Human-Machine Trust Interaction: A Technical Overview

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ABSTRACT

Improving user’s trust appropriately could help in designing an intelligent system and make it work effectively, especially with the fast growth of Web-base technology. This chapter introduces the solutions of improving user’s trust in human-machine interaction (HMI), especially for electronic commerce (e-commerce). The author firstly reviews the concept of trust and the main factors that affects the appropriateness of user’s trust in human-machine interaction, such as the properties of machine systems, the properties of human, and context. On the basis of these, the author further discusses the current state, challenges, problems and limitations of establishing and improving the user’s trust in human-machine interaction. Finally, the author summarizes and evaluates the existing solutions for improving the user’s trust appropriately in e-commerce environment.

INTRODUCTION

Trust is familiar to all of us in everyday life. It plays a key role to mediate human-to-human interaction. We often talk about trust that we have in other people (e.g. family members, friends and colleagues), how much we believe what we see or are told, or how confident we are on somebody or something that could work properly. The trust relationships actually shape our social life. With the advent of complex intelligent machine systems, the relationship between human and machine need to be understood. The key factor influencing this relationship could be the human’s trust in the machine. In general, trust is based on past experiences. If the machine has been able to achieve tasks as expectation all the time, you would establish sufficiently strong trust in it.

With the rapid development of modern technology such as digital computing and network technologies, human-machine interaction is becoming prevalent, appearing in all aspects of human life and work. Human-machine interaction is the study of interaction between people and machines, while the interaction between people and machines occurs at user interfaces. The Association for Computing Machinery gives the following definition: “Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.”(ACM SIGCHI Curricula for Human-Computer Interaction) Human-machine interaction is also sometimes referred to as human-computer interaction or
computer-human interaction. Human-machine interaction shows massive potential to improve human performance and enhance safety. However, it is not uniformly beneficial to people. If trust is not properly considered, there are maybe machine-assisted accidents caused by human-machine interaction. If users trust the capability of the machine even when it does not perform the task perfectly, the disaster could occur. For example the autopilot crashed the Airbus A320 (Sparaco, 1995). In addition, if people refuse to utilize the machine even when it could achieve the goal very well, the advanced benefits of using the machine will be lost.

Such an improper relationship between human and machine can be described in terms of over-trusting or under-trusting of machines. These are illustrated in Figure 1. Over-trusting (too trusting) and under-trusting (not trusting enough) can lead to user misusing and disusing the machine (Parasuraman & Riley, 1997). Reducing over-trusting and under-trusting in the machine system is a very important issue in human-machine interaction. Appropriate trust can improve greatly human-machine interaction. Ideally, the human should maintain a correctly calibrated level of trust that matches the objective capability of the machine system. How to calibrate the user’s trust to an appropriate level? It is essential to understand the factors influencing trust in human-machine interaction.

This book chapter studies the factors influencing the user’s trust in human-machine interaction. We believe understanding this issue is important for us to develop human’s trust in the machine system at an appropriate level, neither too high nor too low. Firstly, the concept of trust and the factors influencing the user’s trust in human-machine interaction are introduced. We further discuss the issues, problems and challenges in this area that are introduced by e-commerce and web services, and recommend a number of solutions in order to improve the trust in human-machine interaction based on the trust influencing factors. Finally, we propose future research directions and conclude the chapter.

**BACKGROUND**

It is very important to calibrate the user’s trust to an appropriate level in human-machine interaction. For this purpose, we have to know what trust is, which factors influence the user’s trust, and how trust is influenced. We begin by reviewing the most common definitions of trust from social science, psychological science and informational science perspectives. We then

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**Figure 1. Theoretical relationship between trust and performance of machine**

<table>
<thead>
<tr>
<th>Trust</th>
<th>Performance</th>
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<tbody>
<tr>
<td>High</td>
<td>Over-trusting</td>
</tr>
<tr>
<td>Low</td>
<td>Appropriate trusting</td>
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</tbody>
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Incorporating Social Trust into Design Practices for Secure Systems

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