Edith Cowan University

School of Nursing and Midwifery

CONCEPTUAL FRAMEWORK FOR CLINICIAN-IN-THE-LOOP SMART HOME PREDICTIVE ANALYTICS

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&

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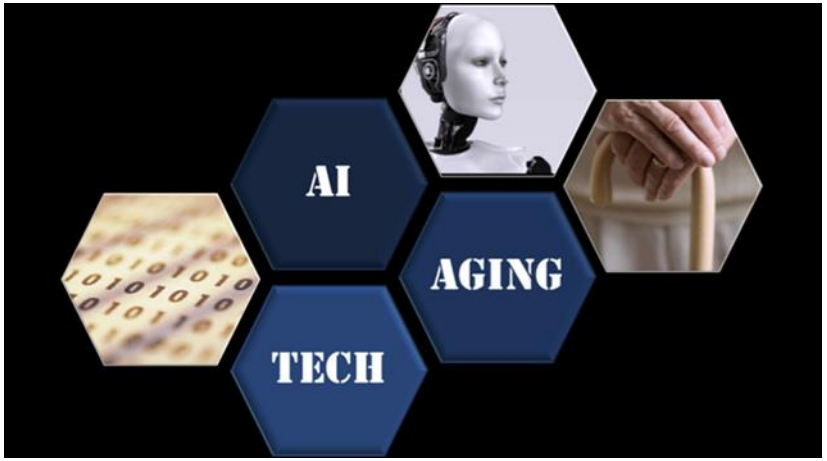
Situating Smart Home Research

- **Gerontechnology**: Designing technology and environment for independent living and social participation of older persons in good health, comfort and safety.



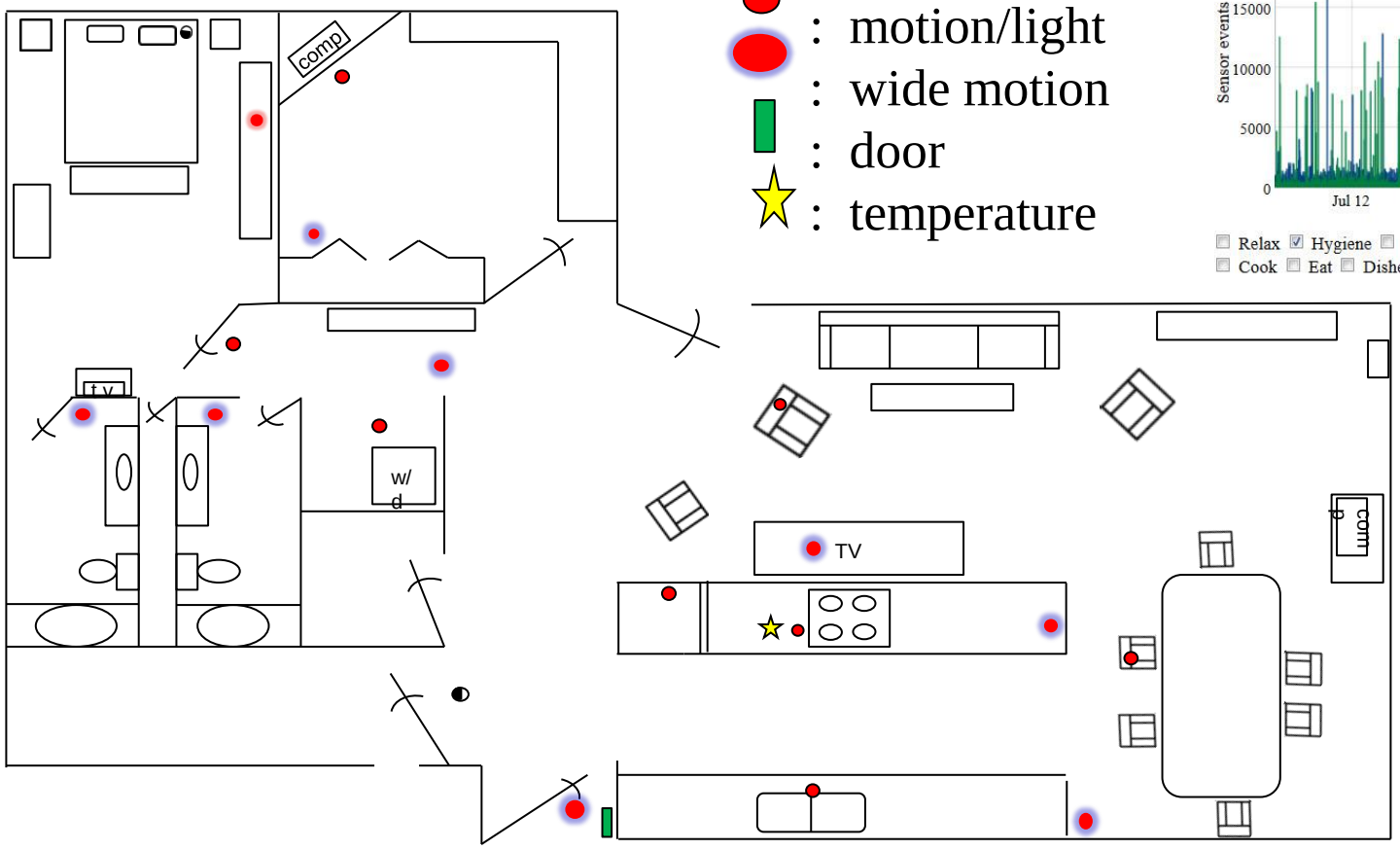
International Society of Gerontechnology
http://gerontechnology.info/about.html

