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Relative Comparison Of Modern Computing To Computer Technology Of Ages

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***Abstract*—We may wonder how far we have gone through the development of computer technology. This research enlightens us on evolvements of the features and functions of computers in the society. Computing devices were developed during the 18th and 19th century, yet the 1940s was the era of electronic computers. In contemporary society, computers are evident in every home while they control several areas such as home appliances, automobiles, and supercomputers, which assist in simulating climate trends and designing aircraft. The history of computer technology and its developments, including functions from 1700 to 2022, is imperative in understanding contemporary technological advancements. In this paper, we will compare modern and traditional computers, focusing on the central processing unit arithmetic logic unit, and memory, including input and output, among other factors.**

Keywords—Computers, Engineering, Aviation, Technology, Physics, Science, Evolution, Education, Colleges, Universities, Schools

Similarities between Modern and Ancient Computing Technology

Central Processing Unit

Both traditional and modern computers utilized the central processing unit (CPU) in their operations. In 1822, a steam driven computer device known as the Difference Engine, which was steam-driven, was invented by Charles Babbage (Ullah, 2012). This device was used in calculating tables of numbers like the logarithmic table. However, the initiative failed because it incurred a lot of expenses. A new machine known as the Analytic Engine that utilized six steam engines was introduced by Babbage. It used punched cards to document numbers for future reference, which ensured reliability of results. The Analytic Engine was grouped into two parts, namely, the mill and store. The mill had a piece of equipment where computation of numbers occurred, consequently providing accurate results. The store was a machine that held numbers. According to computer history, the concept of mill and store was a significant breakthrough in modern computing because they are the same parts used in the current CPU. This reveals why Charles Babbage is referred to as *the founder of modern computers* (Nordhaus, 2007). CPU in modern computers is evident in a microprocessor (Nordhaus, 2007). Intel 4004 was introduced by Intel in 1971 (Ullah, 2012). The single-chip microprocessor is considered the first commercial CPU in the history of computers. The computer equipment was a 4-bit CPU that was designed for calculators. Notably, Advanced Micro Devices (AMD) and Intel are the two distinct companies that design modern processors.

Arithmetic Logic Unit (ALU)

Both modern computing and computer technology of ages were utilized to present data after computation of figures, hence serving as arithmetic logic units. Calculators are considered traditional computers. This is apparent in the early 1870s when most calculations were done manually. During 1880s, bookkeeping and the need for accurate figures in different industries compelled information technology engineers to develop calculating machines and commercial adding machines which utilized computer techniques to provide accurate results (Nordhaus, 2007). James Cortada stressed innovating the typewriter as vital engineering equipment when designing a calculator. Between 1872 and 1874, the circular calculator was designed by T. Odhner from Russia and Frank Baldwin in the US. William S. Burroughs invented another calculator in 1885, while Dorr E. Felt made another one in 1884 (Nordhaus, 2007). These devices used computer techniques to analyze data. In addition, they employed a common matrix array of keys and were designed by companies like American Arithmometer, Burroughs, Monroe, and Felt Comptometer. In the 1890s, the manufacture and sales of calculators rapidly increased. Unfortunately, the calculators were not effective in cases of mass information input and output. With the invention of punched-card technology, which was emulated from the Jacquard power loom, calculation was made much easier.

WWII played an essential role in the history of computers. Gargantum and powerful computers were invented during this period. In 1938, the ZI was made by Konrad Zuse, a German engineer. This was the first programmable binary computer and was invented just before WWII began. In 1939, a more elaborate binary machine was built by Clifford Berry, an electrical engineer, and John Atanasoff, an American physicist. This computer was known as the Atanasoff Berry Computer (ABC) and was the first modern computer that stored numbers using electrical switches. When the switch was flicked off, it showed

number zero, and when it flicked on, it stored number one. In this case, the switches in modern computers were used to store binary digits. This modern computer stored information as digits, unlike the traditional ones, which used the position of wheels and rods to store numbers. In this case, both traditional and modern computers were meant to enhance calculation and storage of digits.

