKING INTEREST IN INVESTING

A tool to help build foundations of wealth



# OUR TEAM



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Stigma around stock market  
that prevents new investors

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Help return basis of investing  
back to data and analytics.

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Employ DRL to train a  
model that accurately  
predicts stock trends.

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Demo and future plans.



# 01

## THE PROBLEM

# 60%

Of Americans are scared to enter the stock market

# FEAR

The stock market is made up of money

And money does not grow on trees

People can be fearful of:

- Stock volatility
- Uncertainty around the stock market
- Lack of education about investment

Inexperience is bad



# 85%

**OF MONEY MANAGERS  
UNDERPERFORM ON  
ANNUAL BENCHMARKS**

They concluded that during these extreme “herding events,” “the top 0.5% of stocks bought by Robinhood each day experience return reversals on average of approximately 5% over the next month whereas the more extreme herding events have reversals of approximately 9%.”

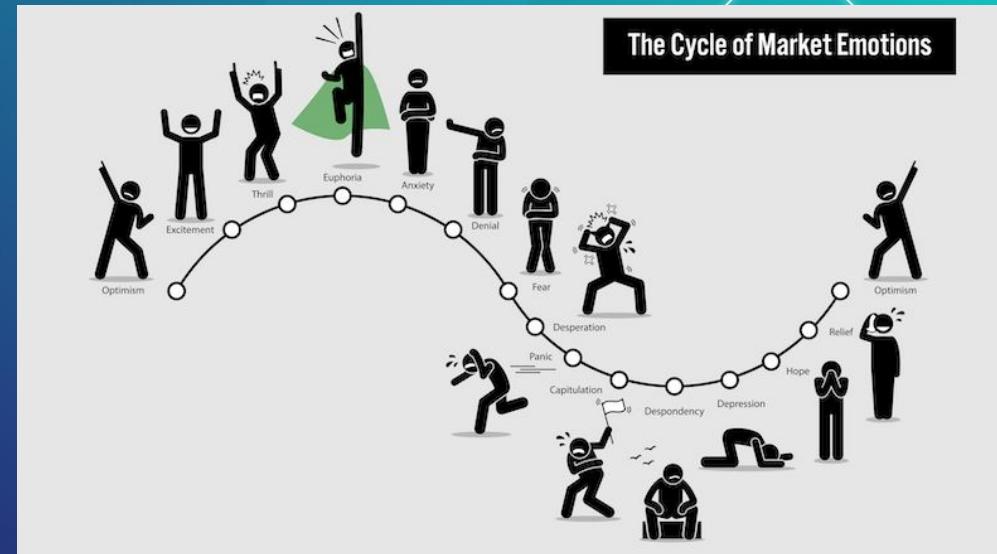
The conclusion: “Large increases in Robinhood users are often accompanied by large price spikes and are followed by reliably negative returns.”

Why did that happen? The authors noted that most Robinhood investors are inexperienced, so they tend to chase performance. The layout of the app, which draws attention to the most active stocks, also causes traders to buy stocks “more aggressively than other retail investors.”

-CNBC

# HERD MENTALITY

- Herd Mentality
  - Price Bubbles
  - Unsustainable
  - Volatile way to invest
  - Takes away the analytics of investing



# 02

## OUR SOLUTION

Create a bot to help give  
accurate stock advice



# MAIN OBJECTIVES

## COMPILE DATA

Trash input → Trash Output. That is why we use Yahoo Finance API to get the most up to date data regarding the stock market.

## UNDERSTAND THE STOCK MARKET

Learn about stock metrics, indicators and important patterns that help predict trends.



