Homo Ludens in the Loop

Playful Human Computation Systems

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1. Auflage 2014. Taschenbuch. 232 S. Paperback
ISBN 978 3 8495 9205 9
Format (B x L): 17 x 24 cm
Gewicht: 447 g

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Introduction

Humans and machines have abilities so different that powerful systems emerge when their abilities are combined. Humans on the one hand can handle a wide range of tasks even building problem solving machines. Their strength is to solve problems effectively. Machines on the other hand solve only a narrow range of problems they are designed for. However they do that very efficiently. The goal of human computation is to combine the flexibility and effectiveness of humans and the power of machines to store, distribute, and process large amounts of data. This approach however introduces a variety of challenges. The aim of this thesis is to explore these challenges in the context of human computation systems with *ludic* elements in particular but also to draw general conclusions from relevant findings.

The most dominant challenge this thesis will investigate is to offer human contributors a valuable reward for their participation. One possible approach to this challenge is to design human computation systems in a way that makes their use an inherently pleasurable experience. A promising way to make tasks more pleasurable is to integrate human computation tasks into digital games as pioneered by Luis von Ahn. Games with other purposes than enjoyment are also called "serious games". In contrast to traditional "serious games" human computation games are not a medium to "teach" human beings. Human computation games reverse the flow of information and let humans create data for computational systems. Chapters 4, 5, and 6 investigate new ways how to design ludic elements for human computation. They explore the design space of systems with homo ludens in the loop and add new games to this space that broaden and deepen player's gaming experiences.

A common challenge of human computation systems is data reliability. Humans are expected to be unreliable; especially in ludic environments where a playful interaction with the system to test its borders is expected. Therefore, players may generate false data either on purpose or for other reasons. Different strategies have evolved to deal with this issue. As human computation tasks are by definition not efficiently solvable by an algorithm, it is necessary to find strategies to handle this challenge. Chapters 6, 7, and 8 investigate different strategies based on probabilistic methods to ensure data reliability in ludic environments. The goal of these strategies is to maximize data quality and to minimize restriction of game design.

Human computation systems generate useful data primarily by observing human behavior and interactions with the system. Designing interactions and developing strategies to gather and interpret human behavior is therefore a vital element. A variety of interaction designs and survey methods has been developed by different human computation approaches. Chapters 3 and 4 layout a new interaction method to maximize data quality and to simplify and speed up task execution. Chapter 4 shows how choosing an appropriate observational method can allow for greater freedom in game design and allow for new mappings of tasks to ludic systems.

Finally this thesis will investigate mappings between tasks and games. Issues that are of interest to human computation are those that are by definition not effectively or efficiently solvable by computational systems. In general, the challenge is to identify a problem or sub problem that is hard to compute but easily done by humans. Finding good candidate tasks is challenging as many problems that are hard for computers are also hard for humans. However many of the tasks efficiently solvable with human computation systems follow certain patterns. Five of these patterns will be discussed in Chapter 2.3. Each pattern takes advantage of a specific human ability, namely aesthetic judgment, making intuitive decisions, contextual reasoning, common sense knowledge, and free interactions with the physical world. This thesis primarily contains original work on tasks involving common sense knowledge in Chapters 3 and 4 and contextual reasoning in Chapters 3, 4, and 5. All chapters illustrate how certain task or task pattern can be mapped to digital games with only small changes to task and game design.