

The Use of AI in Healthcare Research

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What is AI?

“Artificial intelligence leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind” IBM

**Artificial
Intelligence**

**Machine
Learning**

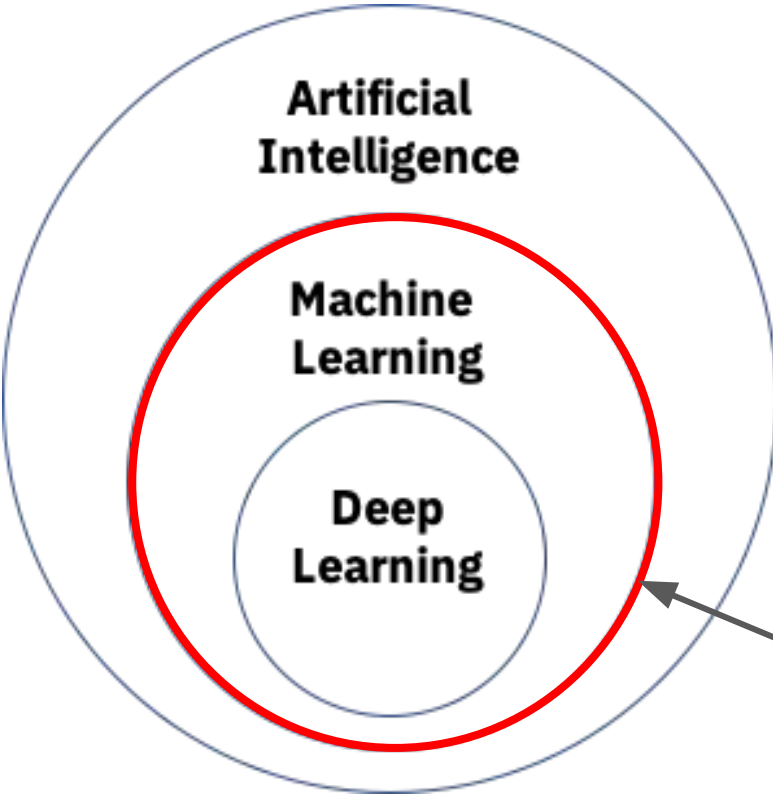
**Deep
Learning**

Computer Science + Data = Problem Solving

Machine learning algorithms:

Input data -> identify patterns -> make decisions

**Healthcare
research
(mostly)**



Machine learning in healthcare

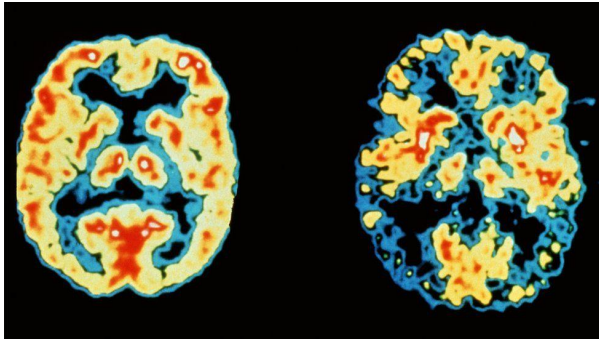
Imaging & Diagnostics

Drug discovery

EHR management

Disease prediction

Treatment



SAMueL

Stroke Audit Machine Learning

Working with the National Stroke Audit (UK) to identify levers for improving speed and use of thrombolysis

