Multidimensional Parity Algorithms to Escalate the Security of Intelligent Mobile Models in Education

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Abstract—The traditional multiple reserves and resounding costs of increase of the corporal volume can be replaced by a distributed file model of divided data employing algorithms, multidimensional integrity, and resilience to complete losses of the storage facilities. The model's created duplicated data enables you to recover some of the split components' lost functionality. A rapid shift in the appraisal and application of knowledge is also required by increasing information and communication technologies. As a result, modern learning methodologies, approaches, and technologies are being developed. This paper describes how to build an automated instructional and analytical complex using semantic information. It has been established what is needed for such an educational and technological complex. Tools built on a semantic network are represented in formal and structural models. Since it was created using a thorough understanding of the topic, the model is intended to facilitate students' perception of the many educational and technical complexities and to enhance the teacher's work.

Keywords—educational process, semantic network, intelligent model, security, multidimensional parity

1 Introduction

Replication (many redundancies) is currently a common way to store data, but efforts are still being made to find new ways to ensure IT security. Replication results in an increase in equipment, power use, and consequently, expenses due to the on-going growth in the amount of material. Operational information restoration might help you attempt to reduce the cost of backup files (error correction). The authors of this study specifically looked at the viability of maintaining files in split state in database systems, where files are split and recovered using specialised multidimensional parity methods that can withstand a gradual loss of storage space. The system's interface is built using existing technologies, and it combines interactive

Java technology with the straightforward hypertext link protocol HTTP (WEB 2.0). The web component uses CMS Word Press as its default content administration system. On a dedicated server owned by PS Internet Company LLP, the website is run using the Apache 1.6.c PHP 7.6 web hosting with the operating system Linux Ubuntu Enterprise. The webserver of choice is MySQL 6.0[1].

Due to secret techniques, duplicate data is produced, enabling the recovery of certain lost split pieces. Since the divided data carries no relevant information, it can be kept wherever without worrying about illegal access. Without understanding the splitting mechanism, it is difficult to recover the information even after gathering all of the split data's components. Only the data owner or author gets access to the information because the splitting algorithm can employ an endless amount of dividing techniques. The restoration of the data is done simultaneously, albeit at the cost of parity files generated by the splitter approach, which focuses primarily on computing bitwise parity with summation mod "two." You can restore a corrupted (missing) file without distorting it by adding the missing file to the original files using this procedure.

The adoption of new technologies that change the educational process to allow for effective learning is the logical basis for the use of information and technology in education. The method of knowledge evaluation and application must be changed as soon as possible to accommodate the advancement of information and communication technology. The technology, methodologies, and approaches employed in education are being updated in this area. The utilization of active, practice-based teaching methods is a crucial component of a modern educational system. It is incomprehensible without computer media National pedagogical science is becoming more popular as a result of the issue of the overuse of digital technology in education during the past ten years. Modern means and structures of sharing information, opportunities for the exchange of information, gathering, manufacturing, build-up, stockpiling, handling, transmission, and access to information resources on computer networks are all features of information and communication technologies. These include microprocessors, equipment, and software solutions computer-based innovations (including global ones) [2]. In below Figure 1 the performance of the dimensional parity checker is illustrated.

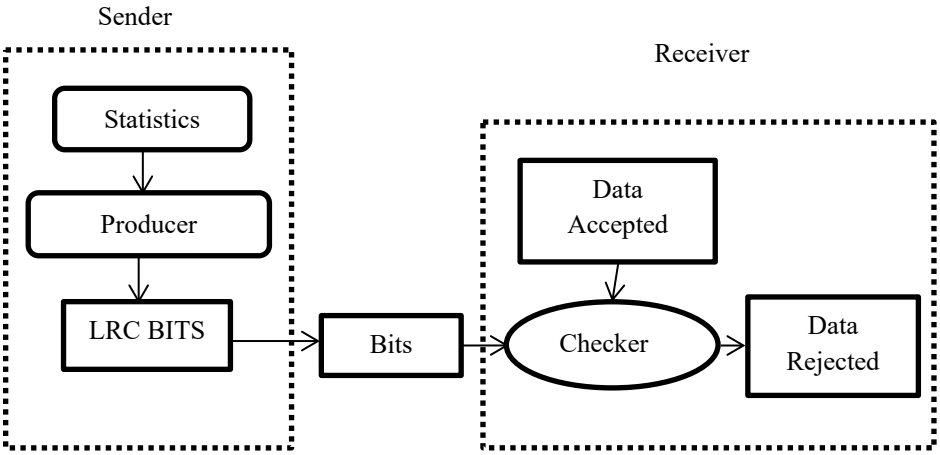

Fig. 1. Performance of dimensional parity checker

Nowadays, there is a significant development in the field of science that deals with the automatic generation of word net. A semantically network is a crucial tool for knowledge field display. The two main important aspects in the use of semantics are the efficiency of data search and the speed at which information may be used for management decisions. As the "semantic network" concept is presented and used practically via new technologies, the meaning internet is still relevant today. Presently, the semantics system is discussed in a wide variety of scholarly literature.

