

A MINI TRADING BOT SYSTEM WITH MACHINE LEARNING IN CRYPTOCURRENCY MARKET

1. Problem Overview

In 2022, people witnessed a “Crypto Winter year” -- more than **50% of market value** has evaporated and in particular **Bitcoin has sunk 75%**.

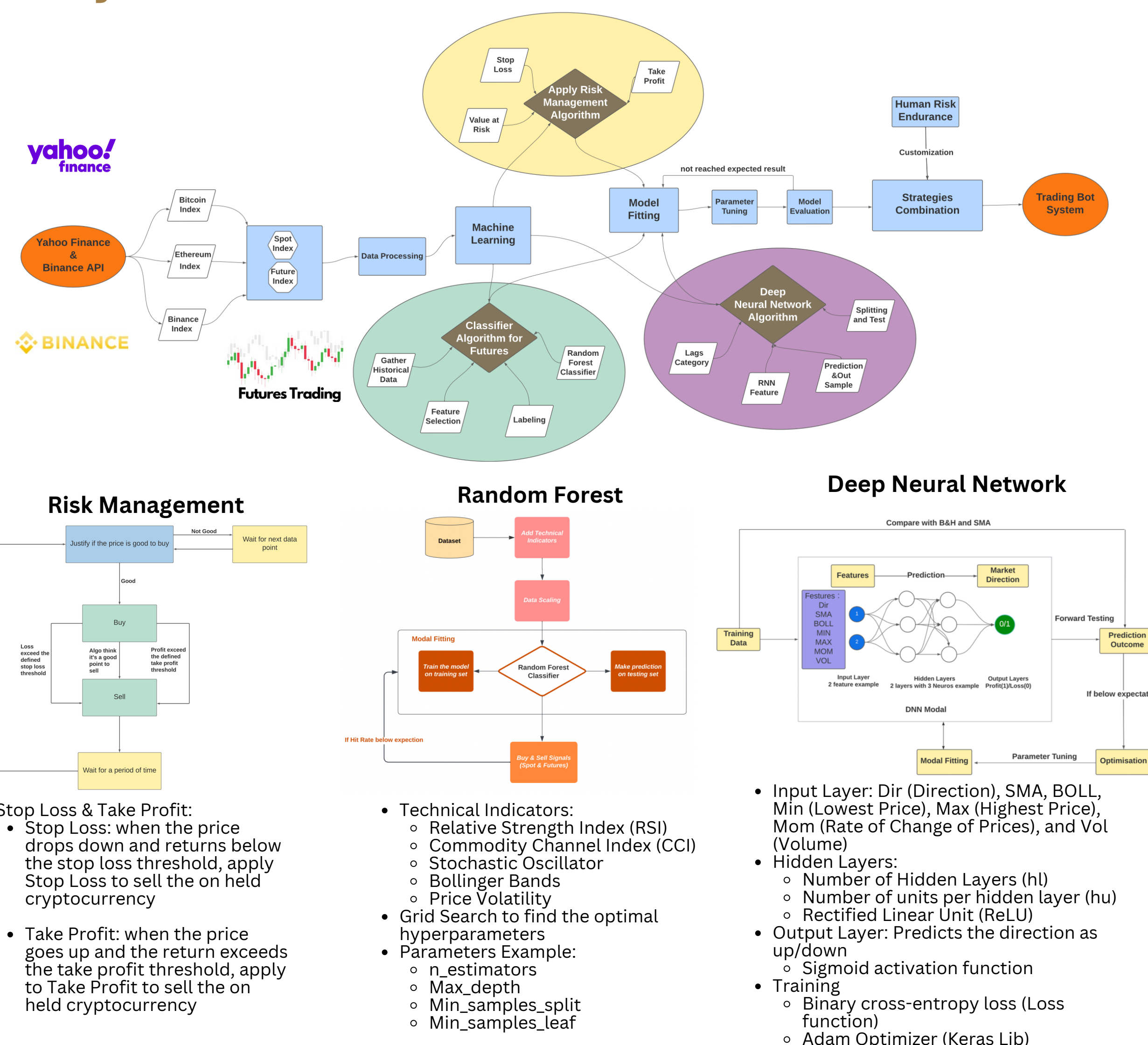


- The crypto market is known for its **volatility** and **24/7**.
- Few **governmental regulations** and prices **up/down limits** in a day.

