MACHINE LEARNING-BASED ANALYSIS OF CRYPTOCURRENCY MARKET FINANCIAL RISK MANAGEMENT

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CRYPTOCURRENCY

Cryptocurrency, also referred to as crypto-currency or crypto, is any virtual or digital money that employs cryptography to safeguard transactions. Cryptocurrencies use a decentralized mechanism to record transactions and issue new units instead of a central body issuing or controlling them.

RISKS

- Selecting a bitcoin exchange based on the entity that maintains the account has no control over transactions and is overbalanced.
- The entity's cryptocurrency wallet does not have an account.
- Losing the private key prevents access to cryptocurrencies.
- The entire cryptocurrency is stolen if the private key is obtained by an unauthorized person.
- Falsifying the entity's private key.

RISKS

- Sending erroneous addresses from entities that cryptocurrency cannot recover.
- Because of cryptocurrency transactions being anonymous on the blockchain, they are recorded from entities that cannot be identified.
- The cryptocurrency has a transaction delay at the conclusion of the term.
- Recording conditions and events for financial purposes becomes more challenging.

SOLUTIONS

1. Employing machine learning techniques to determine the cryptocurrency portfolio's Hierarchical Risk Parity.

2. The suggested system can assess professional accounting by taking into account the impact that is anticipated from financial statements and the risk associated with cryptocurrencies.

3. Identifying the intrinsic risk in cryptocurrencies that has a negative correlation.

4. Based on the likelihood assessment, rank the exchange level control risk.

5. Figuring out the cryptocurrency's highest likelihood risk.

STEP 1

Clustering

Applying the Hierarchical Tree Clustering algorithm to start grouping the assets into different clusters. Following equation converts the correlation matrix between two assets of x and y to the correlation distance matrix A.

Equation

$$A(x,y) = \sqrt{0.5 * (1 - \rho(x,y))}$$

STEP 2

Recursive bisection

Here in the evaluation between each pairwise manner column it uses the Euclidean distance process to provide the augmentation matrix distance A^, as shown by the following equation.

Equation

$$\hat{A}(x,y) = \sqrt{\sum_{m=1}^{i}(A(m,x) - A(m,y))^2}$$

The clusters were produced from the previous equation by applying the recursive method. Now designating the first cluster as (x*,y*), evaluated as the set of clusters as C we get-

Equation

$$C[1] = argmin_{x,y}\hat{A}(x,y)$$

STEP 3

Quasi-diagonalization

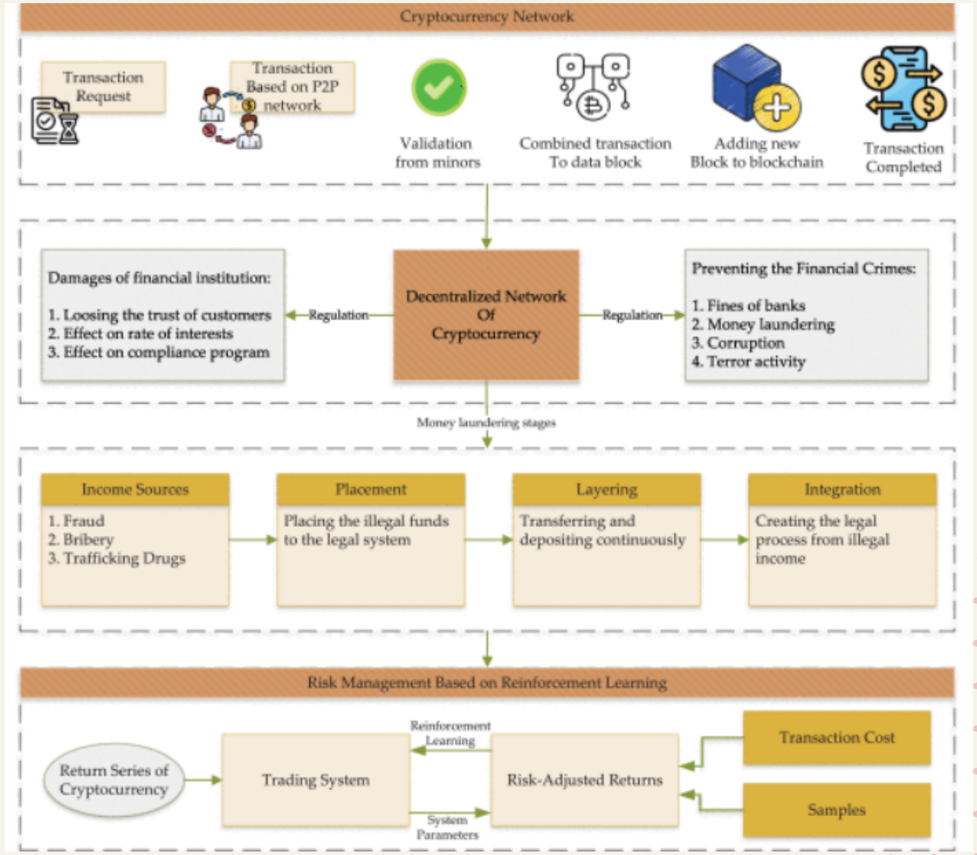
All assets utilize the C[I] single clustering linkage, and the defined distance matrix updates the A^ evaluation process accordingly. This equation evaluates the distance of the new cluster for each asset x that is removed from the cluster.