# WHAT IS DEEP REINFORCEMENT LEARNING?



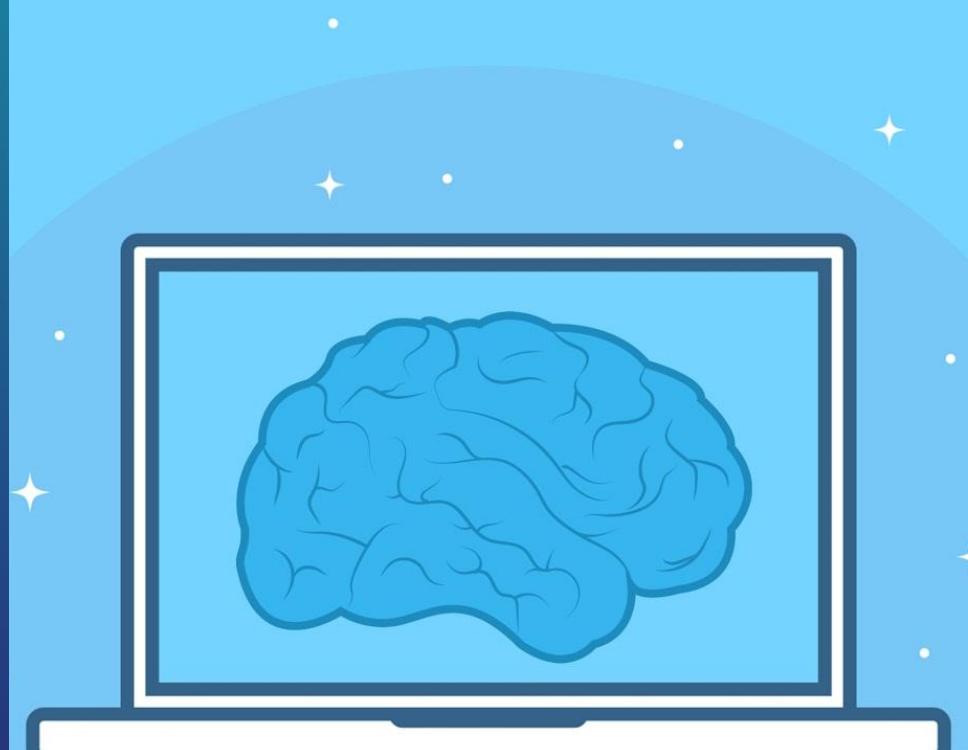
## DRL

Goal- oriented  
algorithms

Maximizing reward

Reinforcement through  
penalization and  
rewards

- **Agent**
  - A thing/person that takes actions navigating through an environment
- **Action**
  - Set of all possible moves an agent can make.
- **Environment**
  - The world that the agent moves in
  - Environment responds to agent
  - Laws and physics that process actions and determine outcome
- **Rewards function**
  - Measures success or failure of an agent's action
- **Policy**
  - Strategy that agent employs to determine the next action based on the current state



# WHY DRL?

- **DRL in financial analysis**
  - Automatically optimize key parameters in models.
  - Popularity with alternative data paved the way for DRL to be implemented into financial analysis
- **Unique Agent predictions**
  - Base actions off alternative models to maximize cumulative reward.





# 03

## THE EXECUTION

# TIMELINE

## R&D

- Research into stock market and DRL.

## BUILD

- Experimented with different models and datasets.

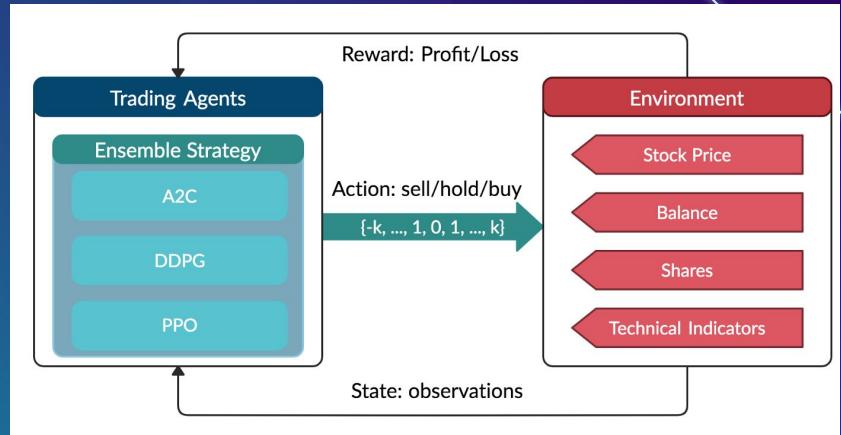
## TRAINING

- Refining algorithm and training bot.



# THE SIMPLE APPROACH

1. Derive data from Yahoo Finance API
2. Compute Ratios preprocess data
3. Train A2C model
4. Profit!



# NOT SO SIMPLE DATA

- Finding **compatible API's** and their requisite versions that would give us the required data.
- Parsing through **relevant statistics**.
- Computing important **financial ratios**
- Training the model with the most recent data regarding a specific stock.