Three main phases make up the inferential data idea:

- thoughts on learning, both as a concept and in connection to one another;
- a chart with tabs, lines, points, and signs is a schematic;
- Utilizing algorithms that operate on these notions, it is possible to derive and get to logical end using computers graphics and databases. A diagram of the semantics can be seen.

The following sections of the essay are arranged as follows. The research on the pertinent earlier work is presented in Section 2. The characteristics of the proposed system, such as the proposed system architecture, implementation model, elements of the graph-based technique, and data analysis, are described in Section 3. In Section 4, the system's efficacy is evaluated and the implementation environment is explained. The solution is presented in Section 5.

2 Related works

Awwad, A. M. A et.al [3] Computers (PCs) have seen a significant shift to smartphones since the introduction of mobile platforms. The number of individuals using wearable and mobile devices has quickly risen in recent years. Statistics data

from September 2020 indicates that there were 6.95 billion mobile subscribers globally. Predictions indicate that this figure would likely rise to 7.1 billion by 2021. Globally speaking, 7.41 billion phone devices are anticipated by 2024. People utilize wearable and mobile technology at an unusually high rate today. Daily tasks like making phone calls, sending texts, utilizing the web, and using various apps are all part of how they interact with their gadgets.

Karipzhanova, A., Sagindykov, K et.al [4] Redundancy is virtually at the theoretical maximum, and the PC approach efficiently increases the overall amount of data stored. Because the algorithm employs complicated computations and discuss due to the method's resource-intensive nature, the storage system's latency may frequently dramatically increase. Due to the threshold-based high availability of the PC, where even a minor excess leads in a complete collapse of the entire storage, access to modern disc space has a high failure rate, which increases the risk of data loss at even the smallest inadvertent outstrips of the failed barrier.

Hutchinson, A., & Karabina et.al [5] unless otherwise specified, when we refer to a "matrices," we always mean a state matrix. We shall never take into consideration matrices of different sizes at the same time; all state matrices addressed in this study will have a common size of (d + 1) d for some dimension d. The majority of the matrices we consider have non-negative values. We will be interested in pairs of state matrices with unique features, which we briefly explain in Proposition. We start by listing a few essential conclusions that were established. The group variant of the method can perform these operations simply using the encoding specified in definition without explicitly building the matrix series.

El Hadraoui, H., Zegrari, M., Hammouch et.al [6] Complex processes have behaviour that is difficult to relationships, conflicts, linkages, or other types of interactions between its component elements, or between a specific system and its surroundings, in a model. As a result of these connections, complex systems display a range of characteristics, such as highly nonlinear behaviour, growth, indeterminate structure, tolerances, and interaction processes. In the context of digital modelling, MBSE is superior to document-based systems engineering because it offers benefits that manuscript system analysis does not. To define the system's design from many stakeholder views, such as system behaviour, programming, equipment, privacy, health, or even other viewpoints, many documents are produced in a document-based manner by multiple writers.

Ishteyaq, I., & Muzaffar et.al [7] with the emergence of the Internet of things shortly, there will inevitably be a demand for extremely high levels of connectivity for wireless systems. High dependability, minimal transmission complexity, extremely low energy consumption, reduced latency, and other characteristics are what define the constantly growing demand for higher machine-to-machine device connection. It is expected that Mobile operators will need to be built to be more internet backbone, more scalable, and primarily focused on apps that involve people in order to address these concerns.

Zhou, S., Jadoon, W., & Shuja et.al [8] the suggested technique consumes less system energy than the other four algorithms, according to simulated findings for various user counts. A reduction in consumption implies that the system is gaining

more energy as a result of the additional channels for energy transfer; additionally, the advantage of the method over the methods is due to the absence of channel interference restrictions, which allows for greater signal strength in the send energy channel and greater energy gain. Additionally, as the amount of mobile devices rises, the system energy performance of some other algorithms begins to decline, whereas the algorithm suggested in this chapter experiences only a minor decline in performance due in part to the accessibility of redundant channels for energy transmission that are unaffected by the transmission power limit and the splitting ratio's attenuating effects on energy reception.