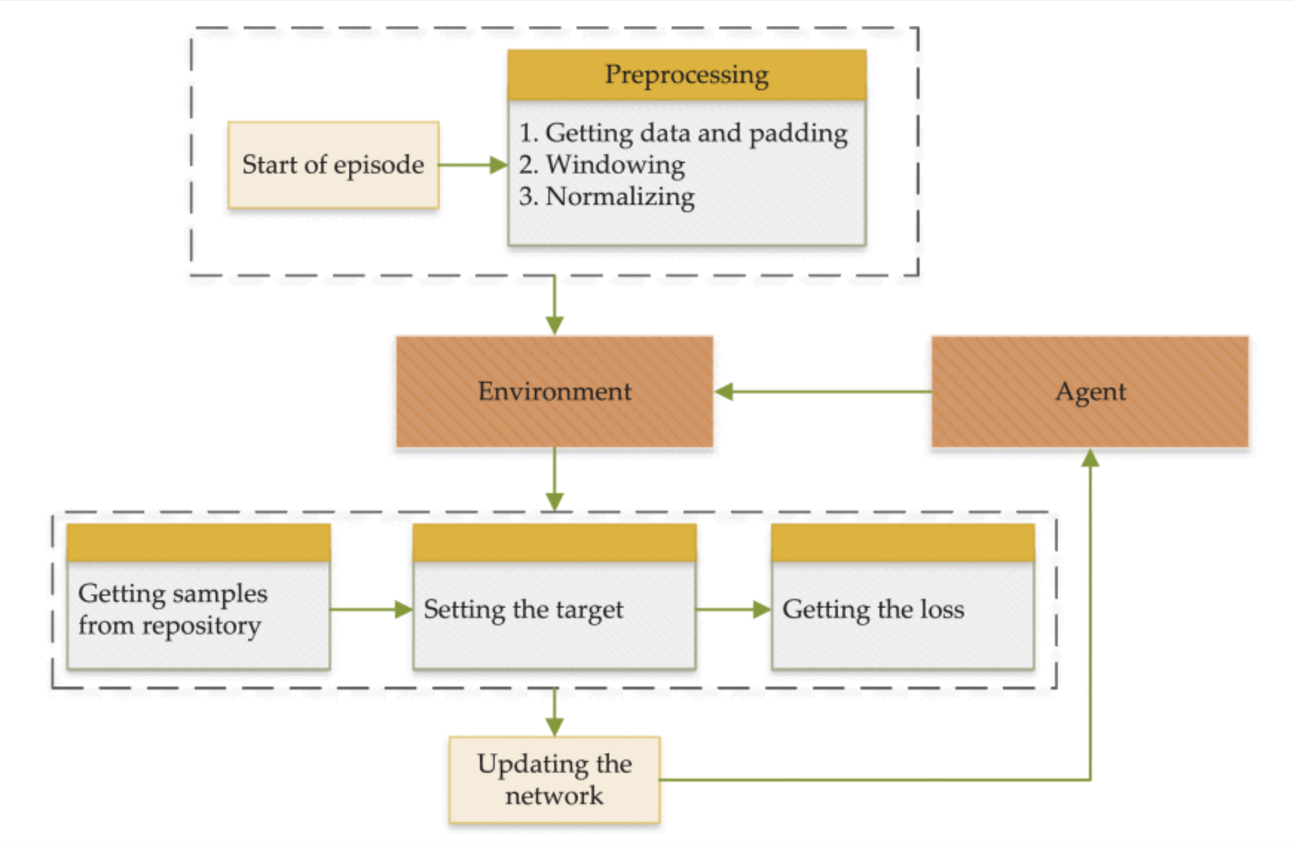
Equation

$$\hat{A}(x, C[1]) = min(\hat{A}(x, x^*), \hat{A}(x, j^*))$$

RISK MANAGEMENT SYSTEM

Cryptocurrency network details containing the request for transaction that process into the P2P network.





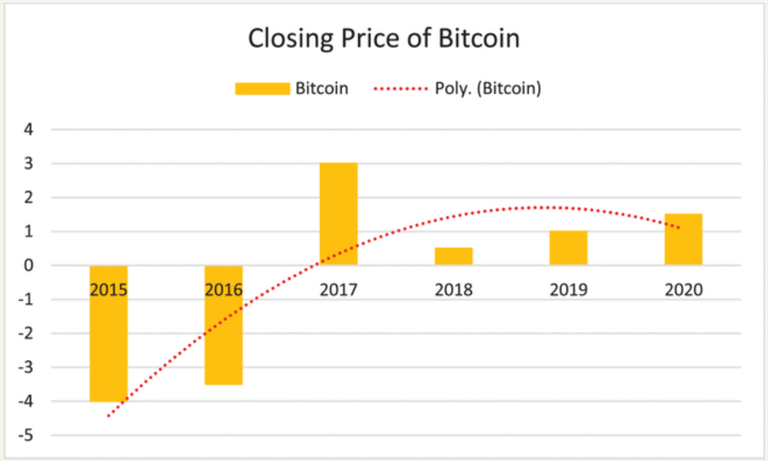
Reinforcement Learning-Based Risk Management

DATA

