

Silesian University of Technology  
Faculty of Automatic Control, Electronics and Computer Science  
Department of Automatic Control and Robotics

MODELLING SOCIAL AND EMOTIONAL  
COMPONENTS IN SOCIAL ROBOTICS  
USING ROBOT ARTIFICIAL INTELLIGENCE

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GLIWICE 2023

# Summary in English

**Summary of the doctoral thesis written under the scientific direction of  
Assoc. Prof. Eng. Adam Galuszka, Professor of the Silesian University of Technology  
„Modelling social and emotional components in social robotics  
using robot artificial intelligence”  
PhD Eryka Probierz**

This dissertation is a series of papers on modeling emotions and social responses in social robotics using artificial intelligence. This research has been published as a list of eight papers grouped into four thematically consistent chapters.

The first chapter focuses on modeling emotional responses in robotics using artificial intelligence and machine learning. Various theories of emotion are discussed, which form the basis for the development of algorithms for emotion recognition and generation. Machine learning techniques, including neural networks, are applied to generate emotional expressions from sensory data. Special attention is given to emotion recognition and adaptive emotional responses. Potential applications of affective robotics in areas such as healthcare, education, and social interaction are also discussed.

The second chapter focuses on the use of Planning Domain Definition Language (PDDL) to automatically plan a robot's actions in the face of uncertainty related to human emotional states. PDDL, which is a formal knowledge representation language, allows precise modeling of the robot's interactions with humans based on their emotional states. The result of the work is a set of two planning domains with illustrative examples, assuming that the robot should respond in a way that reduces negative emotions.

The third chapter covers research focused on a variety of methods for modeling social behavior, including the use of neural networks and machine learning. These methods have been applied in a variety of contexts, including education, healthcare, and industry. One challenge is the need for appropriate datasets for training, especially in terms of ethics and data quality.

The final chapter discusses the use of the PID controller to model selected social components. A PID controller, commonly used in automation, has been used to precisely control the speed of a mobile robot. The focus of this chapter is on maintaining eye contact between the robot and the human, which is a key component of human-robot interaction.

The thesis concludes with a discussion and practical application of social robotics. Social robotics is a research area at the intersection of many scientific disciplines, such as computer science, psychology, ethics, social science, and engineering. It uses artificial intelligence methods, including neural networks and machine learning, to model and simulate the social behavior of robots. Social robotics is not only an engineering challenge, but also an ethical and social one, requiring an integrated approach to research and development. It is interdisciplinary and has a variety of practical applications, which allows specialization in a specific research path, but also shows how much research and opportunities can be realized. This dissertation aims to at least partially fill this research gap and bring additional knowledge to the modeling of emotions and social reactions in social robotics.