2. Motivation and Solution

- Empower people to **save money** and live a more **sustainable/profitable** life
- **Machine learning** methodologies to manage **risk** in **bot trading** with not only **the spot market** but cryptocurrency derivatives, particularly the innovative **futures market**.
- Mini trading bot system using **random forest** and **deep neural network algorithms** to customize strategy portfolios based on **investors' risk endurance**.
- The **performance comparison** of market baseline strategies-**Buy&Hold** and **SMA**(simple moving average) are applied in both the investment return (**ROI**) and risk loss control (**Sortino** ratio) perspectives during the same periods' **hourly** and **daily** data from **spot and future** markets.

3. System Overview



5. Strategies Recommendation

Investor	Systm Strategies	Data Source	ROI	Sortino
Profit Driven	Pure Random Forest/ Pure DNN	Spot & Hourly	60%-70%	1.1-1.2
Risk Neutral	Random Forest+Risk	Future & Hourly	30%-40%	1.1-1.6
Risk Aversion	Risk + Random Forest/ Risk +DNN	Futures & Daily	10%-15%	1.8-2.0

- **Profit Driven Investors:**
 - **pure random forest** or **pure DNN** strategy by **hourly spot** data. The average **ROI** is achieved at **up to 60%-70%** with the **lowest Sortino**
- **Risk Neutral Investors:**
 - a **combination of random forest and risk strategies** by **hourly futures** data, the average **ROI of 30%-40%** with a **medium Sortino**
- **Risk Aversion Investors:**
 - **risk strategies** with the combination of **either Random Forest or DNN** by **daily futures** data. **10%-15% ROI** with the **highest Sortino** for the most stable return

6. Conclusion

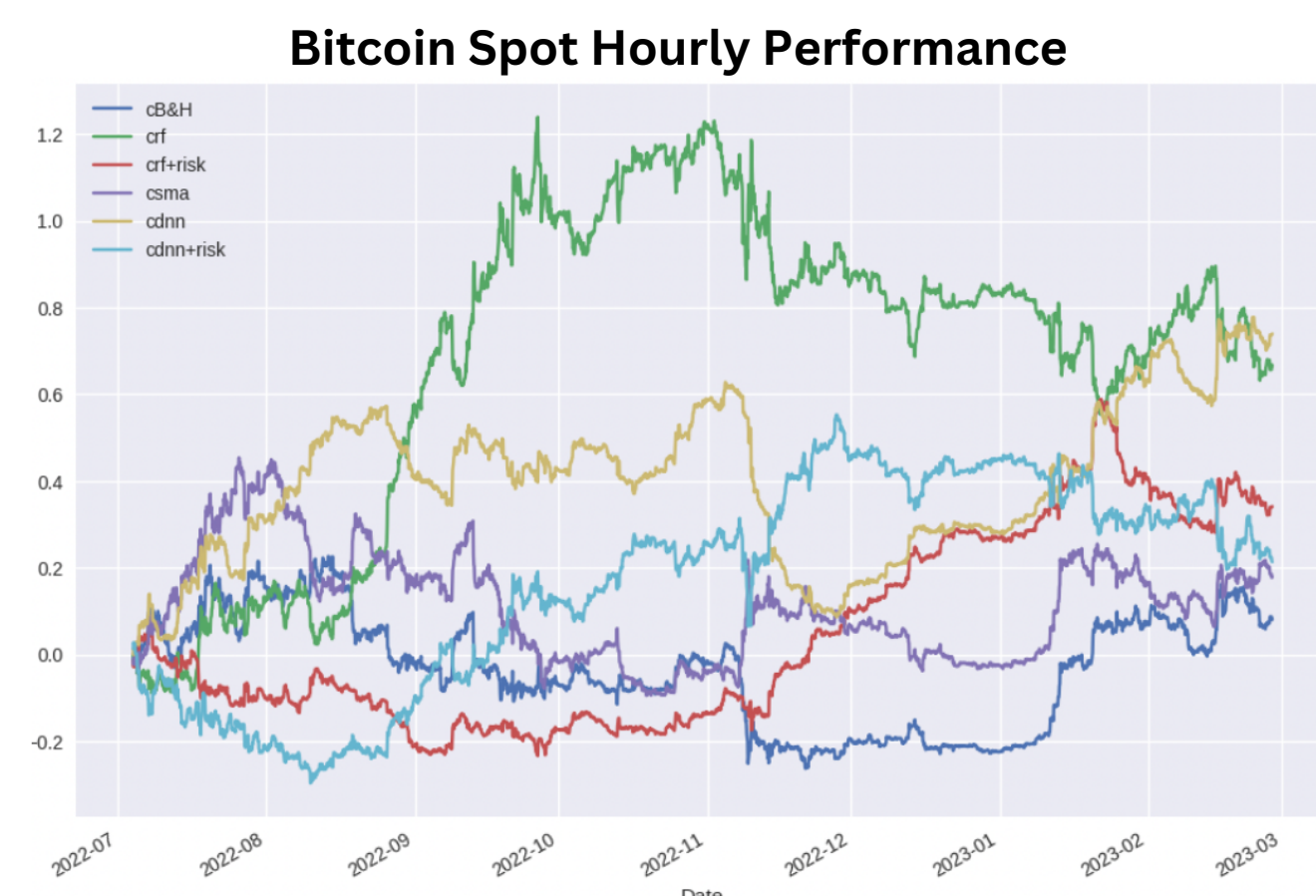
Our research provides a **practical approach** and ensures the **safety** of the trader's investment. Through our system set-up based on investors' risk endurance level:

The **profit expectation** is **well achieved** by implementing our **combination of risk and random forest or risk and DNN or pure separate machine learning strategies** with a relevant **higher Sortino** ratio(more stable of loss control) in the **spot or future, hourly or daily** cryptocurrency trading market.

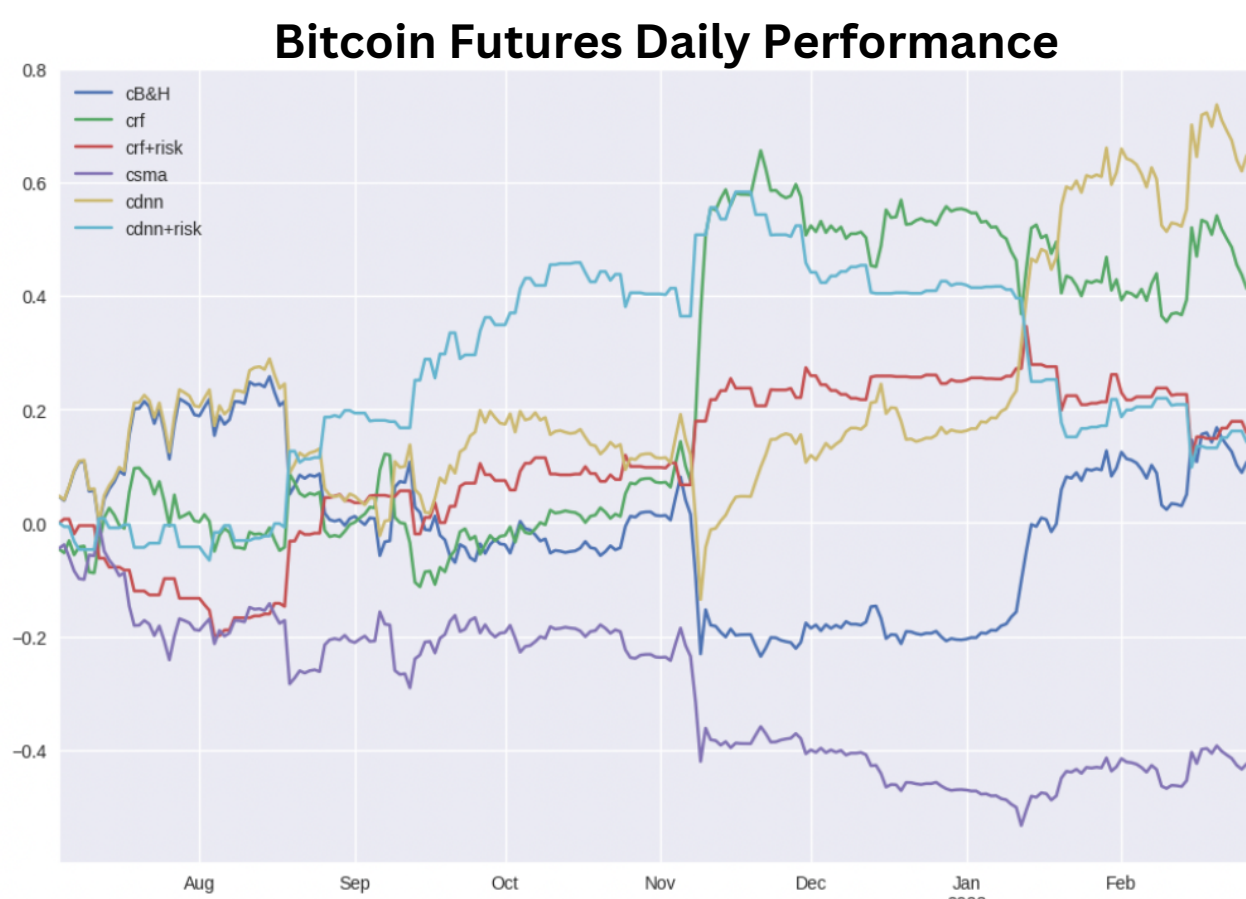
7. Limitations & Future Works

- Limited amount of training data: 1.5 years
 - Suggestion: Adding more historical data for training will help the model to improve its ability to predict future trading signals.
- Top three cryptocurrencies for our trading strategies, which may not accurately represent the whole cryptocurrencies
 - Suggestion: collect more coins data and train/optimize the models
- Public news or social media can greatly influence this volatile market
 - Suggestion: incorporate sentiment analysis in current machine learning models

4. Results