SUPPORTED BY

NIHR | National Institute
for Health Research



Thrombolysis rates in UK are stable at 11-12%

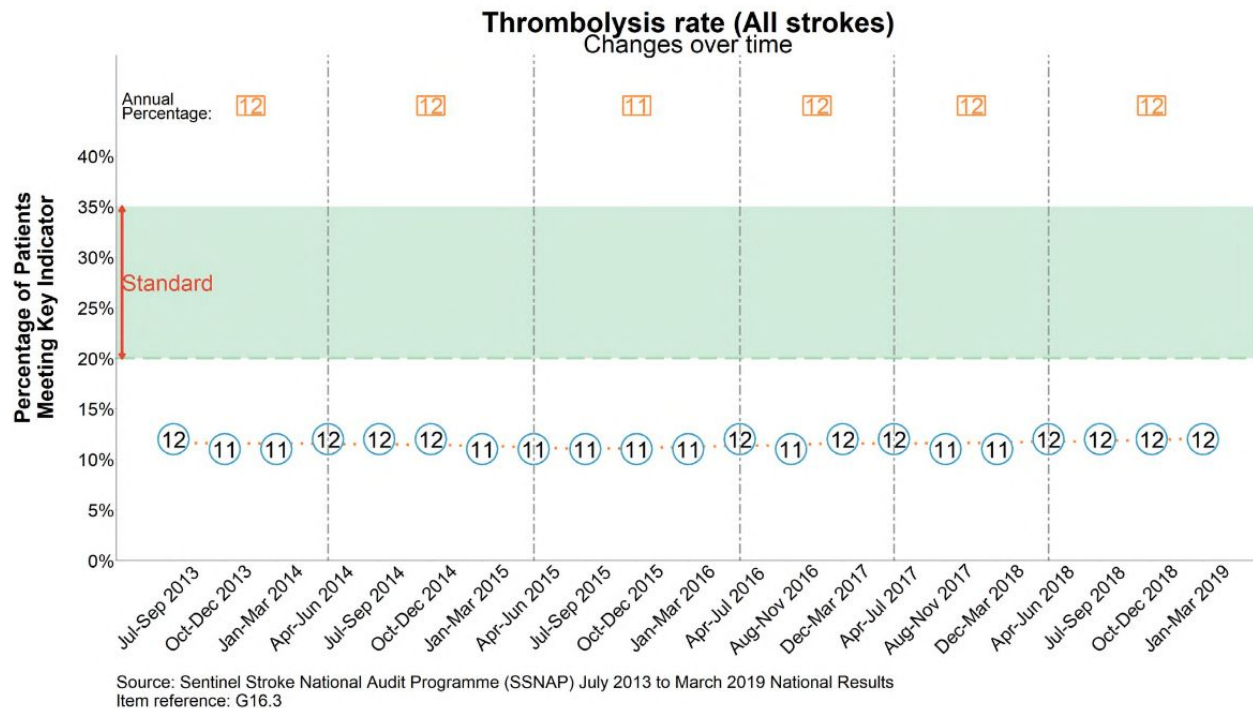
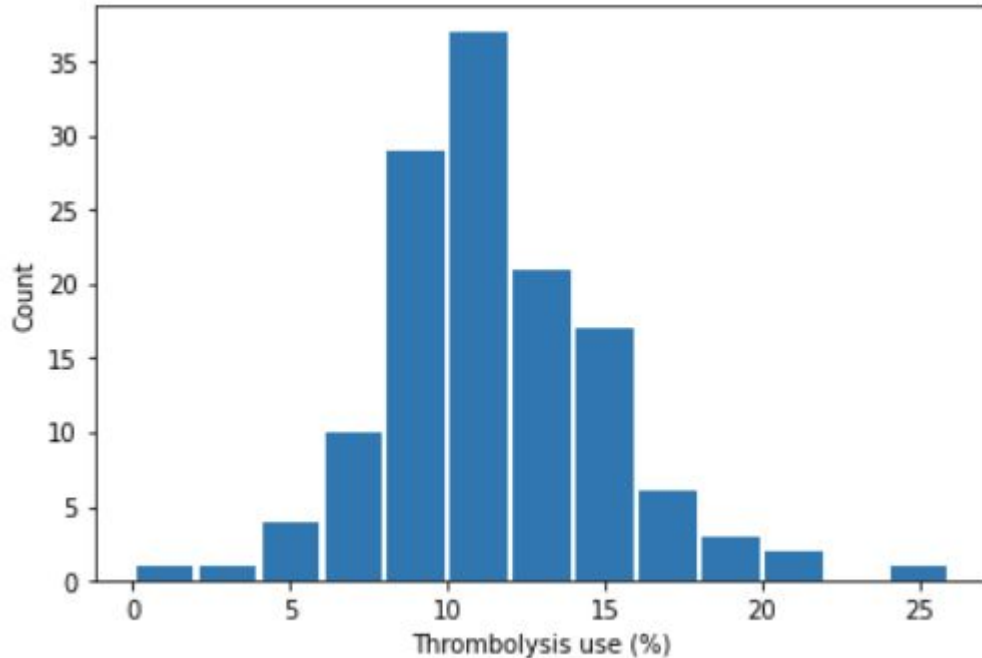


Figure 8. Percentage of patients who received Thrombolysis between 2013 and 2019.

