



# MACHINE LEARNING FOR ALGORITHMIC TRADING

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# ALGORITHMIC TRADING



# ALGORITHMIC TRADING

## I n t r o d u c t i o n

“Algorithmic trading is a type of quant trading that uses pre-specified machine executable instructions to determine the size and timing of trades based on a quantitative model of an asset's price behavior. Over 70 percent of US trading volume is algorithmic. Most of this volume is high-frequency trading.”<sup>[1]</sup>



# ALGORITHMIC TRADING

With Machine Learning

“Machine learning (ML) involves algorithms that learn rules or patterns from data to achieve a goal such as minimizing a prediction error. ML algorithms can extract information from data to support or automate key investment activities. These activities include observing the market and analyzing data to form expectations about the future and decide on placing buy or sell orders, as well as managing the resulting portfolio to produce attractive returns relative to the risk.”<sup>[2]</sup>





# ML FOR ALGO- TRADING

W I D E   &   D E E P   L E A R N I N G

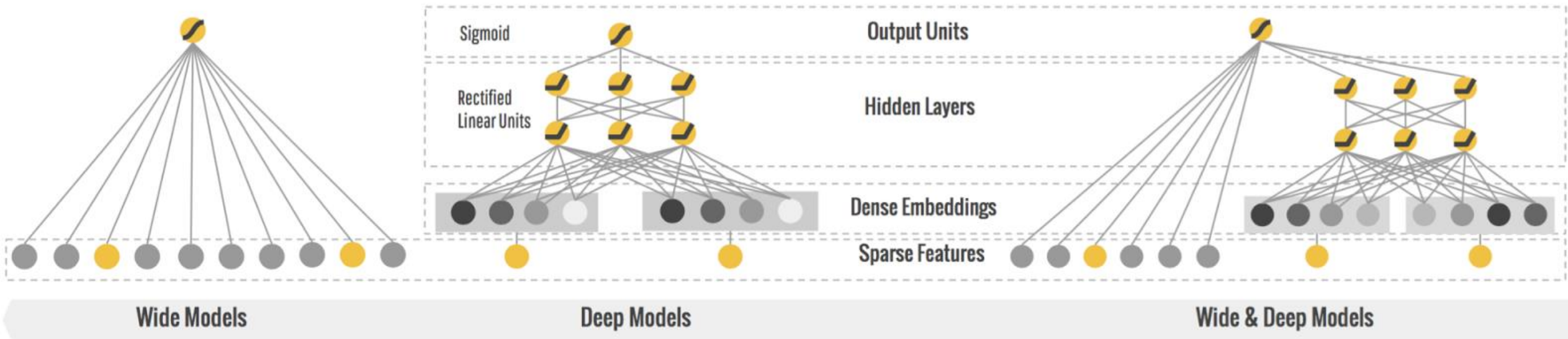
# WIDE & DEEP LEARNING

“Can we teach computers to learn like humans do, by combining the power of memorization and generalization?” [3]

Wide & Deep Learning developed at Google Research was the answer to the previous question.

“It's not an easy question to answer, but by jointly training a wide linear model (for memorization) alongside a deep neural network (for generalization), one can combine the strengths of both to bring us one step closer.” [3]

“It's useful for generic large-scale regression and classification problems with sparse inputs (categorical features with a large number of possible feature values), such as recommender systems, search, and ranking problems.” [3]