Spot Hourly	B&H	SMA	Random Forrestr(RF)	Risk+RF	DNN	Risk+DNN
ROI	8.17%	20.62%	66.57%	34.18%	73.95%	11.04%
Sortino	0.704	1.170	1.139	1.598	1.169	2.399



Future Daily	B&H	SMA	Random Forrestr(RF)	Risk+RF	DNN	Risk+DNN
ROI	8.69%	-43.55%	39.45%	15.58%	46.80%	14.52%
Sortino	0.697	-1.723	1.219	2.058	1.197	1.872

ROI of Strategies with Spot Data

Crypto	Frequencies	B&H	SMA	RF	DNN
Bitcoin	Daily	8.6%	-27.5%	58.8%	32.3%
	Hourly	8.2%	19.6%	63.2%	73.95%
Ethereum	Daily	21.4%	-40%	101.3%	35.2%
	Hourly	23.5%	3.7%	107.7%	80.4%
Binance	Daily	21.4%	-15.6%	2.3%	34.1%
	Hourly	19.7%	10%	96.4%	147.85%

ROI of Strategies with Futures Data

Crypto	Frequencies	B&H	SMA	RF	DNN
Bitcoin	Daily	8.7%	-43.55%	39.5%	46.8%
	Hourly	5.95%	20.3%	54.8%	1.27%
Ethereum	Daily	21.3%	-34.4%	125%	129%
	Hourly	26.4%	28.5%	209.2%	26.02%
Binance	Daily	19.8%	-2.7%	-63.8%	-16.19%
	Hourly	13.3%	-42.8%	13.8%	50.9%

*Date Source: Hourly Binance /Daily Yahoo / Data Periods: 2022 July 4th-2023 Feb.28th