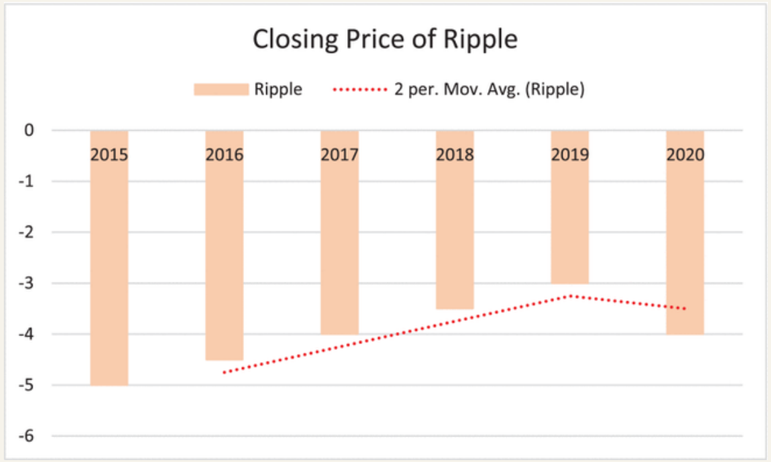
Dataset Information

#	Mean	Min	Max
Block	0.0012	-0.4715	1.7762
Dash	0.0027	-0.2048	0.4381
Burst	0.0042	-0.2705	1.4078
GRS	0.0120	-0.3057	1.4043
NAV	0.0117	-0.6686	5.6764
PND	0.0702	-0.7811	6.0000
RDD	0.0114	-0.6780	2.2124
TRC	0.0102	-0.7880	13.0000
VTC	0.0056	-0.3385	1.3042
XRP	0.0028	-0.3500	1.6826

