

Nordic AI Meet 2026

P4: Machine Learning, Intelligent Systems & AI for Science and Engineering

3. Intelligent Systems with Commonsense Knowledge and Optical Character Recognition for Human-Robot Interaction in Social Robotics

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Abstract: In this research on intelligent systems, we investigate explainable AI (XAI), especially its facet of commonsense knowledge (CSK), in conjunction with optical character recognition (OCR). In XAI, the paradigm of CSK entails everyday knowledge on concepts, properties, and relationships. It is easy for humans and often the hardest for AI systems (e.g. versus encyclopedic knowledge). It often involves design of CSKBs (commonsense knowledge bases), followed by knowledge extraction and use in targeted applications. We consider the application area of domestic and service robots, particularly human-robot interaction in social robotics. For instance, one of the projects is the design of a smart walker for older adults. Researchers have been studying the design and development of such devices for some time. We aim to contribute by developing computer vision capabilities to detect objects and understand the surrounding environment. This information can then be used by the given system to provide haptic feedback to the user. This work entails XAI with CSK, extended from the standpoint of OCR toward a more comprehensive understanding of the robot's surroundings and the overall scene. Such robots are increasingly being deployed in environments designed for people. Beyond just avoiding physical obstacles, these robots must understand the social physics of human interaction, such as recognizing that standing too close to a person or interrupting a conversation is inappropriate behavior. By leveraging XAI with CSK, entailing OCR capabilities, the robot can interpret the context of a room, recognizing that a person holding a tray needs the right-of-way or that a closed door might imply a private meeting. Our proposed methods in this research can thus allow robots to articulate complex social decisions to humans nearby, providing verbal or visual justifications for its movements that foster a sense of safety and predictability in everyday settings. Note that there are growing trends in XAI today. Opaque-box models with deep learning (DL) can offer high accuracy but lack explanation, due to which there can be problems in interpretability, trustworthiness, error-traceability etc. XAI methods offer clear-box models, often comparable to DL in accuracy, yet better in 1st-time scenarios (where the AI has not precisely faced the exact situation with pre-training earlier), as well as in counterbalancing bias and overfitting. This project entails involvement of CSK and other XAI methods, considering the targeted applications. It thus makes positive impacts on humanitarian and societal angles, hence contributing to the humanities and social sciences with AI research and development, by creating knowledge-based, interactive intelligent systems.