Methods of Intrusion Detection for Socially Assistive Robots

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Motivation

- Need for geriatric care workers growing at a rate faster than can be met
- Socially Assistive Robotics (SAR) may be a solution to assist in daily physical and social needs of older adults
- Robots are currently being developed with different levels of potential application in geriatric care
- There is very little research on intrusion detection in SAR
- Patients could be at risk for psychological abuse, financial abuse, or neglect at the hands of a hacked robotic caregiver

Brian 2.1, a socially assistive robot, interacting with a user [1]

Purpose

To develop methods to detect a potentially hacked robot by identifying anomalous behavior.

We propose a combination of technical and non-technical methods for intrusion detection in the following context:

- Socially assistive caregiver robots
- Older adults as patients
- Long term or geriatric care facility

Questionnaire

- Administered in the case of intrusion warning signs
- Developed from existing elder abuse screening tools
- Based on patient responses
- Quick to administer
- Caregiver Psychological Abuse Behavior (CPEAB) Scale [2] used as main model for potential anomaly detection questionnaire

Anomaly Detection Algorithm

- Based on previous REU research on intrusion detection in swarm robotics
- Compares purported robot position with exogenously determined position

Warning Signs

- Is where it should not be
- Spends anomalous amount of time at a given location

Definitive Signs of Intrusion

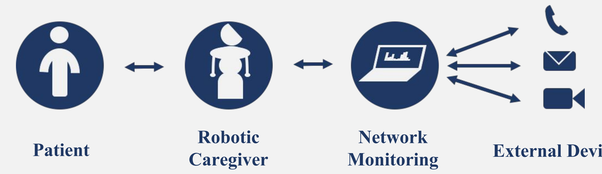
- Transmits false information
- Transmits no information

Audio Monitoring

- Transcribed audio from interactions between robot caregiver and patient paired with software that detects suspicious questions or commands [3]
- Uses topic lists to determine suspicious questions and commands

Network Monitoring

- Technology already available for network monitoring can be used to track communications from caregiver robot to friends and family of patient
- Used to detect anomalous frequency or duration of social communication and flag signs of social isolation



Suggestions for the Future

- A combination of technical and non-technical methods is advisable to defend against intrusion
- Progress in geriatric abuse screening tools should be considered in strengthening anomaly detection questionnaire
- More research needs to be done on intrusion detection in SAR before it could present a good solution to our caregiver shortage

References

[1] D. McColl, W.-Y. G. Louie, and G. Nejat, "Brian 2.1: A socially assistive robot for the elderly and cognitively impaired," IEEE Robotics & Automation Magazine, vol. 20, no. 1, pp. 74–83, 2013.

[2] J.-J. Wang, "Psychological abuse behavior exhibited by caregivers in the care of the elderly and correlated factors in long-term care facilities in taiwan,"The journal of nursing research: JNR, vol. 13, no. 4, pp. 271–280, 2005.

[3] Y. Sawa, R. Bhakta, I. G. Harris, and C. Hadnagy, "Detection of social engineering attacks through natural language processing of conversations," in Semantic Computing (ICSC), 2016 IEEE Tenth International Conference on, pp. 262–265, IEEE, 2016.

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