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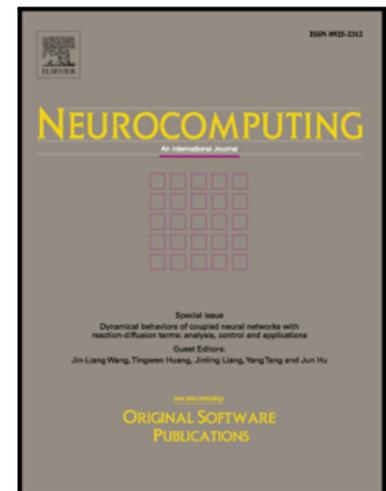
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# Personality affected robotic emotional model with associative memory for human-robot interaction

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## Abstract

The decision making process in communication is affected by internal and external factors from dynamic environments. Humans can perform a variety of behaviors in a similar situation, unlike robots. This paper discusses human psychological phenomena during communication from the point of view of internal and external factors, such as perception, memory, and emotional information. Based on these, we introduce the personality affected robotic emotional model and the emotion affected associative memory model for the robot. We organize an interactive robot system to provide suitable decisions for the robot. Results from interactive communication experiments indicate that the robot is able to perform different actions based on internal and external factors.

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**Keywords:** Associative memory, emotional model, human-robot interaction, personality.

## 1. Introduction

Communication is a fundamental action for humans. In past decades, researchers in the field of psychology have tried to reveal human psychological functions such as neuropsychology, developmental psychology, and cognitive psychology [1, 2]. On the other hand, computer scientists have attempted to establish human psychological functions on the computer, based on psychological knowledge. Specifically, in order to acquire the human functions, the research in *intelligence* as neural networks and fuzzy systems [3], and *cognition and perception* as image processing and voice recognition have been developed [4].

Facial and gesture expressions, being elements of multi-modal information depict a significant role to focus attention on subjects, while sharing the cognitive environment during human-human interaction. In general, capability in sharing the cognitive environment with others is vital for a smooth communication. The continuity and relevance of subjects are among other factors in expanding the cognitive environment [5]. In the human-human interaction, associative memory is a functional and vital brain function in handling continuity and relevance of the subject. To mimic this effective brain function, several

types of artificial neural associative memories with improvements have been introduced, and analyzed mathematically for the memory capacity, noise tolerance and stability of network [6]. These models however are not considered to influence of other functions of human brain. In human-human communication, the decision making process affects the logical thinking factors and also the emotional factors [7]. This emotional effect is one of the key differences between a human and a robot.

The significance of interaction between emotion and memory, with its mutual relationships is discussed in [8]. In general, in communication, the recalled information might change depending on emotional effects. This psychological phenomena is called mood-congruency effect [9]. It is presumed that the emotional factors perform significant roles in human-robot interaction. In other words, we assume that the robot can provide suitable reactions to situations, if the robot performs multi-modal communication based on emotion affected associative memory. In discussing *humanity* from the psychology point of view, one of the significant elements is personality. The concept of personality is regarded as one of the essential factors of emotional response in the psychological field. In other words, personality gives individual differences among people in behavior patterns and cognitive process [10]. Based on differences in age and gender of human, it can be regarded that the impact and reaction based on external stimulus have diversity [11]. Sensibil-

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