Xiao, Y., Xiong, L., Fan, L., & Goryczka et.al [9] A multidimensional distribution on a collection of attributes is created for differentially private data release by dividing the pieces of data into mutually exclusive subsets known as containers or divisions. Following that, for each bucket, the counts or frequencies are displayed. Every entry to the source database must pass via the differentially private interface in order to maintain differential privacy. Once questions concerning random count and other types of inquiries have been asked, the histogram can be used to provide an answer. The usefulness of the published histogram to generic counting queries will be heavily influenced by the partitioning approach. The differential privacy interface puts a bounded Laplace distortion or fluctuation error into each division. The fluctuation error is pooled if the query predicate includes more than one partition.

Xiao, Y., Xiong, L., & Yuan et.al [10] Privacy is becoming a more crucial concern as information technology makes it possible to gather, store, and use vast amounts and types of information about people and organisations. Governments and organisations are aware of how important it is to share this information while yet protecting people's privacy. Recent years have seen a lot of interest in privacy-preserving data analysis and publishing as a viable strategy for information sharing without compromising data privacy. There are several privacy models. The two models, one interactive and the other not. In the interactive model, a trustworthy custodian, like as a hospital, collects data from record owners, such as patients, and provides an authentication system for data users, such as public health researchers, to execute queries or analysis. The outcome of the access mechanism is hampered by the privacy protection system. The curator publishes a "scrubbed" version of the data via the non-interactive method, protecting the privacy of the people whose identities are represented in the data while also offering usefulness for data users. A differentially private histogram of the unprocessed database is generated by a partitioning plan implementation algorithm by sending a series of queries to the interface. By serving as a cleaned-up summary of the raw database and including an optional synthesis file, the histogram can subsequently be utilised to support count searches, other types of approaches, and cooperative learning.

Amstadter, A. B., Moscati, A., Maes et.al [11] the relationship between our operationally defined concept of resilience and more theoretically determined ostensibly protective (or risk-associated) qualities needed to be explored. Resilience is most likely to be influenced by personality traits that have to do with controlling and regulating one's mental and emotional state. Despite the negative emotions and

thoughts that these encounters frequently elicit, psychological equilibrium must be maintained in order to be resilient to bad situations.

3 Methods and materials

The social imperative to raise educational standards and the practical need for deploying cutting-edge computer software in educational settings are what drive the need for information technology in education. Moving away from passive methods of presenting and conveying knowledge in favour of dynamic group and personal work methods, student management, and studies is the aim of improving the educational process.

3.1 Dual dimension parity

Multidimensional erasure codes are a general term for the different code that corrects mistakes techniques. We have developed an easy-to-use procedure that is not source of energy, reliable, equal to PC dependability, and devoid of PC flaws. Although this case's reliability is more than that of a PC, it is still significantly lower than when duplication is used. Create four pieces of equal size from the original information. Let's put some building bricks in a 2x2 matrix. Add a blank row at the bottom and a blank column on the right to the original matrix to make it 3x3. Following the computation of the checksum for the columns and rows, the conclusions will be entered in the empty area [4].

$$\begin{bmatrix} f0_0 & f1_0 \\ f1_0 & f1_1 \end{bmatrix} \rightarrow \begin{bmatrix} f0_0 & f1_0 \\ f1_1 & f1_0 \end{bmatrix} \tag{1}$$

The generated matrix now gives you two options for recovering any data loss: both column and row. The Multidimensional parity-check code's two-dimensional parity is demonstrated by the resultant matrices. Let's finish the matrices by computing:

$$f_{20} \emptyset f_{21} = f_{22} and f_{02} \emptyset f_{12} = f_{22}, \tag{2}$$

Where ∅ implements bitwise addition module 1 and signifies the XOR function. Substantiate that$f_{22} = f_{22}$. If the parity values are expanded and the commutatively of the XOR operation is taken into consideration:

$$f_{20} \emptyset f_{21} = (f_{00} \emptyset f_{10}) \emptyset (f_{01} \emptyset f_{11}) = f_{22} \tag{3}$$

$$f_{02} \emptyset f_{12} - (f_{00} \emptyset f_{01}) \emptyset (f_{10} \emptyset f_{11}) \tag{4}$$

$$(f_{00} \emptyset f_{10}) \emptyset (f_{01} \emptyset f_{11}) = f_{22} \text{ get } f_{22} = f_{22} \tag{5}$$

