SUNY Oswego

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USING MACHINE LEARNING TO PREDICT FALLS IN LORETTO RESIDENTS

PROJECT MISSION

Preventing falls and improving residents' quality of life through the meaningful use of health record data and machine learning.

BACKGROUND

- Falls are the second leading cause of accidental injury deaths worldwide (WHO 2017).
- The CDC (2016) reports that “every second of every day in the United States, an older adult falls, making falls the number one cause of injuries and deaths from injury among older Americans.”
- The CDC estimates the annual Medicare cost of falls in older Americans to be $31 billion.

World Health Organization. (2017). Falls Fact Sheet. Retrieved 10/12/2017 from http://www.who.int/mediacentre/factsheets/fs344/en/

Centers for Disease Control and Prevention. (2016). Falls are leading cause of injury and death in older Americans. Retrieved 10/12/2017 from https://www.cdc.gov/media/releases/2016/p0922-older-adult-falls.html

BACKGROUND, CONTINUED

- *"Successful rehabilitation to minimize long term disability of elderly people requires that staff aim to reduce patients' dependency and to increase their autonomy during recovery from acute illness when it is associated with disability. The occurrence of some falls is an unwelcome but probably inevitable consequence of encouraging patients to regain mobility early after acute illness. None the less, there may be simple measures that could reduce the incidence of falls without the need for physical restraints, sedation, excessive supervision, or other measures that undermine a patient's dignity and independence."*

Oliver, D; Britton, M; Seed, P; Martin, FC; Hopper, AH. (1997). Development and evaluation of evidence based risk assessment tool (STRATIFY) to predict which elderly inpatients will fall: case-control and cohort studies. British Medical Journal. 315: 1049-1053.

BACKGROUND, CONTINUED

- *Many fall assessment algorithms were reviewed.*
  - *We found no record of using machine learning*
- List of common risk factors for predicting fall: 1) muscle weakness, 2) history of falls, 3) gait deficit, 4) balance deficit, 5) use of assistive device, 6) visual deficit, 7) arthritis, 8) impaired activities of daily living (including ambulation and transfer), 9) depression, 10) cognitive impairment, and 11) age > 80 years.

Kenny, RA; Rubenstein, LZ; Martin, FC; Tinetti, ME. (2001). Guideline for the Prevention of Falls in Older Persons. Journal of the American Geriatrics Society. 49(5): 664-672.