Health-Assistive Smart Home

- Technological innovation that addresses older peoples' ambitions and needs
- Gives aging people a choice of where and how they want to age
- Quality of life
- Potential for decreasing ED utilization and hospital admission

Australian Government Institute of Health and Welfare, 2017
https://www.aihw.gov.au/reports/older-people/the-desire-to-age-in-place-among-older-australians/contents/table-of-contents

Sense

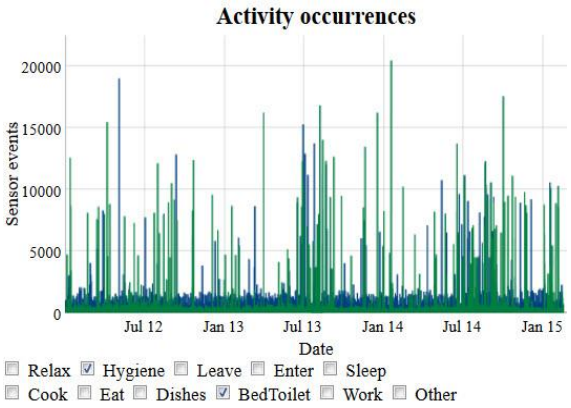


: motion/light

: wide motion

: door

: temperature



Health-Assistive Smart Home

Artificial Intelligence

Artificial Intelligence Agent

- A rational agent capable of making decisions like a human; perceiving its environment through the use of sensors and acting on the environment using actuators
- A device capable of receiving remote instructions and taking an action like turning off a stove).