By applying the XOR method between neighbouring data pairs to produce a 2*2 multiple matrix, all of the data in the rows and columns are connected to one another. It is feasible to obtain each By using a Binary operation on both rows and columns, you may split up each block of data into two different groups. It is possible to

understand this double parity on both y and x coordinates that these interactions reflect. The data can be split up into 16 identical blocks of the same size, and a dual matrix can be created by producing collection of interrelated at the three coordinates y, x, and z with blocks of data related to one another by three parameters:

$$\int f_{i,j,k} = f_{i+3,j\emptyset j-1,l,k} \tag{6}$$

$$\int f_{l,k,m} = f_{l+3,j\emptyset f_{j}-1,j,k} where(l,k,m) \tag{7}$$

$$\int f_{l,k,m} = f_{i+2,j\emptyset j-2,j,k-1} \bmod 3=\{1,2,3\} \tag{8}$$

The dual matrix is made up of successively arranged sets of three planes of these double matrices, just as the aforementioned two-dimensional matrix is made up of one-dimensional matrices. The determined parity information of the upper two planes is used to create the final matrices, which is a plane with the position f = 2. In general, a data block is considered to be symmetrical if any index value is identical to 3. As a result, we have the cubic 3*3*3, which has three border planes made up the information, equality, and are one of the index values equal to 2, as well as the original data, block indexes that are 1 or 2, and the actual data for the frame's block. The real and complicated versions of the multidimensional Gamma function for arbitrary must be defined first before moving on [13]. The flowchart of two-dimensional parity flow is represented in Figure 2.

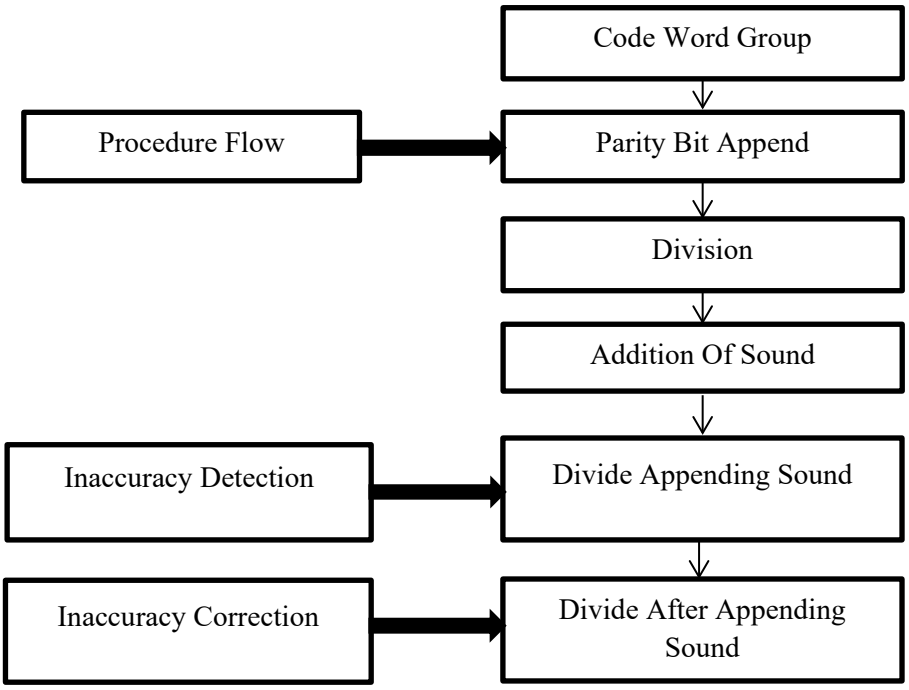

Fig. 2. Two-dimensional parity flow flowchart

3.2 Multidimensional reporting's fundamental characteristics

We've already seen how multimodal isosmotic extrapolation can be helpful in practice. An explanation of the topic's goal is provided after each suggestion [12].

- **Number of methods for recovering lost data blocks:** The primary characteristic of the single-dimensional parity vector in n-dimensional space is using the two remaining flips into passes in each of the n directions; one block's loss can be recovered.
- **Enhancing the simultaneous growth's measurement:** As the dimensionality grows, more recovery possibilities become available when "lost" should this file suffer a potentially fatal loss, data on any of the positions can be retrieved using other files before continuing with the necessary file recovery.
- **Combinations of data loss-causing storage issues:** The sum of all n by k permutations is the sum of all conceivable n by k combinations. If the failed shelf space dimensions are placed at couple fatalities are produced laterally the crossing values of records at the vertex of the two-dimensional matrices, there are no chain restoration alternatives for the loss of blocks.