Memory, Input, and Output

Traditional and modern computers utilized memory storage input and output devices when processing information. Traditional computers used punch cards as inputs of programs and data. Also, punch cards were used as a memory device by Charles Babbage in the Analytical Engine (Ullah, 2012). Initially, punch cards were utilized in the textile industry during 1725, where they regulated mechanized textile looms. From the 1900s to the 1950s, punched cards were used as primary sources of data storage and information entry. Additionally, it was applied in the process of institutional computing. This computer technology was later replaced by magnetic tape during the 1960s. The memory of the very first computers was minimal because they amounted to kilobytes. This memory was used when processing linear equations and the results were printed in the form of binary. With the invention of random-access memory (RAM) between 1970 and 1972, modern computers could easily and randomly access data (Ullah, 2012). Memory in modern computers was boosted with the invention of hard disk drives. It happened when IBM created model 3340 of Winchester sealed hard disk drive in 1973 (Ullah, 2012). This was the prototype of the contemporary hard disk drives and had a storage capacity of 30 Mbytes (Ullah, 2012). The ST506 was introduced by Seagate technology in 1980 (Ullah, 2012). According to history, this model was the first hard disk that increased the memory of microcomputers. Later, 7200 RPM was created by Seagate in 1997 (Ullah, 2012). The ultra-ATA hard disk was meant for desktop computers.

Differences between Modern and Ancient Computing Technology

Workload

Deep learning is only evident in modern computing as it was never applied in the 1700s and 1900s. In deep learning, computational models with multiple processing layers often reveal information by mimicking how the brain processes and comprehends multimodal data. This invention involves creating a system that copies the human brain, which collaborates with the neural networks; hence require speed and adequate memory storage. Pitts and MacCulloh assessed how the brain uses interconnected basic cells, which are neurons, to yield complex patterns in 1943 (Voulodimos et a., 2018). The MacCulloh and Pitts Model of Neuron (MCP) was significant because it initiated the progress of artificial neural networks, which are essential in deep learning. The most important breakthrough of deep learning was the invention of Deep Belief Network that Hinton created in 2006 (Voulodimos et a., 2018). This technology used numerous layers from Restricted Boltzmann Machines. Other deep learning methods and developments include convolutional neural networks (CNNs). On the other hand, traditional computers could not perform heavy workloads like deep learning as they lacked adequate storage and only performed minor tasks such as computations.

Mechanics

Computer vision applies deep learning techniques to achieve essential functions like human pose approximation, face detection, object, action, and activity recognition in modern computing and was not present in computer technology of ages. In this case, modern computers are efficient as they integrate several simple mechanics. In object detection, a computer senses semantic items like birds, airplanes, and humans in digital images, including videos. The creation of large cliques containing candidate windows that are grouped through CNN features is a common approach of object detection framework (Voulodimos et a., 2018). By using the CNN paradigm, modern computers improve object detection accuracies. Researchers still focus on further increasing the performance of the CNN paradigm because this invention estimates object position and fails to detect the precise position of an object. To counter this challenge, engineers recommend using a semantic segmentation approach that applies joint object detection, consequently attaining accurate results.

Alex Krizhevsky and other engineers created AlexNet, a better version of the LeNet during the inaugural ImageNet Large Scale Visual Recognition Challenge (ILSVRC) of 2012 (Karn et al., 2021). AlexNet was the winner and outperformed other competitors by a wide margin. This was a milestone because the invention was a major advancement of prior computer vision techniques as it is widely used in CNNs today and modern computer devices. Rob Fergus and Mathew Zeiler pitched their convolutional network at the ILSVRC 2013 (Karn et al., 2021). Their presentation was in the 3. ZF Net session and was known as the ZDNET. This creation changed the design hyperparameters of AlexNet. Later in 2014, Szegedy and his partners from Google pitched a presentation on Convolutional Network at the ILSVRC and was recognized as the GoogleNet (Karn et al., 2021). Throughout the modern computing era, CNN has been a powerful tool in machines that enhance vision, unlike traditional computers, which focused on calculations with simpler mechanics and laws.

