Connecting to Technology

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***Abstract*—This paper presents the general ideas of the following topics: human-computer interaction, artificial intelligence, and computer security. Beginning with the concept and foundations of human-computer interaction, a look into the development of overall usability of the technology is presented. It links into a more detailed look into the communication between humans and computers, to grow into artificial intelligence. This section views two example approaches on the subject, and the general outlook of AI today. As technology is rapidly advancing, security measures must be increased accordingly; a general presentation of possible threats and the necessary protective measures are provided.**

I. Introduction

The purpose of the beginning of computers was to aid in computing large sets of data quickly. As humans began to realize the power of technology to assist in such tedious tasks, the picture got bigger. Rather than specialized agents for business, the field of HCI came about from a mix of human factors, adaptations of operating systems, and computer science systems [6]. A more in-depth vision into HCI led to the field of AI that help us in our everyday lives with transportation, communication, and many other areas. With the new findings that research is still bringing, scientists aim to tie the dimension of thought processes and reasoning together with that of behavior. Implementing narrow methods and even combining such approaches are modern attempts to depict a thorough understanding of exactly how we connect to computers and allow it to learn.

A. Human-Computer Interaction (HCI)

Human-computer interaction is self-explanatory, in which the term refers to the relationship between the two contributors, especially in ways that allow technology to improve the lifestyle of humans. We use computers when we microwave our food, make a purchase online, call someone on our phones; there are countless ways that we use computers, and it seems their role is constantly growing and incorporating into our daily lives. John Carroll, a professor of computer science, states that usability is the main purpose of HCI studies, and breaks it down into four foundational threads that helps illustrate the history and growth of this theme.

1) Carroll's Four Threads:

a) Prototyping and Iterative Development: Within civilization, advances are made in the sense of hurdles, where a certain aspect is overcome by solving complexities with complexities, but which lead to greater issues that must be resolved with even greater complexities. Known as the "software crisis," this time helped provide "techniques to quickly construct, evaluate, and change partial solutions, prototyping [becoming] a fulcrum for system development" [1].

b) Software Psychology and Human Factors: During the industrial age, machinery may have replaced much of the manual processes, but it still required operating by humans to function. Scientists began to study cognitive ergonomics and engineering towards "how the use of computers fit into the larger design of work methods" [5]. In the current times, this section matches more closely with how programming connects people to how they make their searches and affects their efficiency and productivity.

c) New User Interface Software: This thread deals with the presentation that allows for easy readability of information. Computations were the outcome desired at the origin point of computing, but HCI was developed to empower users and allow new users to more easily understand the systems. It was necessary when data became personal and available to everyone, that the interfaces were also accessible with such applications as graphical user interfaces (GUI), the mouse and the pointer, and shared windows [1].

d) Models, Theories, and Frameworks: HCI affects multiple disciplines, and in application it hopes to guide the user in conducting real tasks with simple actions easy to learn, and easy to use. Carroll describes how the methods and software focuses of usability established a framework of user-centered systems. The former idea relates to performance, subjective views and learning; the latter idea involves ease of deployment and being more powerful and useful [1]. Putting user interface software and tools in play with usability engineering presents the development of HCI and standards of design that really proves usability.

2) Importance of HCI: By examining how people are using computers and how it affects them shows really how technology can be used to improve quality of life. HCI presents a display of controls on how technology is accessible for all users of different knowledge levels and needs. Applying it in the real world today, advances on the study of HCI makes sure that there is increased productivity and ease-of-use for proper management of resources.

B. Artificial Intelligence (AI)

Can machines think? If so, to what extent? Alan Turing opened his paper "Computing Machinery and Intelligence" with the first question in the 1950s [10], and this subject was expanded to the current studies and developments of artificial intelligence that we see today. This inquiry was approached from different standpoints: from the traditional logical perspective, and also from a more analytical and statistical view. There are really no set paradigms guiding this concept, and even Turing expected there to be a great challenge in determining the correct variables that would factor into a successful investigation. To this day, various theories were developed that assisted in establishing great advancements in artificial research and its technology; you can accredit the learning towards the self-driving cars and intelligent assistants such as Siri.

1) The Traditional Approach: When the controversial topic of AI initially launched, interest focused on intelligence as mainly abstract symbol processes; the algorithms and the programming were valued over the hardware system. Philosopher and author of Artificial Intelligence: The Very Idea, John Haugeland, even coined the term GOFAI, for "Good Old-Fashioned Artificial Intelligence" as a label for this movement [6]. At this specific point, computer scientists and psychologists didnt see any other way for AI to develop and assumed cognition for all subjects from game logic to expert problem solving. However, as the possibilities of AI were further explored, several flaws were revealed that inhibited the learning process and could not be necessarily apply to the real world.