Method 1: New multidimensional Encoding

INPUT: Odd integers α1,...,αd ∈ [1, 2], points P1,...,Pd ∈ G, G abelian [5]

OUTPUT: A permutation on 2,..., d with a binary sequence r of length d bits

1. With an additional leading 0, let B[i] be the binary representation of i.
2. $\partial \leftarrow [e-j; j=1.,,,(e-1)]$
3. $S \leftarrow []$
4. $do\ for\ L\ =\ 1\ down\ to\ 1$
5. $L \leftarrow [1], S_t \leftarrow []$
6. For j=2 to l do
7. $L[j] \leftarrow (A[j][l] + C[j][l+1]) mod 1$
8. End
9. $g \leftarrow 1$
10. For j=2 to l do
11. $s_t[j] \leftarrow l[\partial[j]]$
12. $g \leftarrow g = s_t[j]$
13. End
14. $S \leftarrow \frac{s_t}{s}$
15. $m \leftarrow [1], d_0 \leftarrow 1, d_1 \leftarrow 2$
16. For j=2 to l do
17. $V_0 \leftarrow (1 - s_t[j]), d_0 \leftarrow 1, d_1 \leftarrow 2 + V_0$
18. $V_1 \leftarrow (s_t[j]), d_1 \leftarrow 2 + V_0$
19. $rgn \leftarrow \big(2 - 2sr(j)\big)$
20. $M[l + rgn.(V_0.d_0.V_1.[d_1 - 1])$

```
21. end
22. ∂ ← M
23. End
24. Return s,φ
```

3.3 Motivation, goals, and general strategy

The proposed versatile educational test bench has the following specific aims: to provide a personalised learning encounter when it comes to discovering the aspects of electronic vehicles and increase interest in this field. Additionally, it offers innovative approaches to automotive technical education and serves as a complement to theoretical and conceptual learning. It should be mentioned that several developments in the field of electric vehicle diagnosing have already been published in which described created a data-driven methodology based on the most common electric motor seen in electric cars electronic current measurements from the electric engine[6].

One of the project's outcomes was the creation of new, better training manuals that focused on the most recent developments in vehicle technology. Engineering students are introduced to contemporary EV components through this project, including propulsion motors, power conditioning, sensors, and control equipment, high capacity, live electrical battery, and communications systems from a technological perspective. Along with that, the project concentrates on designing novel control strategies, prognosis methods, and power management techniques. The need for smart phones with effective antennas is rising as a result of the rising push for higher data rates, especially at a time when there is a lack of bandwidth in the available spectrum [7].

The following are the anticipated goals this work seeks to accomplish:

- Giving traceability and creating the requirement gathering.
- Frame various model views according to SysML language.
- Utilizing the MBSE architecture to provide real-time sharing and collaboration of the model's properties.
- Using Arena to analyse various model architectures
- evaluating the improved architectures statistically

The target group for the testing project includes current, digital, and mechatronics undergraduate and graduate students as well as researchers and PhD candidates. A possible teaching approach with three different learning levels is shown in Figure 3.

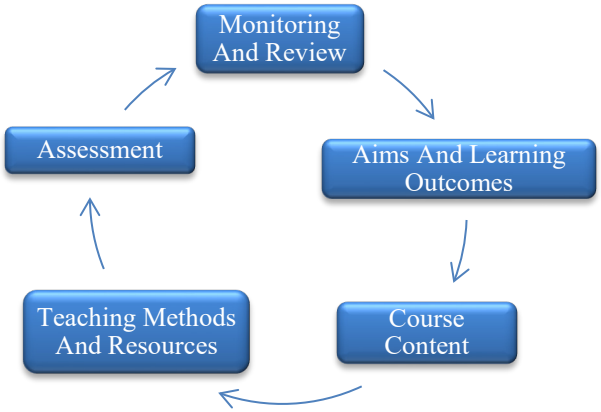

Fig. 3. The educational system's levels of learning

4 Implementation and experimental results

Multidimensional error detection codes are a general term for the different code that corrects mistakes techniques. We have developed a simple technique that is not useful, reliable, comparable to PC reliability, and devoid of PC flaws. Although this case's redundancy is more than that of a PC, it is still significantly lower than when duplication is used.

Basic Parity: The parity is established after splitting the information into two equal-sized blocks:

Which encapsulates the XOR and binary arithmetic additions mod 2 operations? Be careful that due to the stats blocks produced by the XOR operation according to its characteristics can recover any missing components. We demonstrate how to, for instance, execute the operation with both sides being equal. We reduce in light of the operation's involution, and the resulting equality is accurate.