# ML FOR ALGO- TRADING

DEEP REINFORCEMENT  
LEARNING

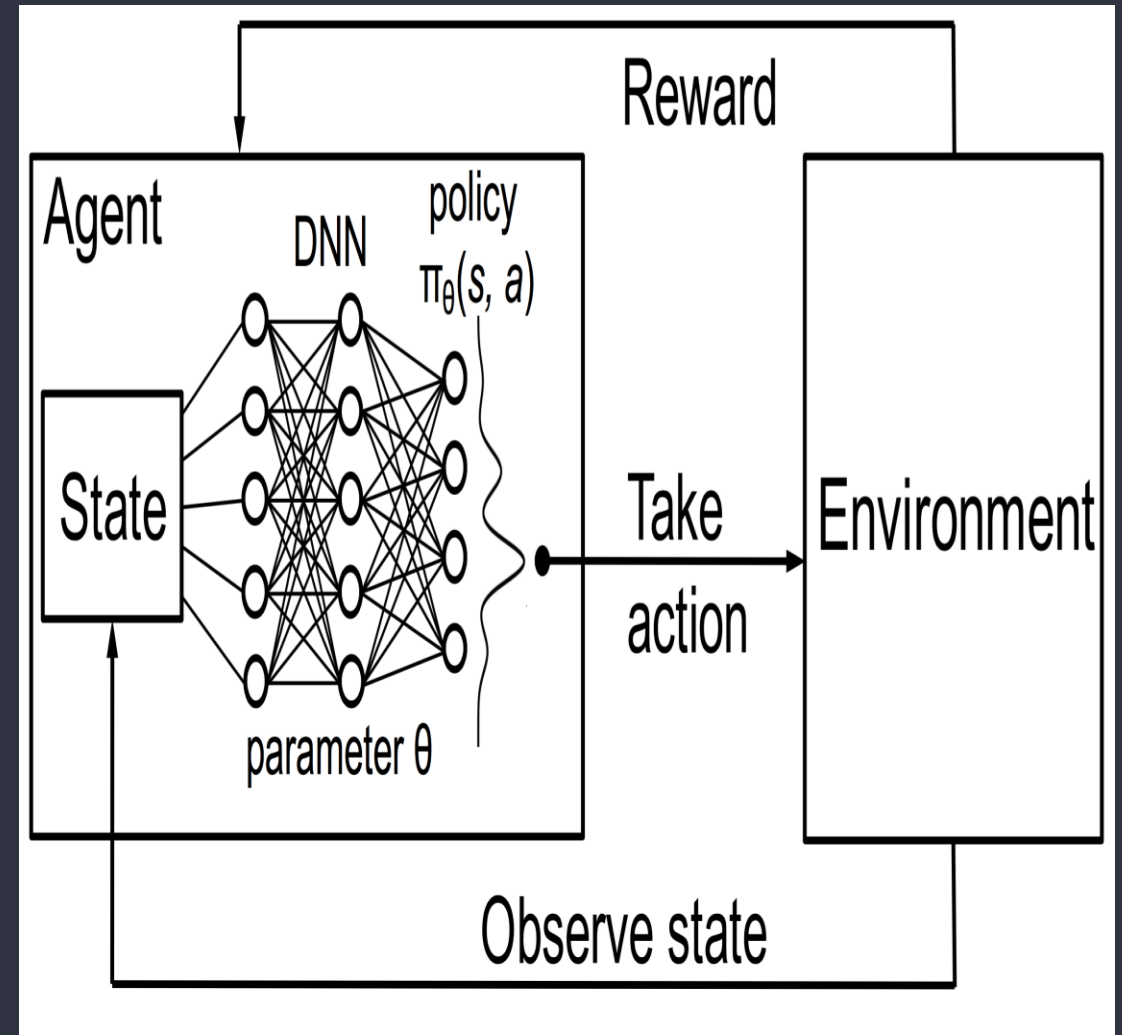


# DEEP REINFORCEMENT LEARNING

## Introduction

“Deep reinforcement learning is the combination of reinforcement learning (RL) and deep learning. This field of research has been able to solve a wide range of complex decision-making tasks that were previously out of reach for a machine.

Thus, Deep RL opens up many new applications in domains such as healthcare, robotics, smart grids, finance, and many more.” [4]