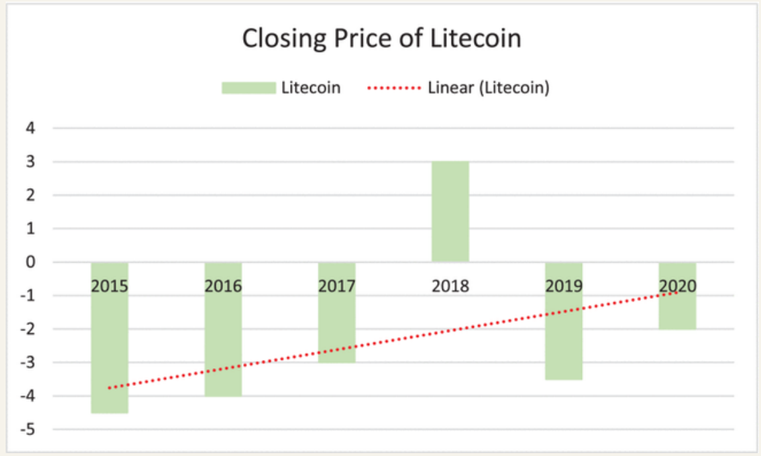
EXPANSION IN 2016 AND 2017, WHICH COMES AFTER A PRECIPITOUS DROP IN 2018 WITH RELATION TO ASIA REGULATION AND EVERYWHERE



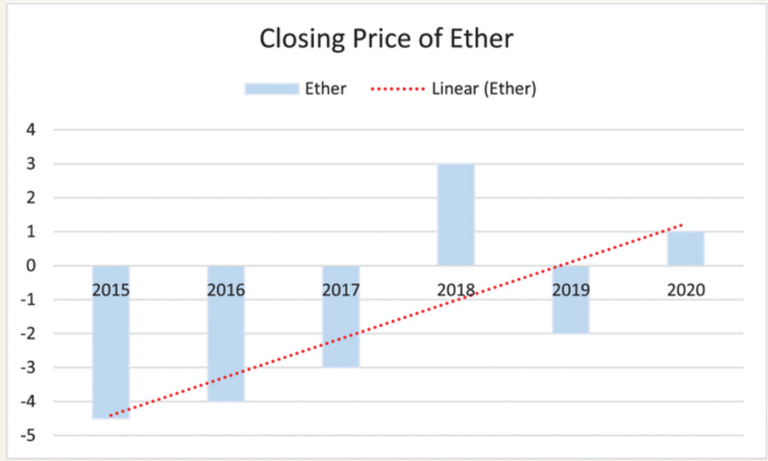
Cryptocurrency closing price of Bitcoin



Cryptocurrency closing price of Ripple



Cryptocurrency closing price of Litecoin



Cryptocurrency closing price of Ether

RESULTS ANALYSIS

Co-variance matrix sample					Co-variance matrix shrinkage			
#	HRP	IV	MV	MD	HRP	IV	MV	MD
Panel A : Window = 350								
Annualized return	1.7802	1.5411	1.2417	3.4232	1.3167	1.5411	1.2414	2.3535
Annualized volatility	0.7718	0.7668	1.3345	1.7562	0.8704	0.7668	1.0501	1.4338
Risk value (10%)	0.0087	0.0004	0.0032	0.0120	0.0124	0.0004	0.0010	0.0035
Conditional risk value (10%)	0.0018	0.0011	0.0004	0.0018	0.0038	0.0011	0.0003	0.0018
Draw down	0.2161	0.2430	0.6058	0.7348	0.2716	0.2430	0.4711	0.6171
Max draw down	0.3324	0.3278	0.6644	0.7723	0.5041	0.3287	0.5811	0.6806
Sharp ratio	0.1605	0.1470	0.0741	0.0717	0.1714	0.0470	0.1050	0.1063
Calmar ratio	5.4074	5.0312	2.0215	4.1214	5.5226	5.0312	2.2872	3.2650
Sortino ratio	0.0061	0.0055	0.0057	0.0110	0.0080	0.0055	0.0052	0.0081

