

Is Social Intelligence necessary for Agent-Agent Interaction ? —Toward Socially Intelligent Software Agents —

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Abstract

In this position paper, we define "Social Intelligence" and develop some examples of future information navigation services by autonomous software agents. We also discuss future directions for the development of software agents and their impact on human society.

Our Definition of Social Intelligence

In this section, we define the "Social Intelligence" of software agents.

In order to measure human intelligence, IQ and more recently EQ have been proposed. IQ is often used in the context of measuring the rational intelligence of an individual to solve difficult problems. In contrast, EQ is used in the context of emotional intelligence that affects another person's emotions.

Using the analogy of a human's IQ and EQ, we define two types of "Social Intelligence" for software agents in the following way;

IQ based Social Intelligence (IQSI)

This is a problem solving ability to resolve conflict or promote cooperation with other agents in a multi-agent system. Complexity of cooperation mechanism is related to IQSI. Simple cooperation, such as exchanging information among multiple search process, is considered to be low level IQSI. More complex cooperation, such as negotiation among rational agents based on game theory, is considered to be high level IQSI. In high level IQSI, the rational agent can make decisions that consider the tradeoff between overall performance of the society and its own benefit.

EQ based Social Intelligence (EQSI)

This is a communication ability with humans (or software agents that have their own personality) that can improve a communication partner's satisfaction. If the software agent behaves like a human and does the task in an acceptable way for his master, this software agent has a high level of EQSI. The level of EQSI is dependent on the partner's satisfaction. In particular, personality and emotion are essential elements for human-computer interaction.

Examples of IQSI and EQSI in future information navigation services are illustrated in the following section.

Future Information Navigation Service

Exponential growth of the Internet has produced a variety of databases and services and therefore, many researchers are trying to develop software agents that act as personal assistants by automatically accessing multiple sources of information, integrating this information, and acting on the user's behalf. Such software agents need high or low level IQSI and EQSI. Some examples are:

- **Cooperative Information Gathering**
Parallel implementation of information gathering by multiple robots needs low level IQSI. If more than one agent attempts to search the same partition in the search space, then redundancy can be reduced when one agent is able to assign its tasks to another. This kind of cooperation (exchanging agents tasks) is often very simple. (Game Theory shows that very simple protocol for cooperation such as Tit-for-Tat promotes cooperative behavior among self-interested agents.) Such types of simple cooperation is considered to be low level IQSI.
- **Commercialized Information Navigation**
As the Internet becomes increasingly commercialized, agents may receive monetary rewards for their services and may negotiate with each other to maximize their expected utility. This kind of negotiation is more complicated and requires high level IQSI. Such an agent should negotiate while thinking not only about maximizing its own short-term benefit, but also other agents benefits. Such types of negotiation is considered to be high level IQSI.
- **Educational Assistant**
An educational assistant suggests appropriate hints or answers to a given question and motivates a student to do further study. Since this type of agent should change its response according to the user's knowledge, personality, interests, and situation; it requires low or high level EQSI. Furthermore the

agents should observe the user's response and select the best timing for providing useful information to the user. If the student can distinguish his assistant agent from a human assistant and is not satisfied with the agent's performance, this kind of intelligent-like personality is considered to be low level EQSI. However if he can not distinguish between these two assistants, such kinds of communication is considered to be high level EQSI.

Discussion and Summary

Our first question is "What is Social Intelligence?". In order to answer this question, we propose the concept of IQSI and EQSI (informal definitions of Social Intelligence). Our next question is "Is Social Intelligence necessary for future software agents ? " Our answer is "Yes, but be careful." IQSI will be necessary for rational Agent-Agent interaction. However, if the agents that have a very high level of IQSI form coalitions that ignore human society, it would cause panic in our society. Final decisions should be made by humans. EQSI will be necessary for good Human-Agent interaction. However, because overkind agent may cause some trouble, a user should carefully select the agent's personalities.