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

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 yahoo. & Binance API **.**♦ BINANCE Prediction &Out Sample **Random Forest Risk Management**

• Technical Indicators:

Bollinger Bands

Price Volatility

hyperparameters

n_estimators

Max_depth

Parameters Example:

Min_samples_split

Min samples leaf

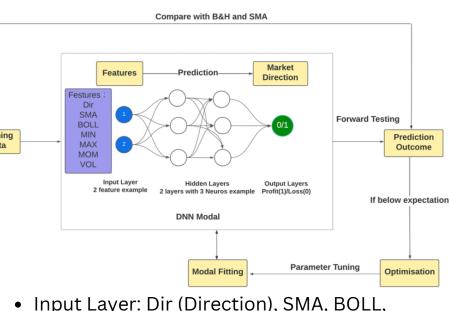
Relative Strength Index (RSI)

Stochastic Oscillator

• Grid Search to find the optimal

Commodity Channel Index (CCI)

Deep Neural Network



- Input Layer: Dir (Direction), SMA, BOLL, Min (Lowest Price), Max (Highest Price), Mom (Rate of Change of Prices), and Vol
- Hidden Layers:
- Number of Hidden Layers (hl)
- Number of units per hidden layer (hu)Rectified Linear Unit (ReLU)
- Output Layer: Predicts the direction as
- Sigmoid activation function Training
- Binary cross-entropy loss (Loss
- Adam Optimizer (Keras Lib)

4. Results

Bitcoin Spot Hourly Performance



Spot Hourly	B&H	SMA	Random Forrest(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

Bitcoin Futures Daily Performance

Stop Loss & Take Profit:

cryptocurrency

• Stop Loss: when the price

drops down and returns below

goes up and the return exceeds

the take profit threshold, apply

the stop loss threshold, apply

Stop Loss to sell the on held

• Take Profit: when the price

to Take Profit to sell the on

held cryptocurrency



Aug	Sep	Oct	NOV	Dec	วดวง	Feb
Future Daily	В&Н	SMA	Random Forrest(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	В&Н	SMA	RF	DNN
Bitcoin	Daily	8.6%	-27.5%	58.8%	32.3%
21100111	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	В&Н	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

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

