



MACHINE LEARNING FOR ALGORITHMIC TRADING

By Mouafek Ayadi
Data Scientist at ODDO BHF

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ALGORITHMIC TRADING

PART 1 INTRODUCTION

ALGORITHMIC TRADING

“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.”^[1]





ALGORITHMIC TRADING

PART 2 MACHINE LEARNING

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.”^[2]





ML ALGOS FOR TRADING

PART 1
WIDE & DEEP LEARNING

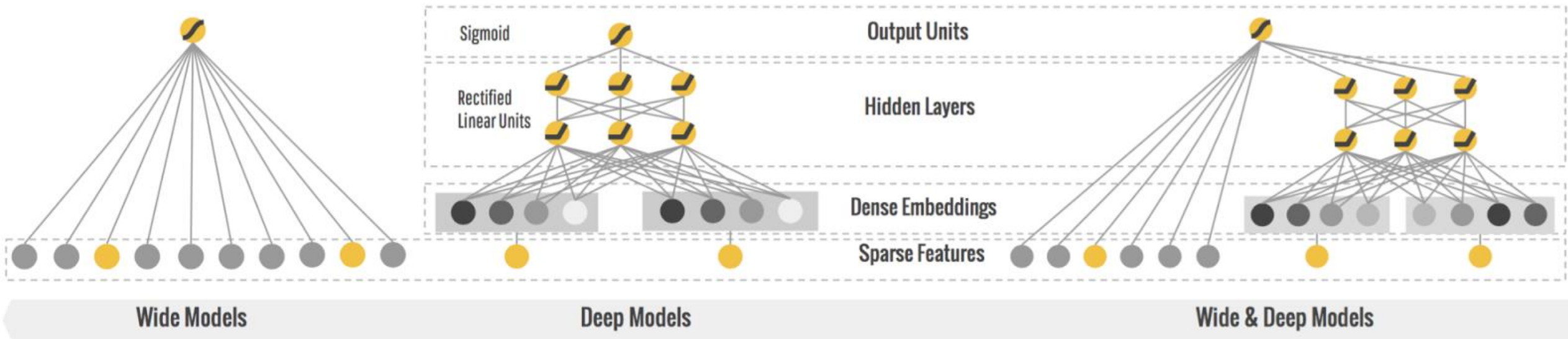
WIDE & DEEP LEARNING

“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 ALGOS FOR TRADING

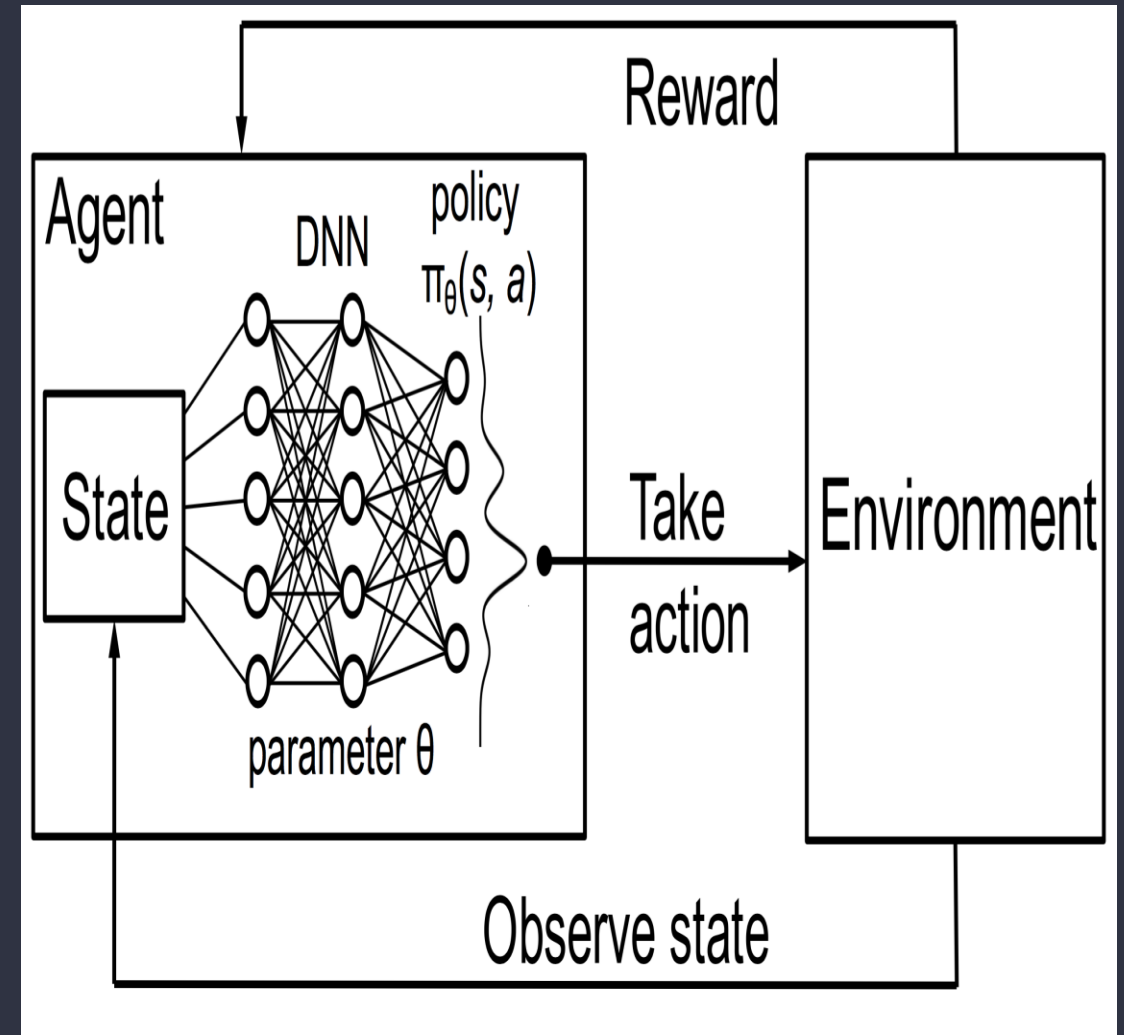
PART 2 DEEP REINFORCEMENT LEARNING

DEEP REINFORCEMENT LEARNING

Intro

“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]



