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Technical Report:

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Introduction:

In this document, the process of the research project conducted on the topic of "Application of Ternary-Based System Architecture" during three semesters will be discussed. This will depict the efforts that were made to fulfill the project and how the subject was expressed. Furthermore, the developmental stages of the software that the research was based upon will be elaborated from a technical perspective.

For a more comprehensive explanation, the course of actions taken for this research will be explained in stages and chapters to narrate the chronological order of the events that took place, since the initial conception until final submission.

Background:

The initial idea of researching and developing Ternary logic was conceived during the undergraduate years of my studies. There is a certain fascination with the concept of machines that can operate on a logic aside from binary.

During those years, a series of studies and research into this concept was conveyed parallel to my bachelor's degree studies and with the assistance of my previous lecturers a beginning point was set. At that time, by reading books, articles, and research authored by Professor Lotfi Zadeh and mathematician Thomas Fowler, a basic understanding of Machine learning, Fuzzy Mathematics, and Ternary Logic was established.

Upon entering to postgraduate studies, it was decided to pursue investigating the subject of Ternary-based systems by searching for a useful application for such technology. However, since the topic can be considered as extremely complex and theoretical, the project was narrowed down to addressing a hypothetical flaw that might exist within the field.

Logically, due to the mathematical conversions of transforming Binary logic to Ternary, there could exists methods to bypass or generally avoid using ternary logic, the real question would begin with "why would be it unfeasible to use Ternary Machines in general". Since there is a lack of evidence to support this question, it was decided to test the performance of such Technology and thus, the foundation of this research was established.

By the assistance of my supervisor, Dr. Nor Samsiah, this concept was then applied to a real-life scenario of using ML and Ternary logic to process a Data set, therefore narrowing the scope of the research to a project fitted for postgraduate Master's studies.

Chapter 1:

The topics of the first segment of the research were written in accordance with the concept of Ternary machines, and to elaborate the problems that were deemed present in their real-life applications. To anchor such topic to something that already exists and can be assumed as a control factor for the comparison, a Machine Learning algorithm was set to act as the default base for the narrative.

With the advice of my supervisor, the topic was limited to a software level of analysis to avoid the complexity of discussing the impact of Ternary logic on all layers of the computation theory. This means, the topic is to be focused on a coding aspect that would be beneficial by avoiding the hardware, operating system, and all other layers that enable computation. Thus, simplifying the research project and preventing the topic to spiral out of scope.

For assessment of a system's performance, two of the most important aspects of the software are the "Runtime" and "Performance" of the code. These two parameters were chosen for the comparison of the Ternary and ML systems to make the comparison possible and realistic.

Chapter 2:

The fourteen documents that were used as citations and references to back the project were chosen for their relation to the topic. Initially a total of 200 documents were taken and researched in full detail, out of which. 10 documents were deemed relevant. During the correction period an addition of 4 documents were found that could be related to ternary systems and they were added to the project respectively. These documents discussed the hardware, mathematical basis, and similarities that could pin Artificial Intelligence to Ternary logic, which would validate the claims of the thesis.

Chapter 3-4:

The research methodology and experimentation sections of the project can be presumed as the crux of the research. They were met with extensive difficulties due to the nature of the project in general. A depiction of the process taken to develop and test the software code will be discussed here in multiple stages. In Addition, the topic of the research method was explained in a practical manner that would reliably measure the runtime and accuracy of the Machine Learning and Ternary Logic software. There were a total of five iterations or stages that took place for the final ternary algorithm to be developed.

Stage 1:

The algorithm designed during the first testing was developed within the visual studio environment since there are multiple libraries, focused on ternary processing available within the platform. However, the main issue with iteration 1 was that the code was volatile and would cause severe crashes on my device.

Stage 2:

The second attempt resulted in a more stable code, but it failed to perform the tasks as intended, since it would give incorrect or incomplete output which were useless for my purposes.

Stage 3:

At this point, the main core of the algorithm designed proved to be flawed. Therefore, a new attempt was made, which would only focus on ternary counting. This way, if there were any noticeable flaws, they could be detectable before further coding and implementation. Another decision that was made was switching to using Python in the Google Colab environment since the diagnostics would've been much easier compared to visual studio. However, the code developed at this stage, was only reliable to process basic ternary task. and did not meet the required the objective for the project.

Stage 4:

This would become the main algorithm, which was later to be used for the project, but due to the heavy impact on my laptop, the research was limited to only perform data cleaning. The reason for this decision was, the algorithm used a 3 tryte technique which would parse the data into a multidimensional matrix format, however the problem was that my Computer's RAM did not allow for the entire 3 tryte process to fully be performed, resulting in frequent crashes.

Stage 5:

Using the previous iteration, this method used a single tryte encoding technique to clean the data set used and provided runtime data for the research's analytic section.

Complications:

Aside from the problems with hardware and software issues related to the ternary programming, my lack of experience in python proved to be another challenge which I had to overcome during the project's course. Another unintended consequence was that I believed that by using C# in visual studio, which is my preferred language in coding, I could make the chapter 4 process become faster; but countless crashed and frequent factory settings resets, kept postponing development. The final issue that can addressed is the time dedicated to running and testing the fifth iteration to successfully execute the code. Each time the software was executed, it could take anywhere from days to weeks to adjust and measure the performance of the ternary system.

Correction period:

After the Viva presentation, the correction period was spent on editing the final draft of the research project, making changes as necessary in compliance with the comments given by the internal examiner, Professor Hadi.

Thank you for your time.

Best regards.A