Risk Performance Portfolio Return =350

Co-variance matrix sample					Co-variance matrix shrinkage			
#	HRP	IV	MV	MD	HRP	IV	MV	MD
Panel A : Window = 600								
Annualized return	1.8728	1.6564	1.1151	3.6573	2.3268	1.6564	1.2000	2.5487
Annualized volatility	0.8200	0.8184	0.8633	1.6037	1.0208	0.8184	0.7373	1.4202
Risk value (10%)	0.0164	0.0171	0.0150	0.0118	0.0028	0.0171	0.0158	0.0114
Conditional risk value (10%)	0.0121	0.0171	0.0150	0.0118	0.0028	0.0171	0.0158	0.0114
Draw down	0.2161	0.2428	0.3833	0.7158	0.2716	0.2628	0.1746	0.5772
Max draw down	0.3324	0.3278	05023	0.7500	0.4041	0.3278	0.3140	0.6613
Sharp ratio	0.1566	0.1447	0.1184	0.0547	0.1633	0.3278	0.1252	0.0140
Calmar ratio	5.6164	5.2040	2.5182	4.4260	5.5618	5.2040	4.1871	3.6333
Sortino ratio	0.0066	0.0061	0.0055	0.0120	0.0073	0.0061	0.0050	0.0087

Risk Performance Portfolio Return =600

Co-variance matrix sample					Co-variance matrix shrinkage			
#	HRP	IV	MV	MD	HRP	IV	MV	MD
Panel A : Window = 850								
Annualized return	1.8626	1.7656	1.1050	4.4316	2.3220	1.7656	1.6566	2.8160
Annualized volatility	0.8721	1.0010	0.8031	1.6817	1.0626	1.0010	1.1066	0.5563
Risk value (10%)	0.0540	0.0485	0.0703	0.0682	0.0435	0.0485	0.0573	0.0605
Conditional risk value (10%)	0.0066	0.0050	0.0037	0.0084	0.0051	0.0050	0.0046	0.0063
Draw down	0.2161	0.2428	0.2102	0.7058	0.2706	0.2428	0.4284	0.5673
Max draw down	0.3048	0.3278	0.3681	0.8414	0.3618	0.2428	0.4284	0.5673
Sharp ratio	0.1482	0.1403	0.1157	0.1028	0.1563	0.1403	0.1180	0.1122
Calmar ratio	6.2135	5.4426	3.5133	5.4013	6.2640	5.4426	3.1515	4.1337
Sortino ratio	0.0068	0.0065	0.0056	0.0142	0.0076	0.0064	0.0065	0.0105

Risk Performance Portfolio Return =850

RISK MANAGEMENT IMPLICATION

#		Portfolio	Risk-min Portfolio	Determined Portfolio
Ether	Re Red.	0.36147	0.01604	0.18276
	SV Red.	0.11214	0.00062	0.02242
	ES Red.	-1.1343	-0.10155	-1.1678
	VaR Red.	0.03360	0.03481	0.01032
	Risk Red.	0.88681	1.726E-04	0.88072
Litecoin	Re Red.	0.30877	0.01345	0.17277
	SV Red.	0.06648	0.00048	0.01712
	ES Red.	-1.4214	-0.00340	-1.1617
	VaR Red.	0.03267	0.03267	0.01738
	Risk Red.	0.88406	0.01338	0.88120
Monero	Re Red.	0.15474	0.01345	0.17360
	SV Red.	0.02642	0.00045	0.01037
	ES Red.	-1.44440	-0.07701	-1.1527
	VaR Red.	0.01570	0.03505	0.01644
	Risk Red.	0.88474	0.003718	0.87813
Ripple	Re Red.	0.13604	0.01433	0.13105
	SV Red.	0.02828	0.00045	0.01832
	ES Red.	-1.60810	-0.07886	-1.3374
	VaR Red.	0.01338	0.03232	0.02005
	Risk Red.	0.88101	0.01650	0.88208
Dash	Re Red.	0.20472	0.01671	0.08772
	SV Red.	0.07440	0.00060	0.00822
	ES Red.	-1.2055	-0.10151	-0.28641
	VaR Red.	0.01715	0.03543	0.03114
	Risk Red.	0.87746	0.00033	0.81262