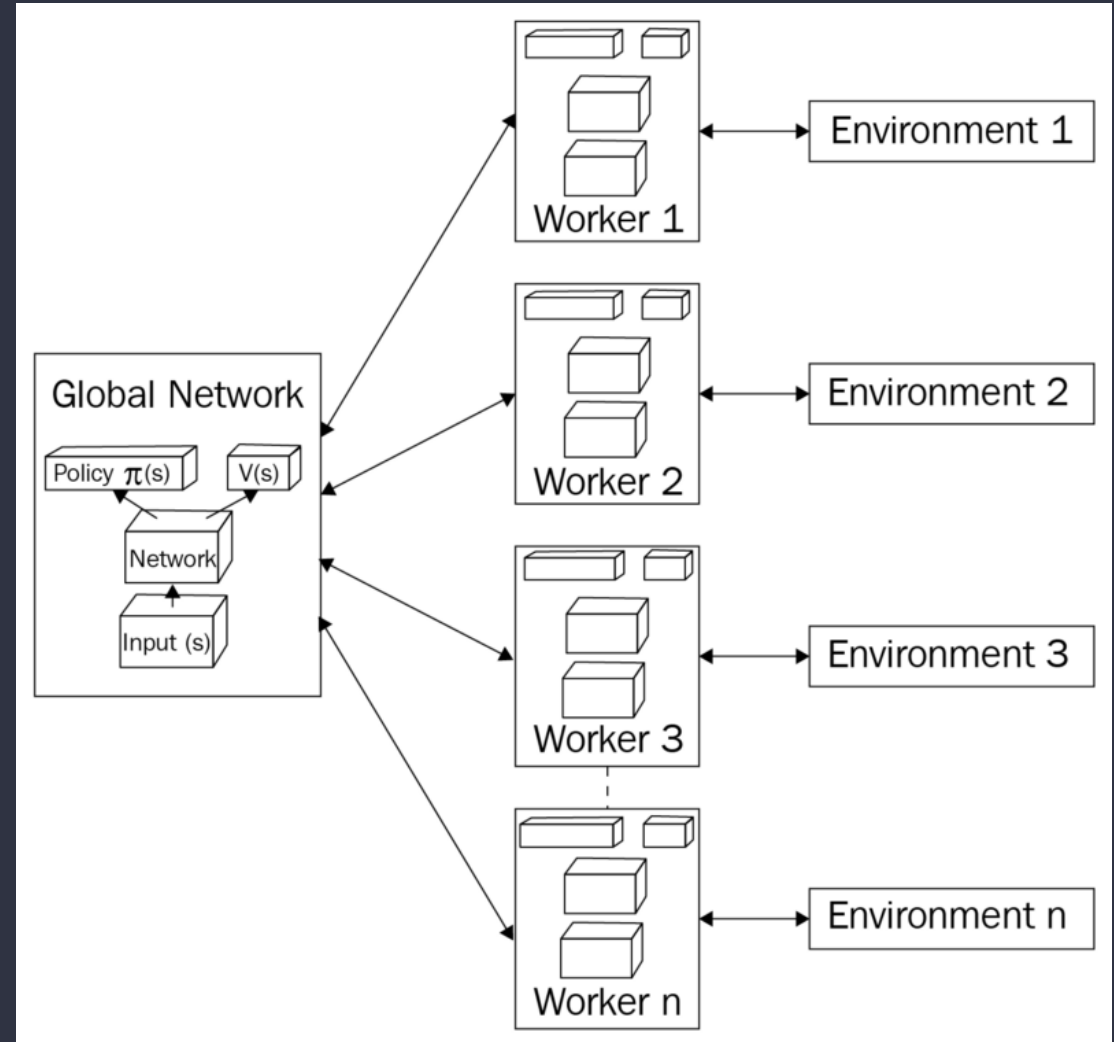
# DEEP REINFORCEMENT LEARNING

## A 3 C

The Asynchronous Advantage Actor Critic (A3C) was developed by Google's DeepMind.

A3C consists of multiple independent agents(networks) with their own weights, who interact with a different copy of the environment in parallel.

“We now describe our variants of one-step Q-learning, one-step Sarsa, n-step Q-learning and advantage actor-critic”. [5]