- Similarly to that, we utilize the procedure to demonstrate equality
- From this point on, we have a triple of relations, and we may utilize the triple to recover any lost data block:

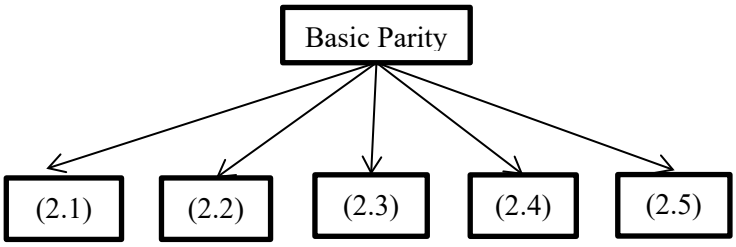

Fig. 4. Basic parities in dimensions

The data that make up the final data triple are connected by parity relations is shown in Figure 4, and they can be visualised as a one- dimensional vector located at position M: Calculated in modulo is 2. This indicates that 1-3=2 and 2+1=0 in the parity formula (2.5).

Parity in two dimensions: Divide the initial set of information into four equal-sized components. In two dimensions, let's visualise the bricks as a 3*3 matrix. Add a bottom row and an additional column to the matrix's right empty column to make it 2*2 [1]. The checksums for the columns and rows will be calculated, and the results will be written in blank spaces. Two dimensions parity is shown in Figure 5.

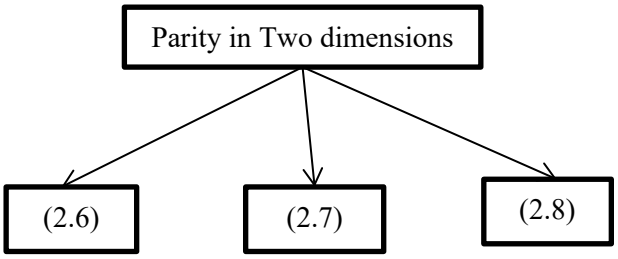

Fig. 5. Parity in Two dimensions

Now that a data matrix has been created, you can restore any loss of data in two separate ways, namely by rows and columns. The subsequent atmosphere shows how the Multidimensional parity-check code is two-dimensional parity. By computing the parity values, let's finish the matrix. We obtain two equalities: and, where, as you may recall, is the bitwise addition mod 2 operation XOR.

As a result, a 2*2 multiple matrixes will be created, connecting all of by using an XOR technique on adjacent data pairs, the information in the columns and rows. By combining the columns and rows in an XOR operation, every data block could be retrieved in one of the 2 directions in this example:

Where the index values—which represent the residue ring—are computed modulo 2. These relationships can be thought of as two-dimensional parity for the one-dimensional vectors of rows and columns in the Y, X coordinates.

Parity in three dimensions: It is depicted in Figure 6. By dividing the data into eight equal blocks and producing parity data on three coordinates, the procedure as described allows you to obtain a multi-matrix:

With data blocks connected by three components already:

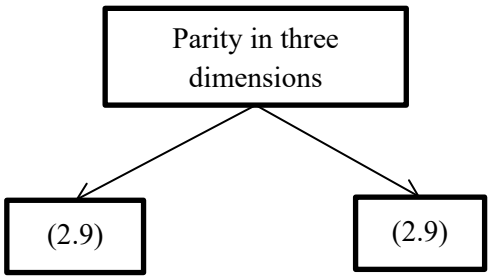

Fig. 6. Parity in three dimensions

The three-dimensional matrix, in turn, is made up of sets of two-dimensional matrices in three dimensions (2.10) organised consecutively below one another, if the surface medium mentioned above is made up of one-dimensional (2.10) elements. The determined parity values of the upper two planes are used to create the plane with z=2 is represented by the third matrix. A symmetry block is often a data block with any index value equal to 2. The original data is consequently translated into a 2x2x2 cube with block indicators of 3 or 4, three border planes where the parity records is situated, and unique index value of 2.

Parity Nth dimensional: The suggested approach of constructing parity blocks and the paradigm of data splitting into blocks may support any n-dimensional parity is represented in Figure 7. In this situation, the data will be initially partitioned into blocks of size n, and after being subjected to the parity generation procedure, we will have 3n blocks, where n is the parity dimension. As a result, parity relations will link the blocks that are created.