Cryptocurrency Portfolios Risk Evaluation

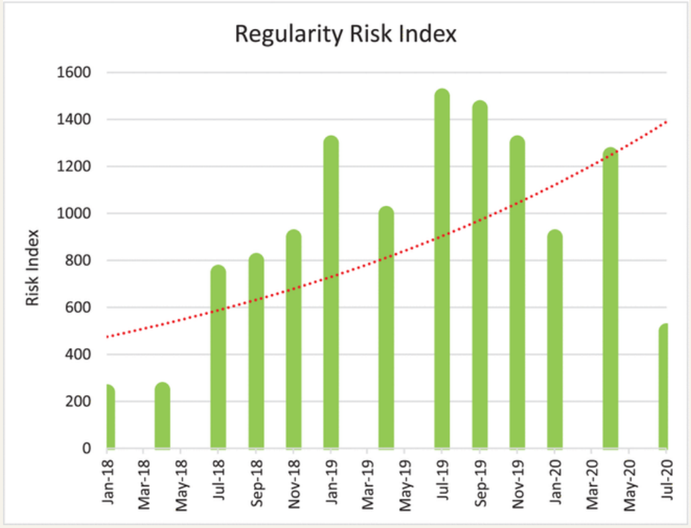
#		Portfolio	Risk-min Portfolio	Determined Portfolio
Ether	Re Red.	1.28061	1.87070	2.40800
	SV Red.	1.80370	1.10246	5.30463
	ES Red.	-5.0316	-4.1045	-8.2243
	VaR Red.	0.01623	0.01511	0.01735
	Risk Red.	0.50242	0.25081	0.80183
Litecoin	Re Red.	1.20528	1.51362	3.00627
	SV Red.	1.11537	0.40111	3.15825
	ES Red.	-4.1370	-2.5324	-9.010
	VaR Red.	0.03062	0.02683	0.03074
	Risk Red.	0.25147	0.18600	0.71374
Monero	Re Red.	3.40470	1.78403	1.57681
	SV Red.	1.14130	0.056533	0.10732
	ES Red.	-30.851	-3.1866	-9.860
	VaR Red.	0.01116	0.03353	0.02460
	Risk Red.	0.84375	0.03722	0.55654
Ripple	Re Red.	1.48004	1.64376	3.68558
	SV Red.	1.41625	0.50570	5.48850
	ES Red.	-9.136	-4.7730	-11.800
	VaR Red.	0.02516	0.03074	0.02237
	Risk Red.	0.37526	0.12837	0.77280
Dash	Re Red.	1.55502	1.88101	1.115265
	SV Red.	1.57531	0.73011	1.60248
	ES Red.	-5.0815	-3.5858	-5.4536
	VaR Red.	0.03743	0.03241	0.02516
	Risk Red.	0.46056	0.13176	0.52801

Cryptocurrency Portfolios Risk Evaluation for 30 Days

PERFORMANCE EVALUATION OF THE PROPOSED RISK MANAGEMENT

Layer Name	Profit	SR	MDD
PAMR [47]	9.7058	0.0138	0.4789
UBAH [48]	5.1587	0.0132	0.6332
Basic DQN [49]	7.3628	0.0132	0.4321
UCRP [50]	6.3277	0.0153	0.4277
EG [51]	0.7552	0.0207	0.4401
Proposed RL	20.8785	0.0142	0.2750

Performance Comparison of the Cryptocurrency Portfolios



Risk index regularity in cryptocurrency market

High risk management portfolio based on RL

THANK YOU

Source :
https://ieeexplore.ieee.org/document/9743945