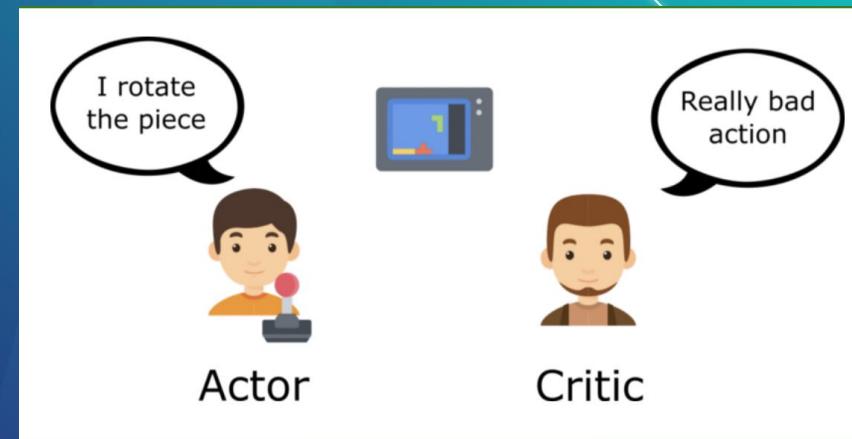
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1.100227	0.809829	42.599299	8.899818	3.871583	0.572660	1.340058	4.619061	1.012545	0.021566
0.000000	0.000000	1.610916	0.250201	0.268773	0.869490	6.662276	88.670610	5.939866	0.002240
0.000000	0.000000	1.610916	0.250201	0.268773	0.869490	6.662276	41.621919	2.788169	0.004772
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0.850124	0.233454	2.278912	2.122294	4.400118	0.798830	3.970926	121.757897	2.086100	0.013748

	date	tic	op_inc_q	rev_q	net_inc_q	tot_assets	sh_equity	eps_incl_ex	com_eq	sh_outstanding	...	cur_assets	cur_liabilities	cash_eq	receivables
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1	19990930	AXP	906.0	5584.0	648.0	132616.0	9744.0	4.18	9744.0	447.6	...	NaN	NaN	5102.0	48827.0
2	19991231	AXP	845.0	6009.0	606.0	148517.0	10095.0	5.54	10095.0	446.9	...	NaN	NaN	10391.0	54033.0
3	20000331	AXP	920.0	6021.0	656.0	150662.0	10253.0	1.48	10253.0	444.7	...	NaN	NaN	7425.0	53663.0
4	20000630	AXP	1046.0	6370.0	740.0	148553.0	10509.0	1.05	10509.0	1335.0	...	NaN	NaN	6841.0	54286.0

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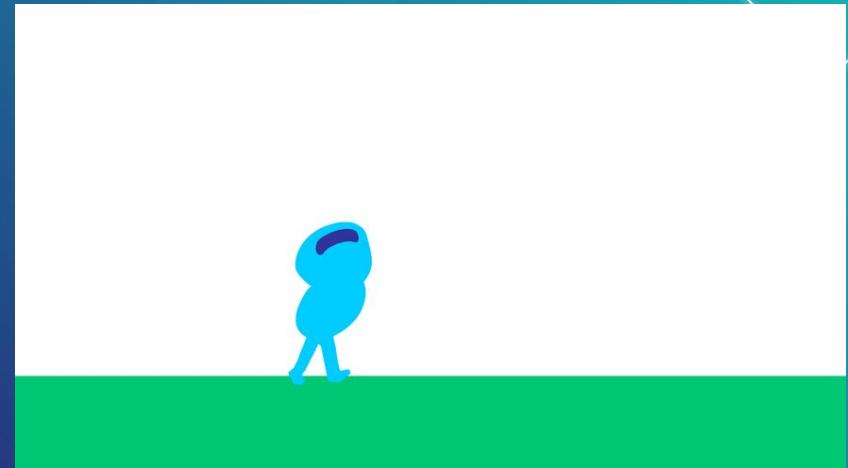
# WHAT IS AN A2C MODEL?