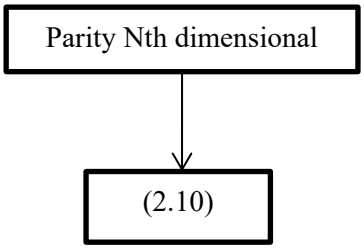

Fig. 7. Parity Nth dimensional

Basic traits of dimensional parity: Increasing the equality factor, there are more possibilities to locate lost data blocks. After regaining the loss of one of the blocks with the aid of the other two, the main characteristic of a single-dimensional integrity vectors in n dimensions is pass control in all n orientations. As dimensionality increases, methods for controlling cross-parity and other chain recovery strategies are likewise becoming more and more available. If other files may be used to recover the "lost" statistics for any of the places (if this file suffers a potentially catastrophic

deletion), with corresponding time of the required file at the next step, further recovery alternatives become available as the dimension grows. While other algorithms' system energy performance begins to decline as the number of connected phones rises, the algorithm suggested in this chapter only experiences a negligible decline in performance, in part because redundant channels are available for energy transmission that are free from the influence of transmission power limits and the dividing ratio's attenuating effects on electricity receiving [8].

The performance comparison of the system for various channel counts is shown in Figure 8. As the number of users rises, the system's energy efficiency naturally declines as a result of the increased in the total equivalent distance of energy transmitted. The released histogram's classification utility is assessed, and it is contrasted with other privacy - preserving classification algorithms [9]. Using best linear unbiased counting queries, we assess the quality of the released histogram, calculate the average absolute search error, and contrast the outcomes with those of alternative algorithms. To determine the average query error, we performed 100 random counting queries using the Age and Income characteristics. Two range conditions on the two characteristics are used in the random searches. In order to compare our results, we also constructed a different multidimensional approach known as hierarchical dirk and another data release algorithm known as consistency check. The average absolute query error with regard to various threshold values is displayed in Figure 9. According to Figure 10, we see that the increased variance within partitions causes the query error to rise with a rising predefined threshold.

