



HUMAN COMPUTATION

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ABSTRACT

Human computation is a new concept of using human effort to perform tasks that computers cannot yet perform. It involves performing a computational process by outsourcing some of the difficult-to-automate steps to humans. Combining computer intelligence with human intelligence can help solve the world's most vexing problems.

This paper provides a brief introduction to the emerging area of human computation.

Key Words: *Human Computation, Human-Based Computation, Human-Assisted Computation, Ubiquitous Human Computing, Distributed Thinking.*

1. INTRODUCTION

In conventional computation, a human being uses a computer to solve a problem by providing problem description and algorithm. Human computation tends to effectively reverse the roles. In this case, the computer is no longer an agent of its user, but instead

the processors are human beings, called workers. Human computation systems harness the cognitive power of a group of workers connected to the Internet to execute some tasks. Applications designed to implement human computation comprise of a group of tasks, each of which can be performed by one worker [1].

Coined in 2006, the term “human computation” is one the several interesting ways that people work with computers. It involves delegating certain

functions in a computer system to human beings. Human computation constructively channels human brainpower to perform the tasks (such as image recognition/classification, language understanding, and real-life planning) that challenge even the most sophisticated computer programs. There are artificial intelligence (AI) problems that computers are either cannot solve or are very poor at solving, but they are easy for human beings to solve. Human computation has the potential to collect, organize, and validate information where computers alone fall short. Unlike computer processors, humans require some incentive or reward to become part of a collective computation [2].

Reproducibility is a necessary but not sufficient requirement for results of human computation. In

order to be informative, the results of human computation must be reproducible.

Typical examples of tasks using human computation include labeling images, conducting user studies, annotating natural language corpora, annotating images for computer vision research search engine, content moderation, and entity reconciliation, conducting behavioral studies [3]. Tagging of email messages and games that involve people tagging images with keywords are also examples of human computation. Human computation is arguably responsible for writing the world's largest encyclopedia.

With the growth of the Web, human computation systems can involve human abilities

(such as abstraction, complex pattern recognition, imagination, and creativity) of a large number of people via the Web to perform complex computation and find solutions to life's most difficult problems, such as cancer, HIV, climate change, famine, and drought.

2. APPLICATIONS

Human computation applications involve many workers making small contributions toward a purpose. Various kinds of applications of human computation exist today. Four different problem domains can be defined in which human computation is most useful:

aesthetic judgment, making intuitive decisions, contextual reasoning, and free interaction with the physical world [4]. Specific practical applications of human computation include two major areas [5]:

Online gaming: Research efforts in human computation have largely targeted on the development of entertaining games. Social game were proposed to provide entertainment to the

online game players. For example, games with a purpose (GWAP), such as the ESP Game, specially focus on online gamers [6]. An interesting application of human computation games is in natural language processing applications to enhance web search engines. The recent application of human computation to online games has led to the emergence of a new paradigm called the Human Computation Games (HCGs). Within this area, games with purpose have become important since they motivate contributors to the process through entertainment.

Crowdsourcing: Here human computation systems coordinate workers to perform tasks in exchange for monetary rewards. Crowdsourced human computation can potentially provide work for a large numbers of people, without imposing specialized skill requirements. With the popularity of platforms like Amazon's Mechanical Turk (www.mturk.com), it is feasible to hire scalable resources at low cost [7].

The relationship between human computation, crowdsourcing, and collective intelligence is shown in Figure 1 [8].

3. LIMITATIONS

There are some challenging problems that need to be solved before we can realize the full potential of human computation. The knowledge on how to best organize humans to work seamlessly together with machines is yet to be fully understood. How do we know if a problem would benefit from a collaboration of human/computer teams? We may have to rely heavily on researcher intuition to decide which problems to solve using human computation.

Human computation faces a fundamental challenge of motivating a human contributor to participate. A promising approach is to integrate human

computation tasks into digital games. Using digital games has been found to be a good incentive for human computation. Although individuals play games to seek pleasure, their behaviours can be controlled by various types of rewards or incentives. Three incentive schemes are commonly used: social, financial, and game points [9].

4. CONCLUSION

Human computation is a newly evolving field that harnesses human intelligence to solve computational problems that are beyond the scope of existing artificial intelligence algorithms. It allows organizations to outsource tasks traditionally performed by experts to a team of remote workers over the Internet.

More information on human computation can be obtained from the journal and conference dedicated to it. *Human Computation* is an international journal for publishing high-quality scholarly articles in all areas of human computation. HCOMP is the Conference on Human Computation and Crowdsourcing. For this year (2017), HCOMP will be held October 24 - 26 in Québec City, Canada

(<http://www.humancomputation.com/2017/>).

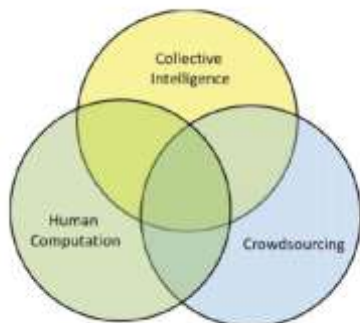


Figure 1.The relationship between human computation, crowd sourcing, and collective intelligence [8].

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