- Advantage Actor Critic model is a type of RL model that reinforces learning through rewards.
- Actor and Critic Relationship
  - Actor has the policy
  - Critic Calculates value functions
- Advantage function reduces variance of outcomes
  - Policy gradient adjusts the reward
  - Actor takes actions based on reward



# TRAINING THE MODEL

1. Create the right environment
2. Compute the optimal rewards function
3. Set up agent
  - a. Buy, Sell, Hold
4. Run A2C model



A2C									
Sr. no.	learning_rate	n_steps	gamma(discount factor)	momentum	alpha	timesteps	Indicators	Results	
1	0.0007	5	0.99	0	9.90E-01	100000	SSMA', 'RSI', 'OBV', 'EMA'	Total Profit - 1.005	Total Reward - 1.05
2	0.0007	5	0.99	0	9.90E-01	150000	SSMA', 'RSI', 'OBV', 'EMA'	Total Profit - 0.974	Total Reward - 0.98
3	0.0001	5	0.99	0	9.90E-01	100000	SSMA', 'RSI', 'OBV', 'EMA'	Total Profit - 0.96	Total Reward - 2.2
4	0.001	5	0.99	0	9.90E-01	100000	SSMA', 'RSI', 'OBV', 'EMA'	Total Profit - 0.99	Total Reward - 2.6
5	0.001	10	0.99	0	9.90E-01	100000	SSMA', 'RSI', 'OBV', 'EMA'	Total Profit - 0.97	Total Reward - 2.86
6	0.0001	10	0.99	0	9.90E-01	100000	SSMA', 'RSI', 'OBV', 'EMA'	Total Profit - 0.97	Total Reward - 2.86
7	0.001	5	0.99	0	9.90E-01	100000	STOCH', 'OBV', 'EMA'	Total Profit - 0.994	Total Reward - 1.39
8	0.001	5	0.99	0.3	9.90E-01	100000	STOCH',	Total Profit -	
9	0.007	5	0.99	0	9.90E-01	100000	STOCH', 'OBV'	Total Profit - 1.01	Total Reward - 1.38

# MAIN OBSTACLES

Finding compatible versions of various packages.

Refining A2C algorithm.

Learning to Create an endpoint from AWS sagemaker and implementing the product as a website.

# 124%

Trading bot's annual return of investment for a 30 stock portfolio

# 04

## DEMO AND IMPLEMENTATION

Real world application for our product.