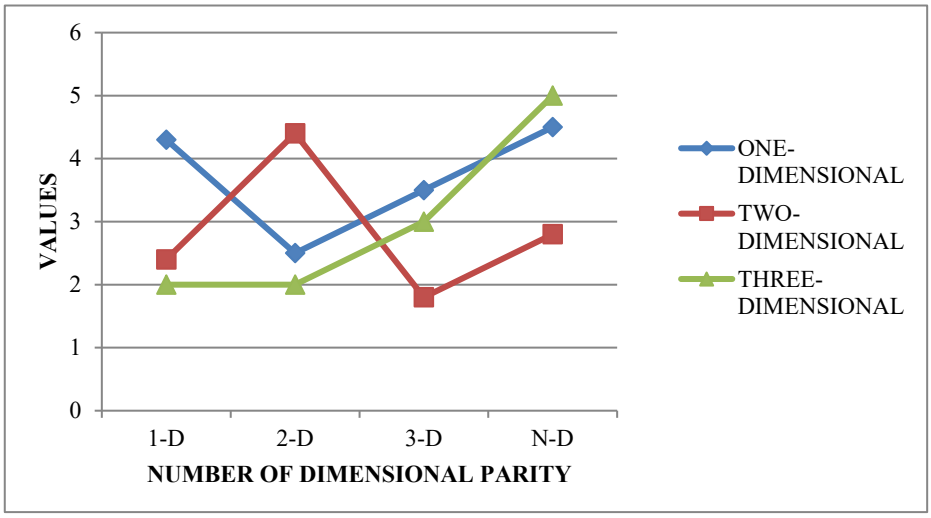

Fig. 8. Performance comparison of the system for various channel counts

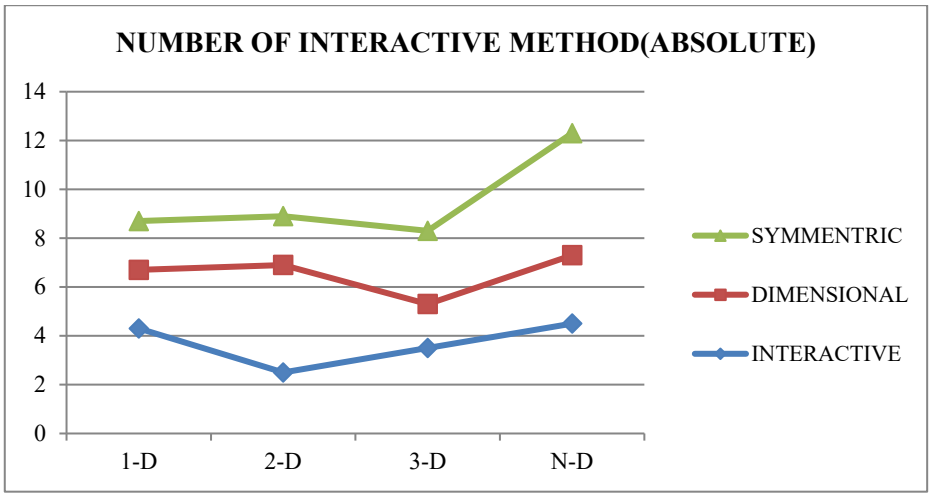

Fig. 9. Number of queries and query error: Absolute count

To compare the query error, we fix the height in the conventional dirk method and the threshold in our dirk algorithm. We can observe that the best utility for a random workload is provided by our multidimensional approach. Because relative count queries' errors vary greatly for sparse data, it should be noted that the utility outperforms other algorithms much more in this case. So, with sparse data, our multidimensional technique produces better results. We utilize the average inquiry to show how our approach can be applied to other, non-distributive inquiries. We use Gender and Earnings as dimensions to convert 2D counting from a 1D counting. Between the original information and the stolen data, the change in average (age) is then compared for each Income. The original data produced the blue line, and the perturbed data produced the red line. We can observe that there are very little differences between the two groups of values.

In situations where there are fewer queries, the interactive model outperforms our no-interactive method. The random workload's query error in the integrative framework, however, could grow as the number of inquiries rises. Figures 9 and 10 show that our multidimensional parity approaches beats the interactive model for both absolute query and comparative query when the number of inquiries is between 1 and 3. The income is plotted on the x-axis, and Plotted on the y-axis is the appropriate count of each revenue amount across the entire domain. The variation between the original and released values (Laplacian noise) distributions is seen in Figure 8 For each data release, we tested 100 randomly generated queries and conducted 100 independent releases before averaging the findings. Error rates on average are 63.2. Figure 9 shows how many times each error occurs. The query error is on the x-axis, while the likelihood of each error is on the y-axis. The actual error, which is much smaller than the predicted error, is depicted in Figure 10. [10].

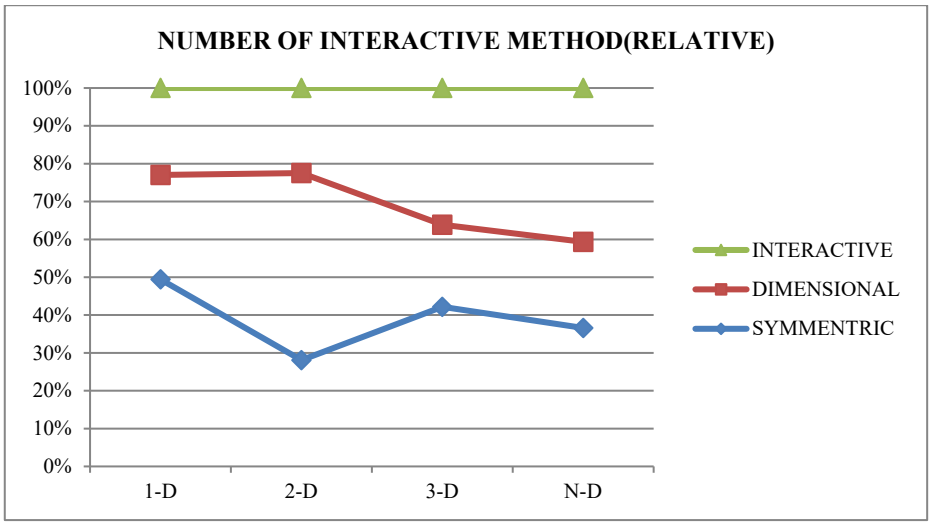

Fig. 10. Number of queries and query error: Relative count

5 Conclusion

The method of storing and distributing files that divides them based on dimensional parity rather than using encryption protects the data and the security of the content from unauthorised access. The capacity to create an internally consistent and up-to-date model of stored and processed data with a high level of protection against external attack is the key distinction between this technology and conventional cyber security. Major, in the event of unlawful access, the system forbids you from using the data. Split data doesn't by itself include valuable information. The second factor has to do with the fact that only a portion of the divided data can be used for the recovery process, meaning that the storage locations must be recreated. The outcome is a persuasive application of the acquired information. Education must be reorganized in order to improve semantic systems. This requires a clear representation of concepts and the relationships among them. By fusing contemporary concepts with contemporary concepts and understanding-promoting ideas, you will be better able to remember and retain information.

6 References

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