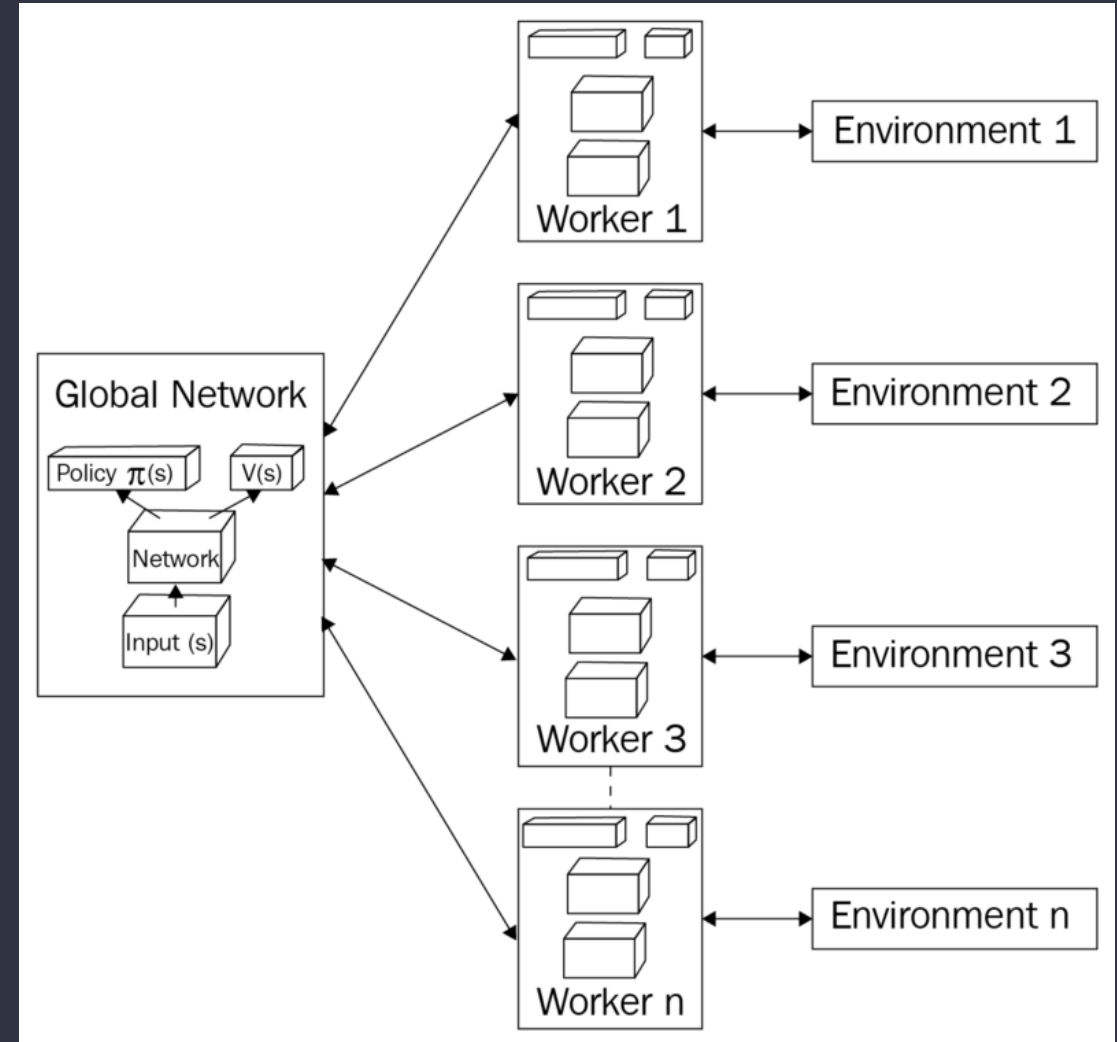
DEEP REINFORCEMENT LEARNING

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]