Clinical Ground Truth

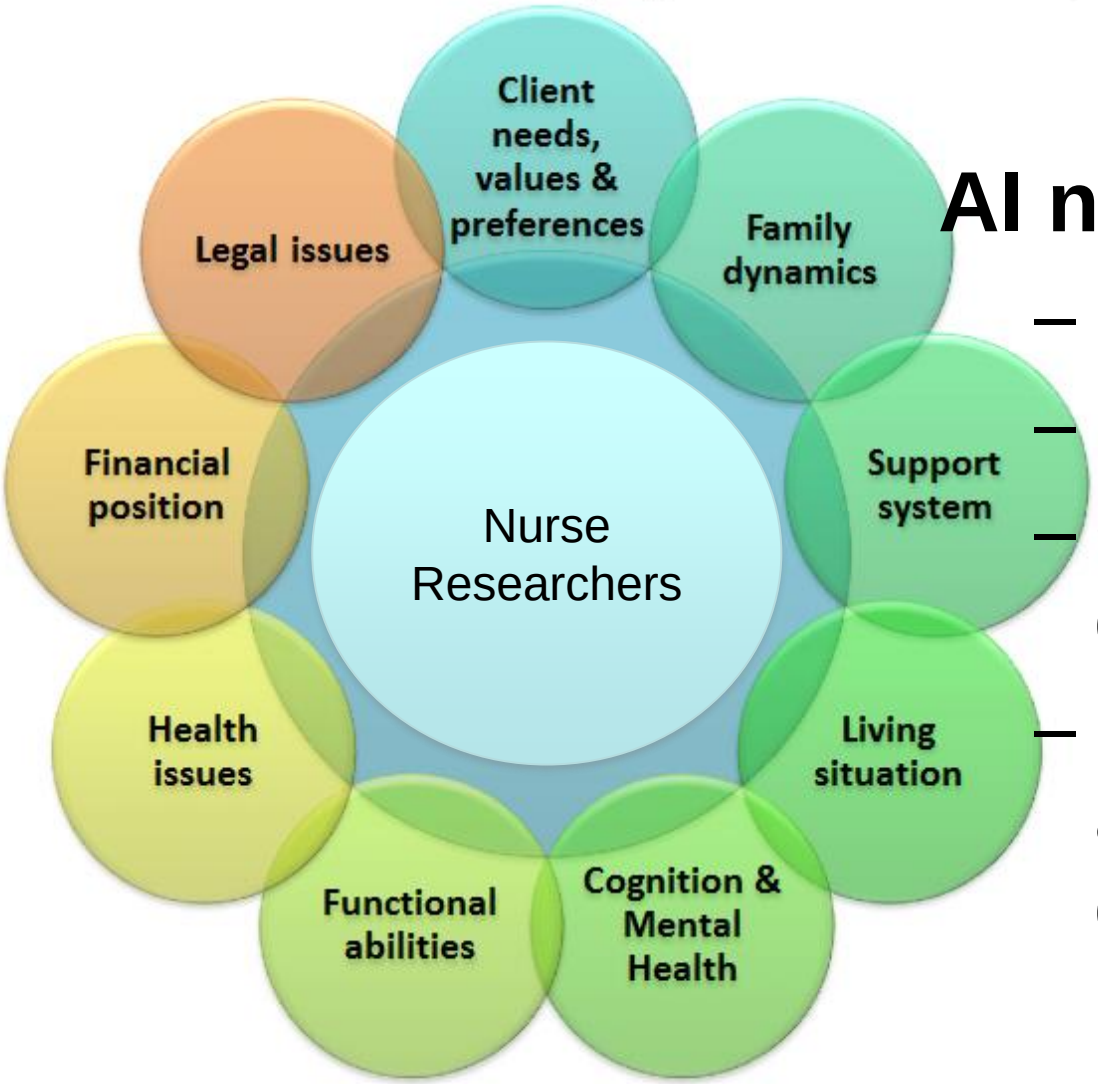
- Uses nursing knowledge of patients' health status for training the intelligent agent
- Key concepts:
  - Choosing good training data sets
  - Labeling raw data accurately
  - Deciding how to categorize various types of health changes

Why AI Needs Nursing

- Nursing clinical judgment infused in AI provides “ground truth” that is critical to “train” the algorithm for machine learning.

Patient advocacy
Self determination
Older adult end-user

Holistic Approach



AI needs nursing for:

- Design
- Implementation
- Closing the loop in the data
- Facilitate treatment and healthcare team decision-making