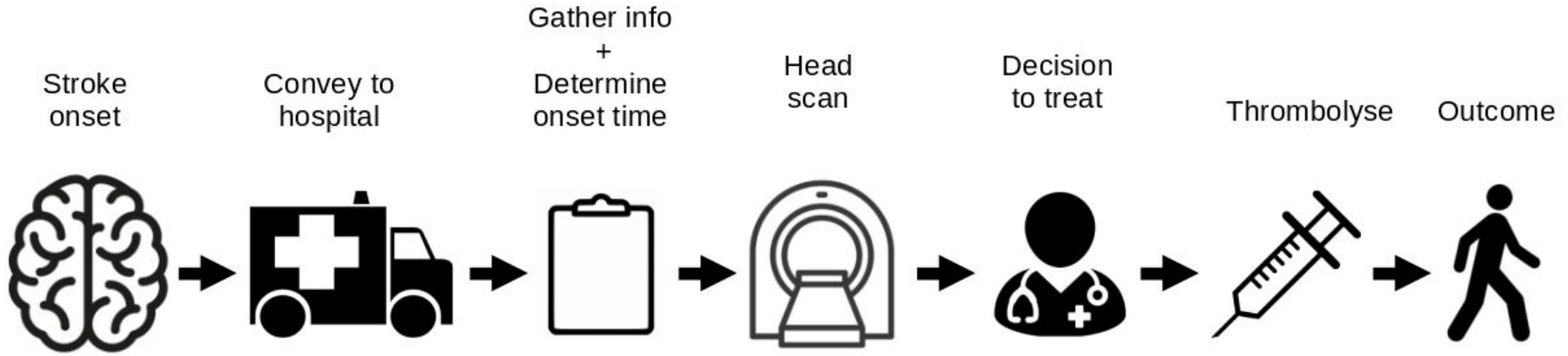
But rates vary across hospitals



What causes this variation?

- Patients?
- Processes?
- Decision making?
- A mix of the above?