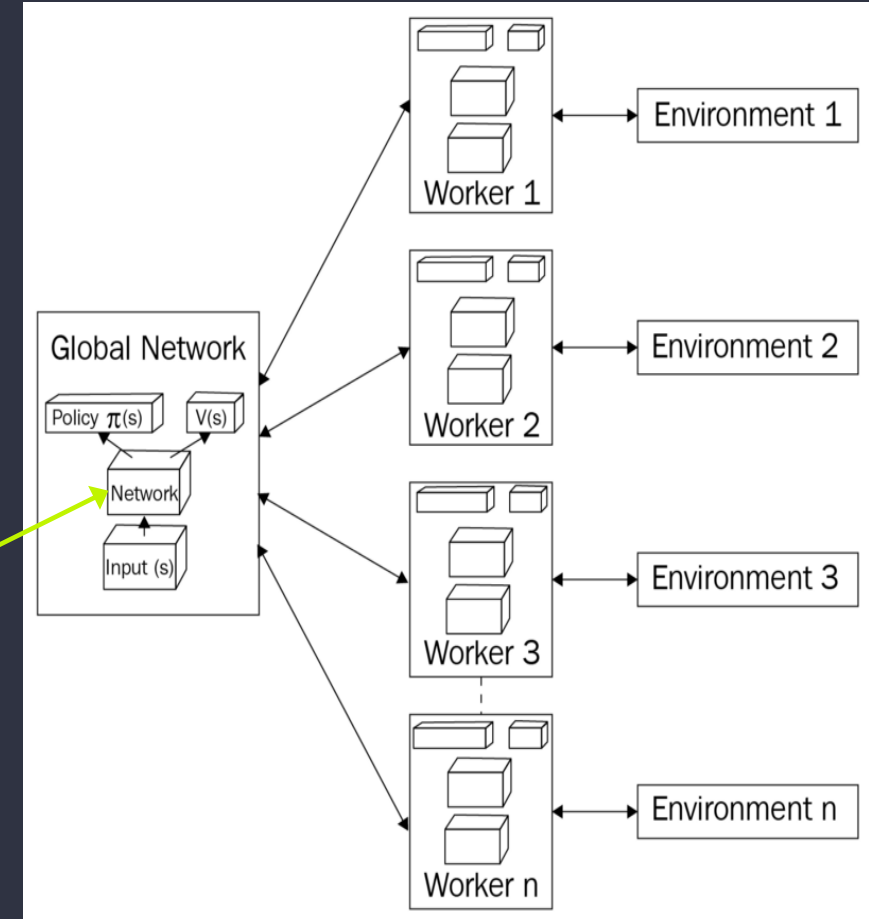
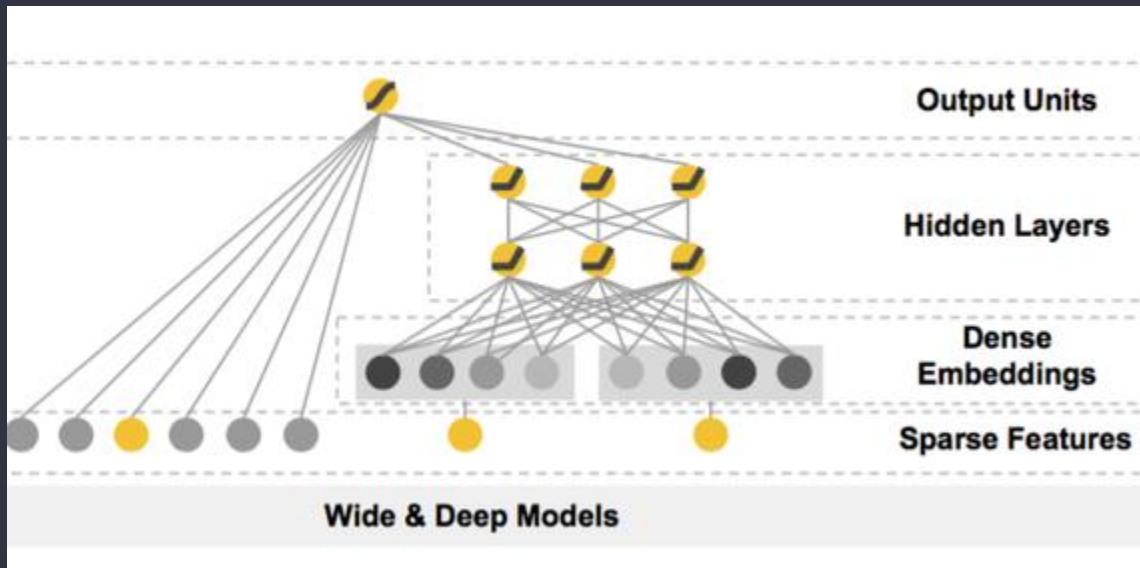