2) The Statistical Approach: What else could it be? [6] The certainty that researchers primarily was challenged with the thought that this rationality was too structured on logical inferences. Due to the fact that the general rules and assertions would already have to be written in to calculate somewhat accurate results, the actual number of paths was restricted from a true output [4]. This then made way for a more statistical view more specifically through probabilities.

Larry Hardesty even claims in his article that "the probabilistic approach has been responsible for most of the recent progress in artificial intelligence" [4]. He refers to the computer programming language Church created by MIT research scientist Noah Goodman; this program takes into account the input of basic algorithms, and as more is learned, it revises and calculates accordingly. Church was tested at a Cognitive Science Society conference, and it trumped over traditional AI algorithms in consideration of modeling human thought [4].

Peter Norvig and associates expand this perspective with their presentation on "The Unreasonable Effectiveness of Data." They state that rather than detailed models and complicated algorithms, creating simple models based on data as the driving factor provides better performance. For example, when studying language, abstract representations are difficult to "learn or validate Relying on overt statistics of words has the further advantage that we can estimate models in an amount of time proportional to available data and can often parallelize them easily" [8].

3) AI Today: Although the field of AI has not yet been conquered, findings have certainly brought us a long way. It made sense that initial research focused on logical inferences, as this set the basic guidelines on how computers should function. However, in order to have the responses more complex and actually learn, it was necessary to move interest into more statistical and data bases. This information would be easier to set rules for and also continue to learn from.

However, just like how the brain is made up of several different parts working together, it cannot be narrowly focused. The total workings must be taken into account computational psychology (behavior), computational philosophy (mind), and computer science (actions) [9]. Integrating the various approaches involves more complicated agents but maximizes its prospects for success. This would also allow more realistic structures to be formed.

Can AI eventually even surpass human intelligence? With certain respects, such as in reference to generative algorithms, this may be very possible. It is exciting to know that the feedback of current AI and the exchange of learning between humans and computers bring us those couple steps closer towards actually achieving such technology.

C. Computer Security

More than just involving the physical machine, computer security in the modern sense refers to the protection of the hardware, information, and the service [3]. Additionally, protection in this case means to keeping secrecy and integrity of information. Systems can be placed at risk by both external or internal factors. Although it may be difficult to completely block all attacks, measures may certainly be taken to prevent or block any anticipated attacks or cover vulnerabilities.

1) Threats: The most commonly known threats to computer systems would be external forces such as Trojans, viruses, phishing, and social engineering deceptions. These usually involve an attacker with malicious intent employing such methods in order to access and exploit confidential information and resources. Another popular method is the denial-of-service (DoS) attack, in which makes the particular service temporarily or indefinitely unavailable to its users and disrupting business. No matter the scheme, the risks with any vulnerabilities would cause much loss financially and would most likely instigate legal issues as well.

2) Protective Measures: With humans being increasingly more dependent on technology, the level of risk increases as well with the exposure of more personal information into the networks. As a result, it would be best to take precautions and set threat prevention and detection controls, as well as response mechanisms. Common methods of computer security begin with installing anti-virus software and firewalls, and implementing cryptography. Audits and tests can be run periodically to root out any bugs or other possible threats before they become a bigger issue. Simply setting a strong password and using two-factor authentication, being skeptical of application or

link reputations, updating security software regularly are easy defense moves that can be applied against potential attacks.

However, even with these measures it may at times be difficult to block an attack, and breaches may occur. Indicators of an attack would be suspicious activity logged in an account, unusually slow network performance, website unavailability, or an increase in spam [7]. It may actually be difficult to locate the attacker because they would have access to manipulate the logs; reverting back to the original state would also be a challenge if the origin of the problem cannot be located. In these cases, it is recommended to work to isolate the most important information to save, and then make changes to account credentials to remove them from exposure. Evaluating any losses and learning from the experience should ensure for the future that the data will be more secure.

II. Conclusion

Exposing so much of our lives to the digital world leaves us open to vulnerabilities that we must shield ourselves from in order to secure our data and maintain a healthy relationship with the computer as well as other humans. Only at this point and also simultaneous to current discoveries in the different interests of computer science, such as HCI and AI discussed, can there be effective learning. There may not be a definite right or wrong way approach the fields, but understanding the history and its adaptations display insight into which are more successful. We can certainly expect more growth and evolution in the future in all of these topics that will continue to assist with our tasks and even promote innovation.

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