Ph.D. in Information Technology
Thesis Defense

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Mathyas GIUDICI – XXXVII Cycle

Persuasive Conversational Agents to Foster Sustainable Behaviours: Design, Evaluation, and Technology

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Abstract:

It is now undeniable that climate change is happening. More and more individuals must be encouraged to adopt sustainable behaviors. In the Human-Computer Interaction field, there is a growing interest in environmental sustainability. Nowadays, we have various digital systems embedding persuasive techniques, also referred to as Persuasive Technology (PT), that demonstrate their efficacy in fostering greener habits. Building on this literature, Conversational Agents, i.e., digital technologies that allow people to interact through natural language, are a promising platform for new sustainable PT systems. They can tailor messages to individual users and are already widespread as digital assistants in households. The present thesis contributes to the field of Persuasive Conversational Agents (PCAs) by investigating the integration of different persuasive techniques to foster more energy-conscious behaviors within home settings. In particular, the work begins by exploring the state of the art in persuasion and systematically surveying how PCAs have been used in the sustainability field. Then the monograph proposes the results of a first investigation into the effectiveness of different persuasive strategies in promoting energy-saving behaviors and a second investigation in the same area on the use of multiple strategies versus a single strategy approach. Based on the results of a focus group, we conceptualized a framework to guide the future design of conversational agents for domestic sustainability. In addition, the thesis presents different designs and implementations of conversational agents for environmental sustainability. Leafy is a traditional rule-based conversational agent embodied in a smart mirror and designed to gamify interaction with the home automation environment, while GreenIFTTT is a generative AI-based mobile chatbot that facilitates the creation of home automation applets, nudging the final user towards energy efficiency and reduction. The impact of Large Language Models (LLMs) on PCA for sustainability has also been addressed by evaluating the responses generated by such LLMs to open green-related questions posed by potential end-users. We also explored the generation of HomeAssistant applets and the impact of such LLMs in not only assisting users in home automation creation but also in creating more energy-efficient solutions. Finally, the thesis goes beyond individual persuasion by presenting work on using a chatbot to help coordinate a solar community, i.e., a group of people (from a neighborhood) that shares solar panels. Additionally, an

exploratory study on how LLM-based conversational agents can aid in discussions and moderation within groups is proposed.

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