ML ALGOS FOR TRADING

PART 3 PROPOSED ARCHITECTURE

DEEP REINFORCEMENT LEARNING FOR TRADING

A3C WITH WIDE & DEEP NETWORKS



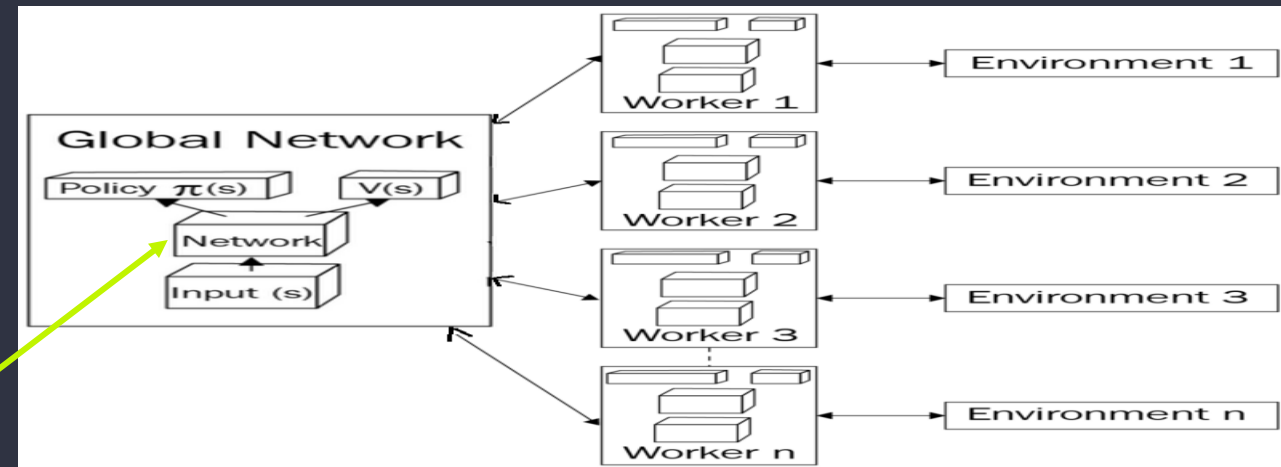
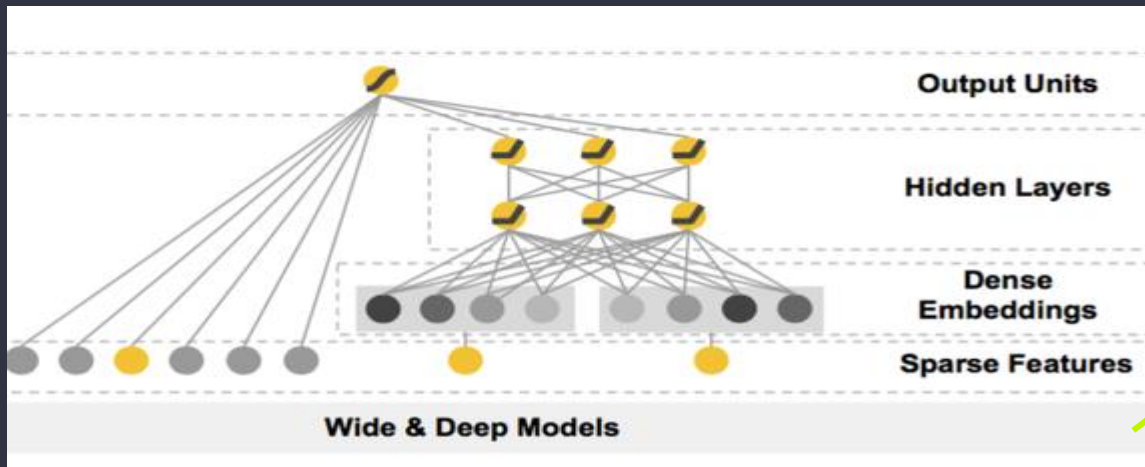
DEEP REINFORCEMENT LEARNING FOR TRADING

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.

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/sector pattern), alongside a deep neural network used for generalization (detect new market/sector pattern).



Personal Work (ongoing)

https://github.com/MWFK/Market_Prediction-Building_Trading_Strategies

References

- [1] <https://www.yuque.com/xhades/hs3xtz/ibg3cw>
- [2] <https://ml4trading.io/chapter/0>
- [3] <https://arxiv.org/pdf/1606.07792.pdf>
- [4] <https://arxiv.org/abs/1811.12560>
- [5] <https://arxiv.org/pdf/1602.01783.pdf>



THANK YOU

Q & A