Traditional computers focused on enriching the calculation skills of human beings since they are not very efficient, unlike modern devices that integrate complex mechanics. These computers applied simple laws and mechanics; hence were inefficient. For instance, the third Earl of Stanhope, based in England, created a multiplying calculator in 1777. Later in 1801, the application of fabrics in an automatic loom and control of weaving patterns by using sequencing punched cards were introduced by Joseph-Marie Jacquard, a Frenchman. Nonetheless,

the looms contributed to riots as the machines replaced many workers during the second half of the 18th century. This invention was important during the technological and industrial revolutions. Mechanical calculators were commonly used in the 1820s to facilitate computation of figures. The arithmometer was a traditional computer device created by Charles Xavier Thomas de Colmar. This equipment performed four essential mathematical functions like division and multiplication through manual control. In addition, the calculator subtracted and added figures by a single accumulator and employed ripple carry propagation. During World War I (WWI) the arithmometer was a vital computer device. Charles Xavier Thomas de Colmar applied the stepped drum mechanism that was made by Leibniz, which acted as a digital-value actuator. This showed how computer technology of ages applied simpler mechanics and laws as they were slow, whereas modern computing integrates complex mechanics and laws because of its high speed.

Electric and Non-Electric Computing Machines

Modern computing machines are electric compared to non-electric machines utilized in the traditional era. During the traditional era, non-electric computing machines used punch cards which were very slow. In 1890, which was a census year, Herman Hollerinth utilized punched cards as an input in data processing equipment in traditional computers. Ideally, 80 variables were represented by a single card. An electrical circuit would be completed when the card is read. A reader ought to count the number of closed circuits. It only took six weeks for the census information to be available to the public. Later in 1896, the Tabulating Machine Company was launched by Hollerinth. In 1924, the organization was rebranded to International Business Machines (IBM) after a series of mergers and acquisitions.

On the other hand, an all-electric computer was assessed in 1939 by John V. Atanasoff. The design used the Boolean logic, which performed calculations, revealed data, and implemented instructions. Later on, between 1943 and 1945, the Electronic Numerical Integrator and Calculator (ENIAC) was invented (Ullah, 2012). This technology was made at the University of Pennsylvania and was regarded as the first-ever electronic digital computer. ENIAC was created by J. Presper Eckert and John Mauchly, who were professors. The machine contained approximately 18,000 vacuum tubes, weighed up to 30 tons, and used a room that measured 20 by 40. However, Walter Brattain, John Bardeen, and William Shockley built a transistor in 1947 at Bell Labs (Ullah, 2012). William later built a junction transistor which revolutionized ENIAC. Transistors substituted the traditional vacuum tubes as they are small and light. Transistors were more reliable than vacuum tubes because they did not easily burn out. ENIAC, the first digital computer, used approximately 18,000 vacuum tubes, and they often burned out, making it unsafe as it was erroneous (Ullah, 2012). This illustrates the difference between traditional computers, which were non-electric, and modern computers, which are electric.

Conclusion

Traditional and modern computers are similar as they utilize CPUs when assessing information. In this case, mill and store acted as CPU in traditional computers and are evident in modern computers as a microprocessor, produced by Advanced Micro and Devices (AMD) and Intel in the contemporary computer industry. Traditional and modern computers are used as arithmetic logic units. They also utilize similar memory, input, and output techniques. The two types of computers are different because of workload where modern computers perform many functions like deep learning, whereas traditional computers only focus on calculation. Another difference regards mechanics, where modern computers integrate many simple mechanics and laws while traditional ones applied simple laws and mechanics. Traditional computers were non-electric, whereas modern ones are electric according to the history of computers. Therefore, modern computers are more reliable than traditional ones because of their high speed and large memory.

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