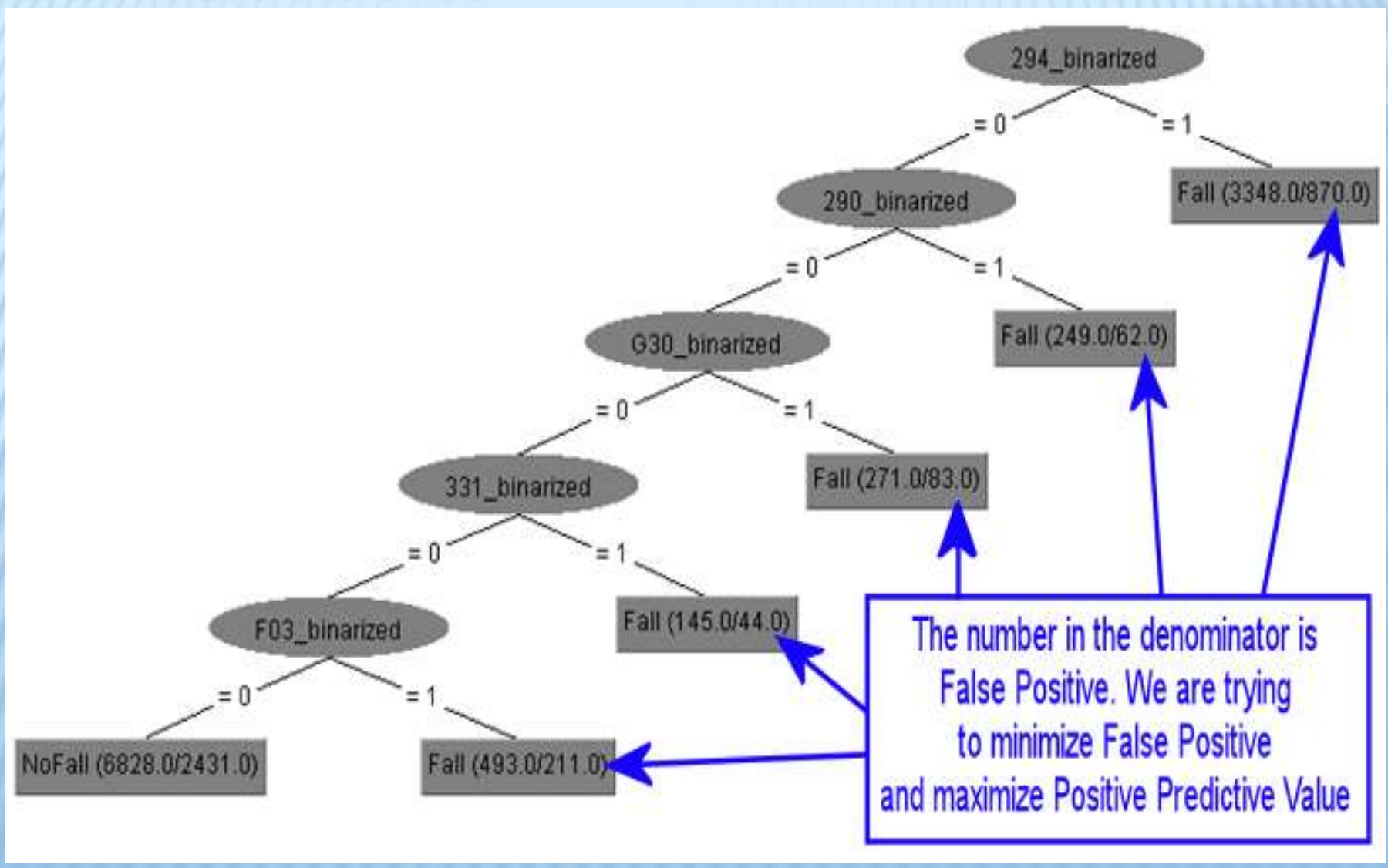
DATA ANALYZED

- 22 comma-separated value (csv) tables with 11843 resident records from January 2005 to present
- The four tables used:
  1. ICD
  2. General Admission Observation
  3. Fall Assessment
  4. Norton

VARIABLES ANALYZED

ICD	Gen Admission	Fall Assessment	Norton
290	Confusion	Previous fall	Physical condition
294	Toilet Performance	Cognitive status/behavior	Mobility
331	Verbalization of Pain	Age (85 or older)	Incontinence
F03	Complains of chest pain	Health condition	Gender
G30			Age On Admission