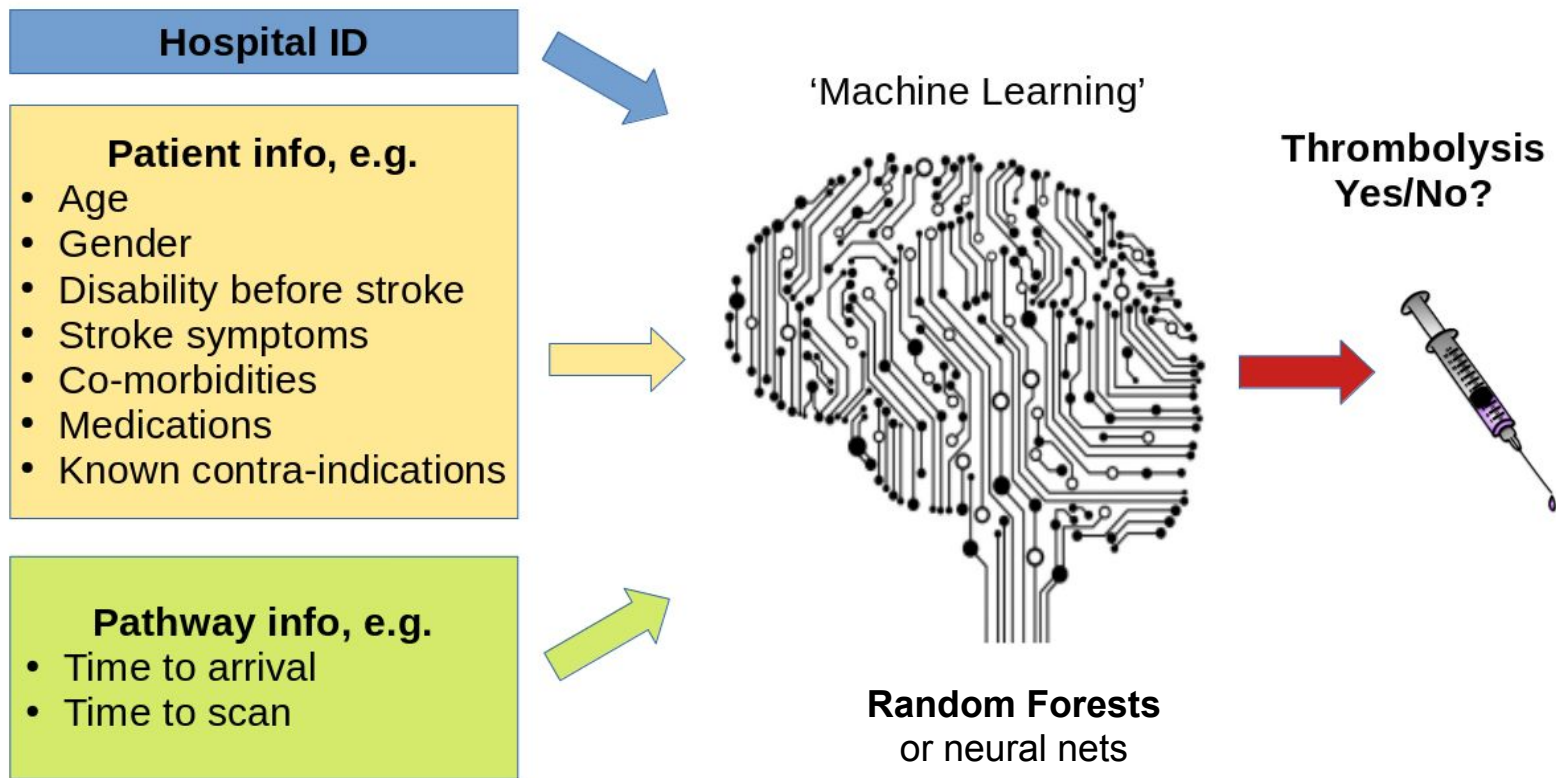
Our model pathway



We model:

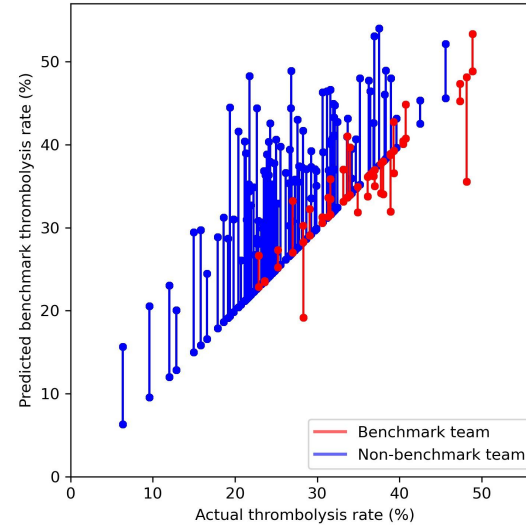
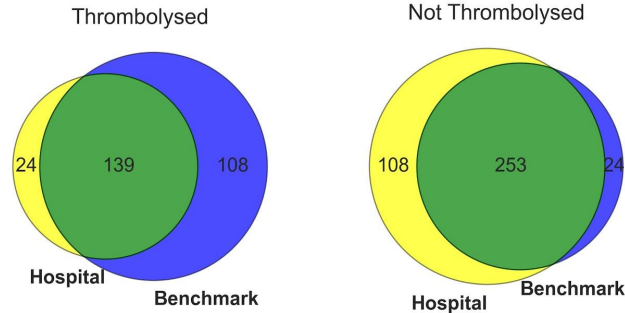
- Speed of patients through different parts of the pathway. What happens if we change these?
- Clinical decision to treat with thrombolysis or not. **What decisions would be likely at another hospital?**

Learning the decisions made at each hospital



Clinical Application

- Training
- Self audit
- Hospital dashboard
- Decision support system?