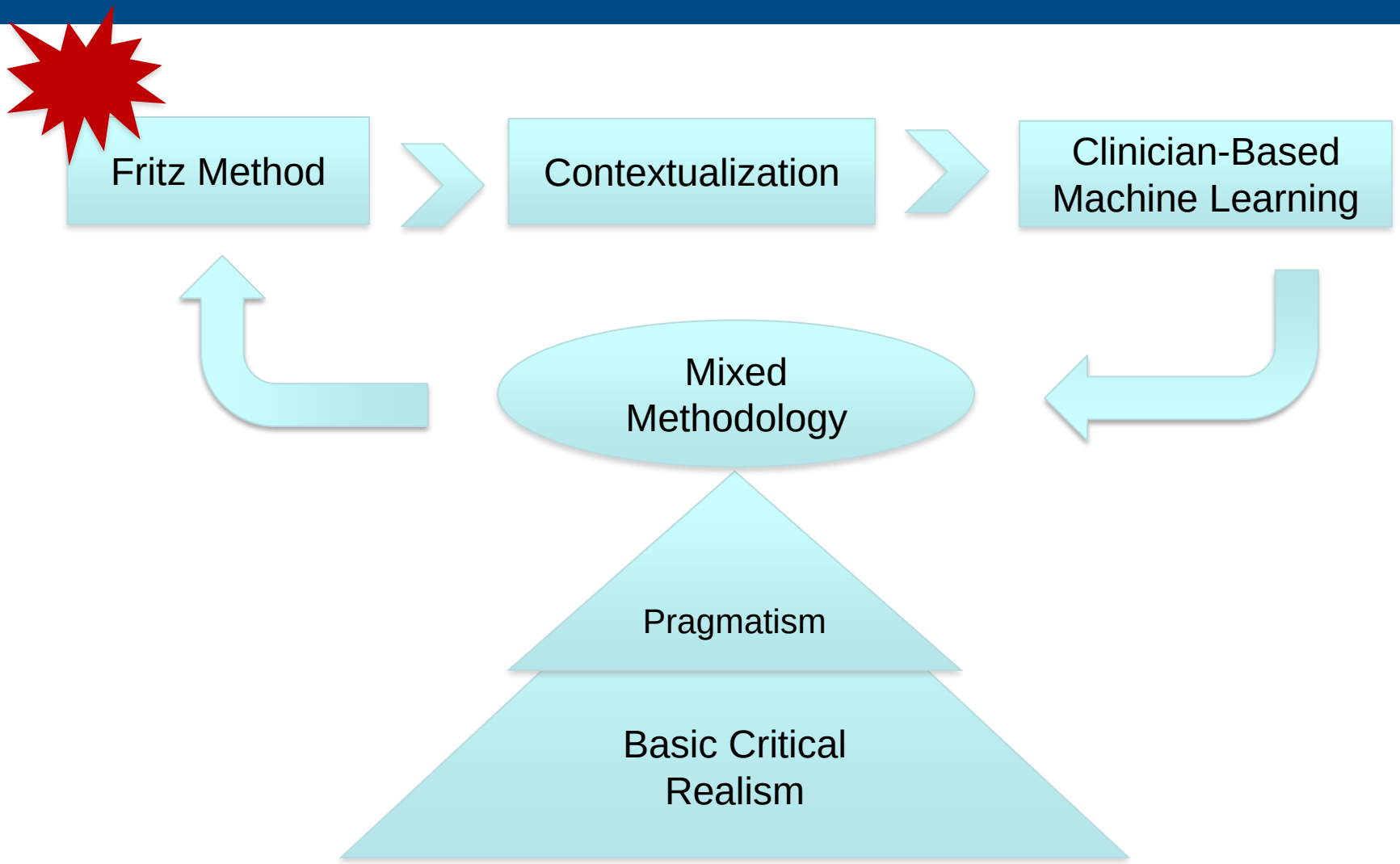
Nursing's Role in Smart Home Research

- Nurse researchers are optimally positioned to collaborate with the multidisciplinary team to conduct Smart Home research.

- **There is a need for conceptual frameworks and pragmatic methods for nurse researchers.**

Laying the Foundation

Clinician-in-the-Loop – Artificial Intelligence (CIL-AI) Conceptual Framework



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FEATURE

WILEY Nursing Inquiry

A conceptual framework for clinicians working with artificial intelligence and health-assistive Smart Homes

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Abstract

The Smart Home designed to extend older adults independence is emerging as a clinical solution to the growing ageing population. Nurses will and should play a key role in the development and application of Smart Home technology. Accordingly, conceptual frameworks are needed for nurse scientists who are collaborating with multidisciplinary research teams in developing an intelligent Smart Home that assists with managing older adults' health. We present a conceptual framework that is grounded in critical realism and pragmatism, informing a unique mixed methodological approach to generating, analyzing, and contextualizing sensor data for clinician-based machine learning. This framework can guide nurse scientists in knowledge construction as they participate in multidisciplinary health-assistive Smart Home and artificial intelligence research. In this paper, we review philosophical underpinnings and explicate how this framework can guide nurse scientists collaborating with engineers to develop intelligent health-assistive Smart Homes. It is critical that clinical

Fritz Method

	Data Collection	Data Processing	Data Analysis
Qualitative	• Semi-structured interview • Participant experience during the changes in sensor data	• Nursing assessment	• Identifying health events in telehealth and health assessment data
Quantitative	• Sensor data of motion, contact, temperature, humidity, and light data.	•AI and Middleware: •Pre-labeled sensor data.	•Annotating raw sensor data

Clinician-Based Machine Learning

Building on the Foundation

CIL-AI framework and Fritz Method as a foundation to support Smart Home research:

- Socioeconomic, cultural and ethnic backgrounds;
- Sleep and Dementia
- Experience of participants living in smart homes
- Clinical decision making

Implications

- Research
- Nursing Practice
- Nursing Education
- Health Policy

Take-aways

- AI for aging-in-place is here
- AI will become increasingly intelligent
- Nurses should play a key role

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Thank you!