# CLOUD IMPLEMENTATION

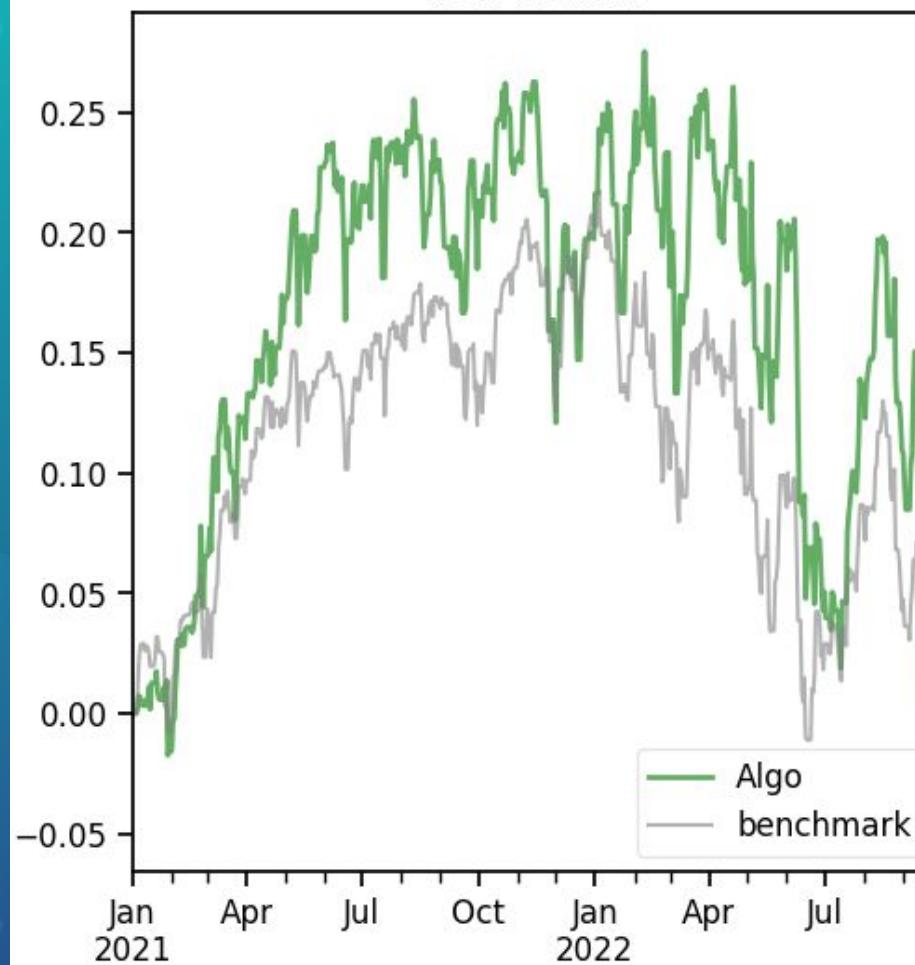


amazon  
SageMaker Studio **Lab**



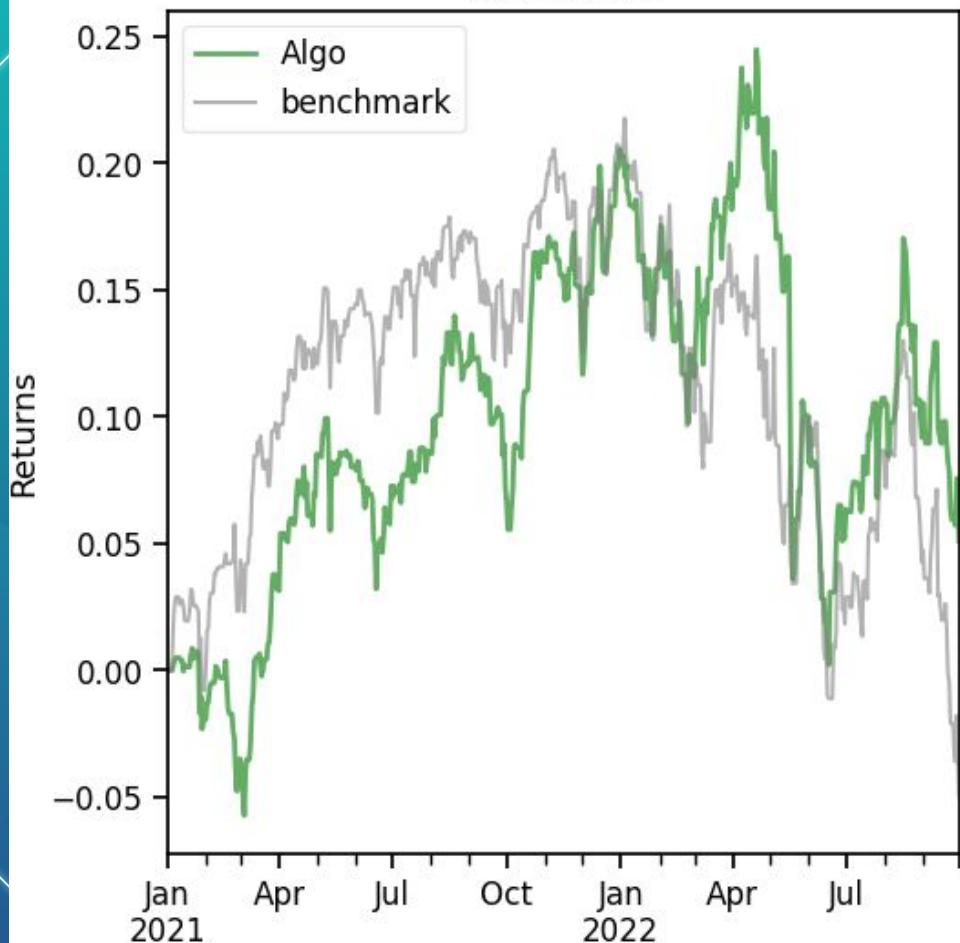
## New Normal

Boeing



Nike

## New Normal







# FUTURE PLANS

- Output action reasoning
- Analyze news articles to develop popularity of stocks
  - Bring in outside factors, not just statistics
- Provide daily stock picks
- Business plan
  - Membership based paywall
  - Ad revenue

# THANKS!

Do you have any questions?



# QUESTIONS?