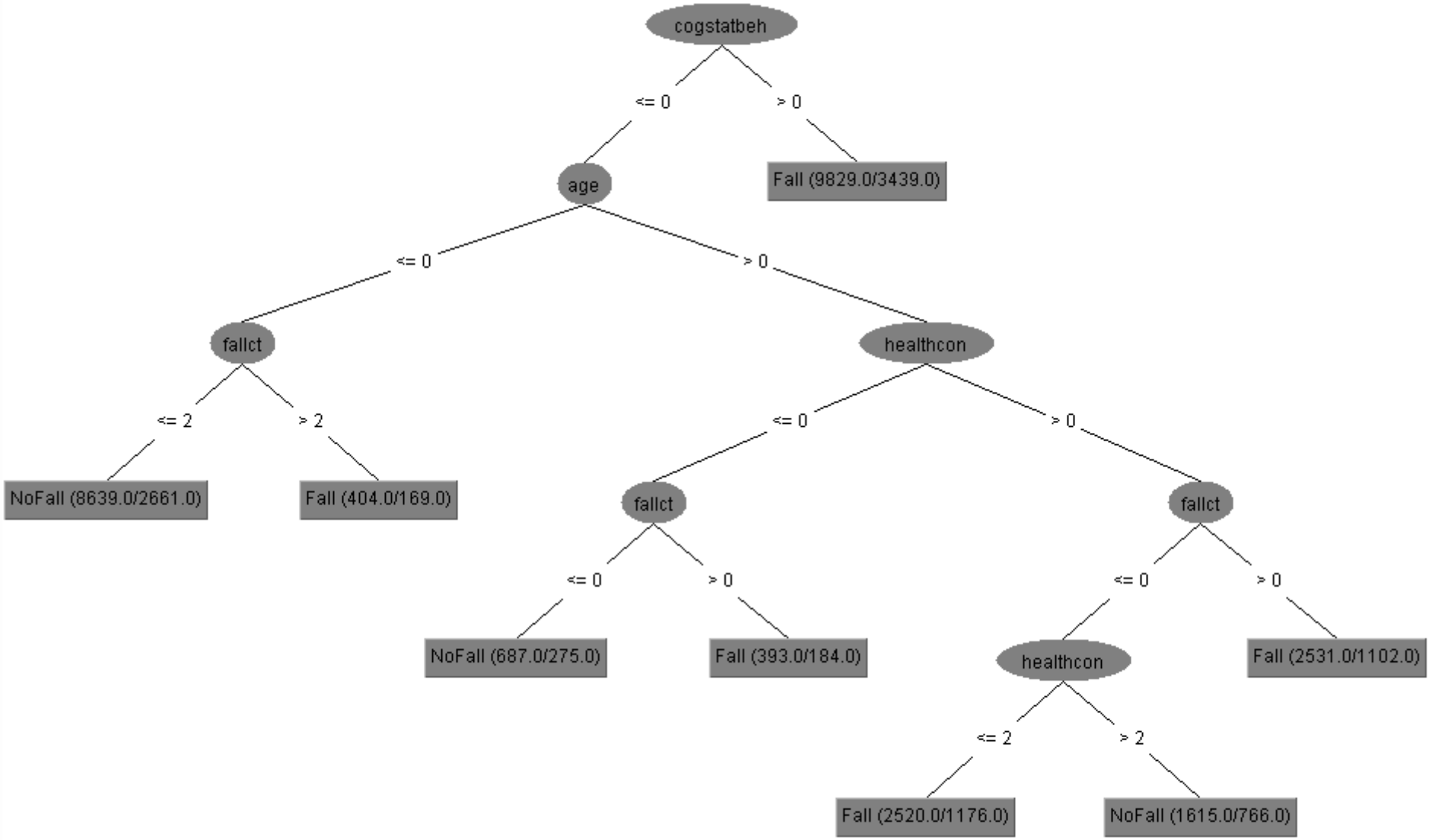
ICD ANALYZED



RESULTS

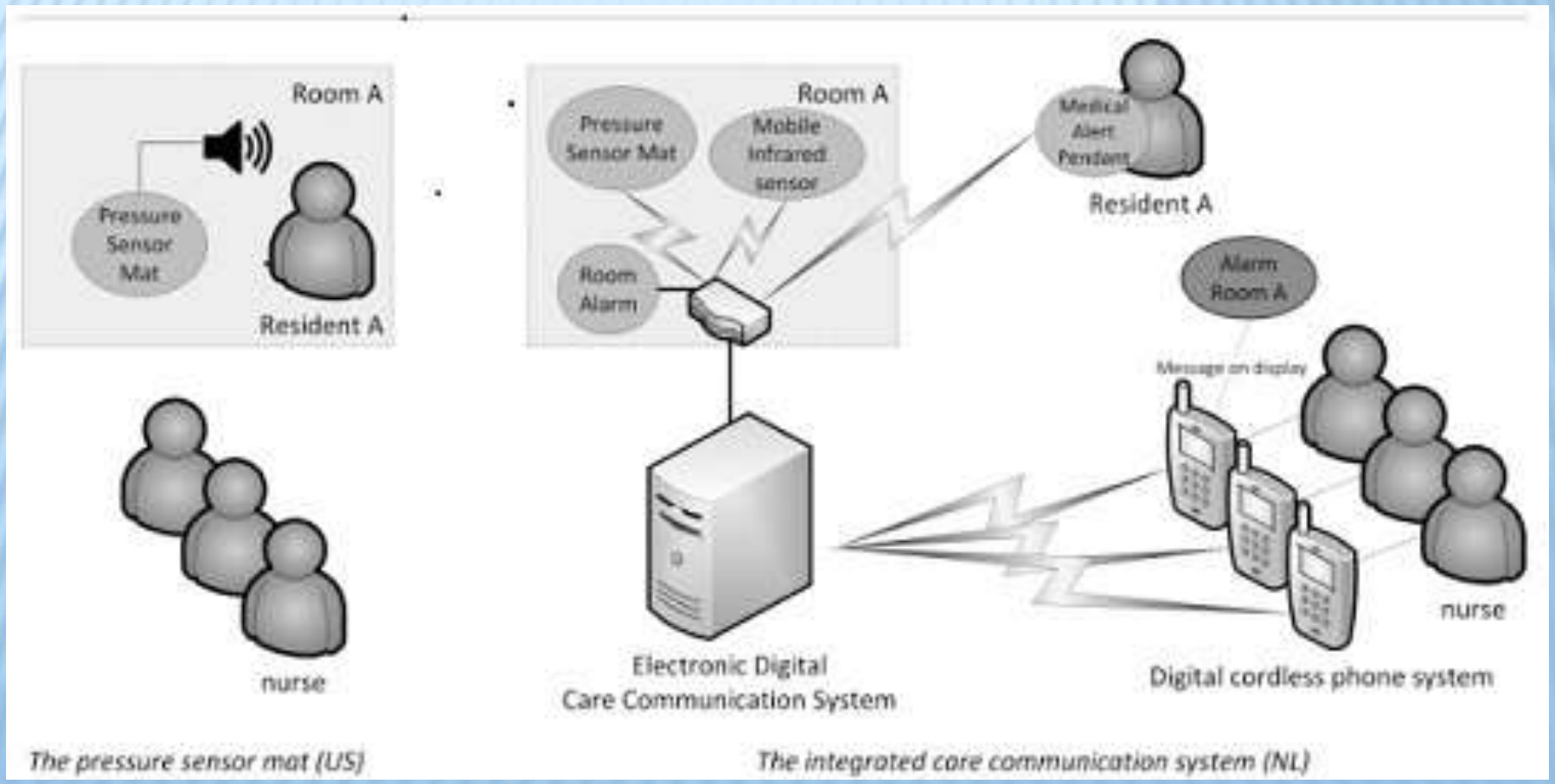
	J48-18V	RT-18V	J48-25V	J48-8V	RT-8V	RT-Simple
True Pos	4321	6502	6349	7107	6790	6519
False Pos	3197	2701	2854	2647	2194	1666
True Neg	7811	8307	8154	8361	8814	9342
False Neg	6013	3832	3985	3227	3544	3815
Accuracy	56.8%	69.4%	68.0%	72.5%	73.1%	74.3%
Specificity	71.0%	75.5%	74.1%	76.0%	80.1%	84.9%
PPV	57.5%	70.7%	69.0%	72.9%	75.6%	79.6%

RESULTS


cogstatbeh
<= 0
> 0
age
Fall (9829.0/3439.0)
<= 0
> 0
fallct
healthcon
<= 2
> 2
<= 0
> 0
NoFall (8639.0/2661.0)
Fall (404.0/169.0)
fallct
fallct
<= 0
> 0
<= 0
> 0
NoFall (687.0/275.0)
Fall (393.0/184.0)
healthcon
Fall (2531.0/1102.0)
<= 2
> 2
Fall (2520.0/1176.0)
NoFall (1615.0/766.0)

MORE TO CONSIDER

- Instinct and intuition = good
- Audible alarms = bad



THE FUTURE FOR THIS PROJECT

- Using data analytics to identify residents at the highest risk of falling could become an important aspect of preventing falls in the future.
- Results need to be re-tested and validated
- Future prospective analysis
  - Future research
- Implementation