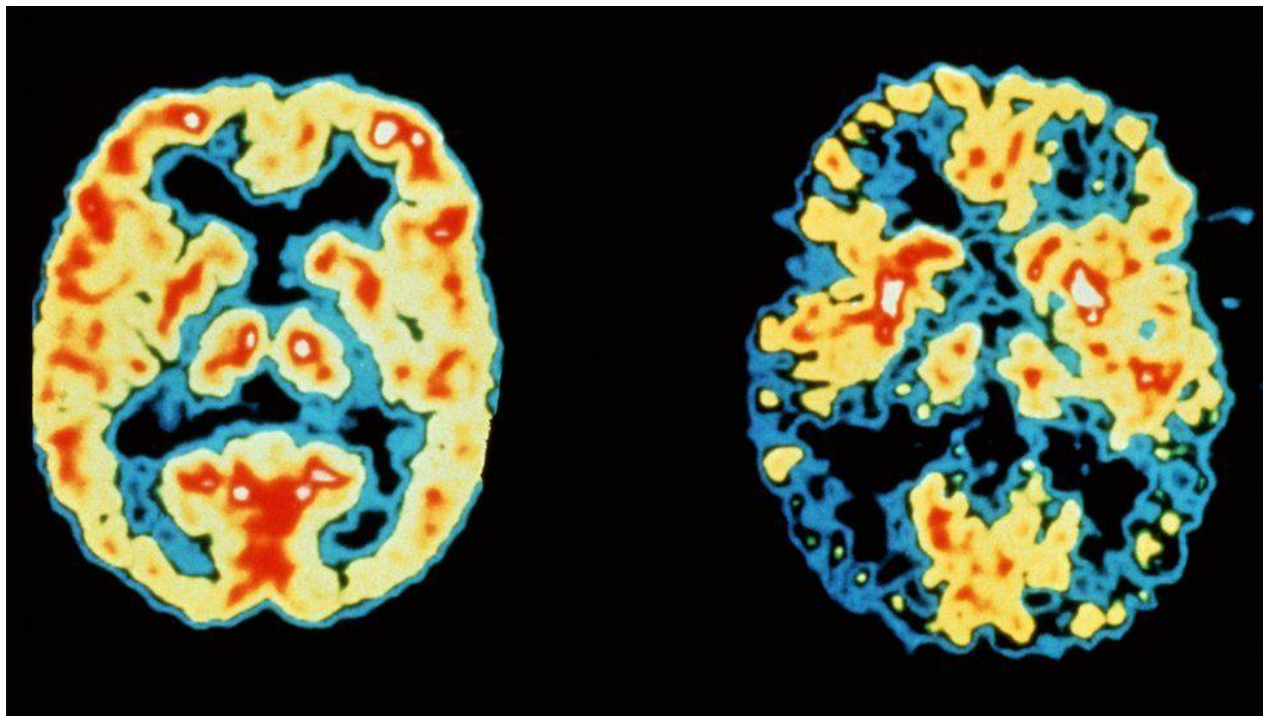
N Patients: 524
Thrombolysis rate (%): 31.1
Agreement (%): 70.0

Predicting incident dementia in memory clinic patients



DEMON Network

Data science and AI for dementia



Data & Population



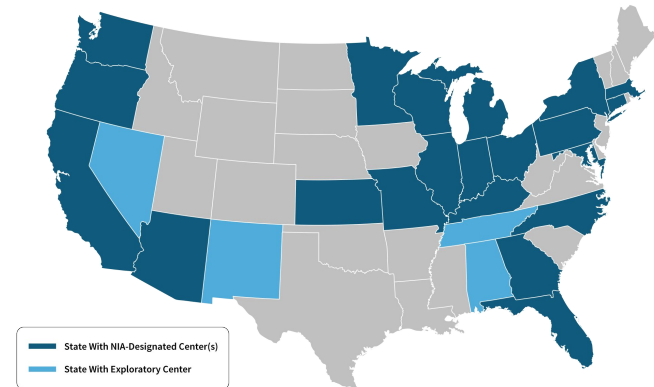
Data

- National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS)
- Collected between September 2005 and February 2015
- 30 centers in the US
- 256 variables*

Population

- 15307 participants dementia free at baseline
- 1568 (10.2%) diagnosed with dementia within 2 years

* variables excluded had text values, were not recorded at initial visit or were constant



Performance: ML outperforms existing methods

	Existing Models ^b		Machine Learning Models ^c			
Performance Measures ^a	BDSI	CAIDE	LR	SVM	RF	XGB
Overall accuracy	0.83 (0.01)	0.76 (0.01)	0.92 (0.00)	0.91 (0.00)	0.91 (0.00)	0.92 (0.00)
Sensitivity	0.37 (0.03)	0.18 (0.02)	0.48 (0.02)	0.46 (0.03)	0.32 (0.03)	0.46 (0.03)
Specificity	0.88 (0.01)	0.82 (0.00)	0.97 (0.00)	0.97 (0.00)	0.98 (0.00)	0.97 (0.00)
Positive Predictive Value	0.92 (0.00)	0.90 (0.01)	0.94 (0.00)	0.94 (0.00)	0.92 (0.00)	0.94 (0.00)
Negative Predictive Value	0.23 (0.02)	0.10 (0.01)	0.63 (0.03)	0.61 (0.03)	0.67 (0.04)	0.66 (0.03)
Area Under the Curve	0.72 (0.01)	0.52 (0.02)	0.92 (0.01)	0.91 (0.01)	0.92 (0.01)	0.93 (0.01)

^a Values represent mean (standard deviation).

^b Values quoted are for recommended thresholds.

^c Values quoted are for a decision threshold of 0.5.

Clinical Application

- Aging population
- Increased service demand
- Decision making aid
- Trial recruitment?



Thankyou & thoughts

Considerations

- Sharing patient data
- Patient autonomy
- Safety and outcomes