# ML FOR ALGO- TRADING

A3C WITH WIDE & DEEP  
NETWORKS

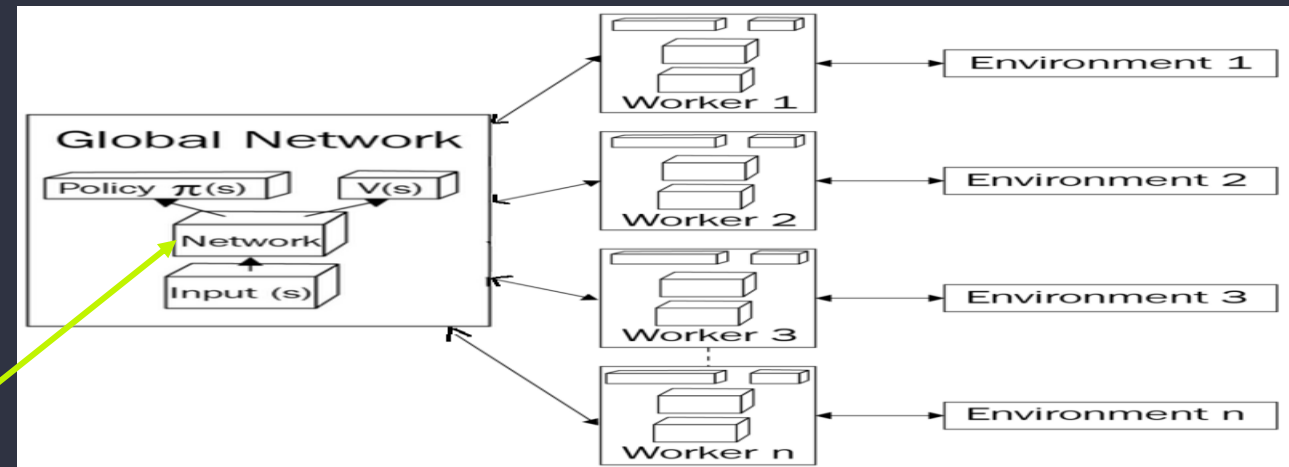
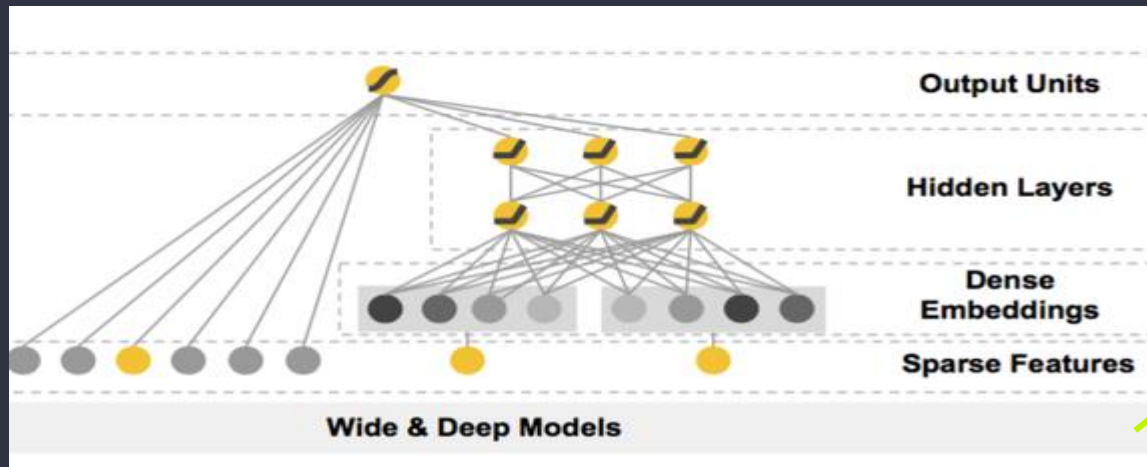
# DEEP REINFORCEMENT LEARNING FOR TRADING

## A3C with Wide & Deep Networks

In a single financial market we can implement A3C that consists of multiple independent agents(networks) with their own weights that can operate in different sectors, who interact with a different copy of the environment in parallel used to simulate different sector scenarios.

Our idea is to make the Model-Free A3C bound by the market previous behavior and current trends, in order to predict seconds ahead of recent stock values. This will rely on the Wide & Deep Artificial Neural for approximating both the Actor and the Critic.

In order to make the Artificial Neural Network more compliant with the Financial markets and their respective sectors where the agents operates in, we define a Wide & Deep Models, where wide linear model is used for memorization (historical market data/sector pattern), alongside a deep neural network used for generalization (detect new market/sector pattern).







# SUSTAINABLE DEVELOPMENT IN AFRICA

The Projected Impact

## Current Standings

- Tailored Algo-Trading solutions due exist, but only for B2B service, or through a physical brokers and agencies.
- In Africa rare B2C service Startups and Financial institutions provide online platforms for Trading.
- Public online AI powered trading platforms are almost unheard of in Africa and especially in Tunisia.
- Our region is virgin terrain to have such an investment due to the presence of AI talent and market potential.



## Projected Impact

- The proposed algo idea is to be deployed on digital platforms to democratize trading by providing a B2C service.
- Having an AI powered trading platforms is a leap in the Africans continent financial services sector.
- Moreover, if it's open for the public as a B2C service it will be a game change for financial market passionate individuals.
- Shift from human based trading system based on their intuition to AI centered data driven trading system.

### Personal Work (ongoing)

[https://github.com/MWFK/Market\\_Prediction-Building\\_Trading\\_Strategies](https://github.com/MWFK/Market_Prediction-Building_Trading_Strategies)

### References

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[4] Vincent Francois-Lavet,  
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# THANK YOU

Q & A