

Pop-Up University 2019

Can Artificial Intelligence Accelerate Precision Medicine?

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What is Artificial Intelligence?

[Link](#)

What is Artificial Intelligence?



Robot pepper in Carrefour



Siri



Google Car



Military applications



Chirurgical pediatric robot



Agriculture



Project Malmo - Minecraft



Fitness Tracker

“Artificial intelligence is the new electricity.” – Andrew Ng, Chief scientist, Baidu Research

Precision Medicine

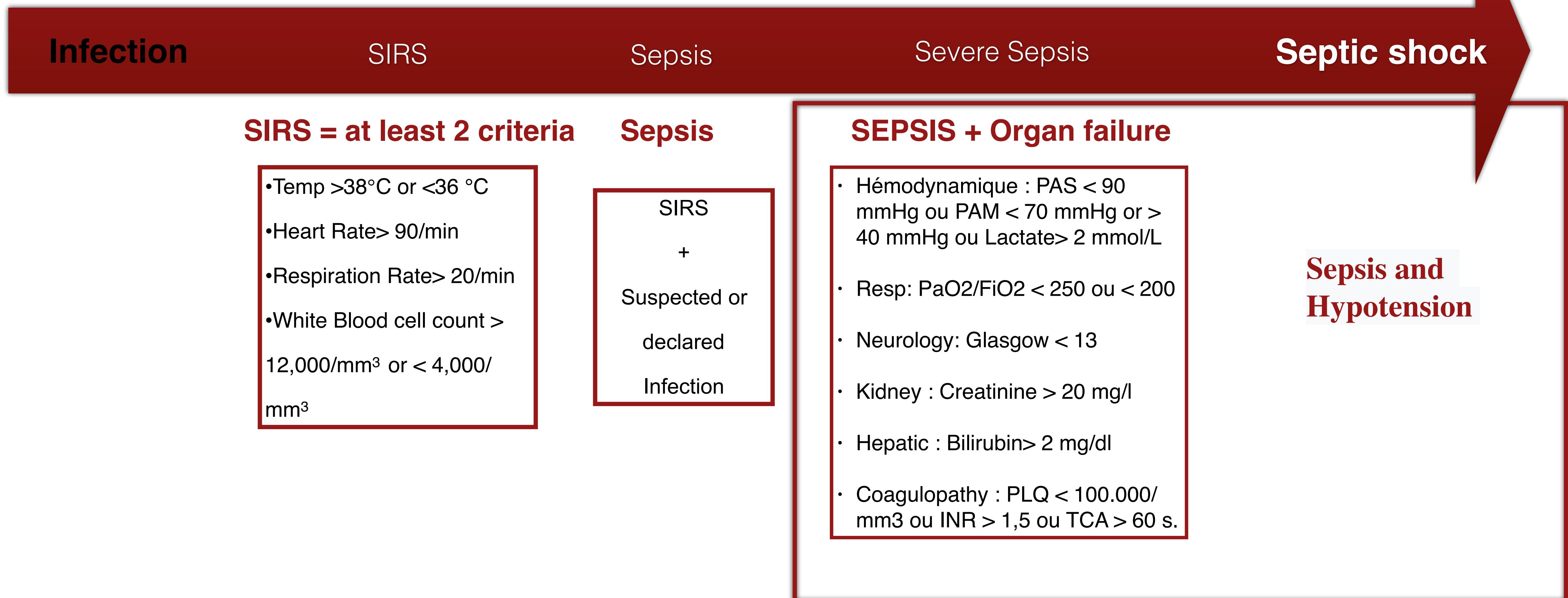
Early Prediction of Sepsis from Clinical Data

- What is Sepsis ?
- Machine Learning, Neural Networks & other complicated words
- Example 1 : Random Forests
- Example 2 : Auto- encoders

Sepsis

Sepsis condition

Sepsis is defined as a life-threatening organ dysfunction caused by a dysregulated body's response to infection.

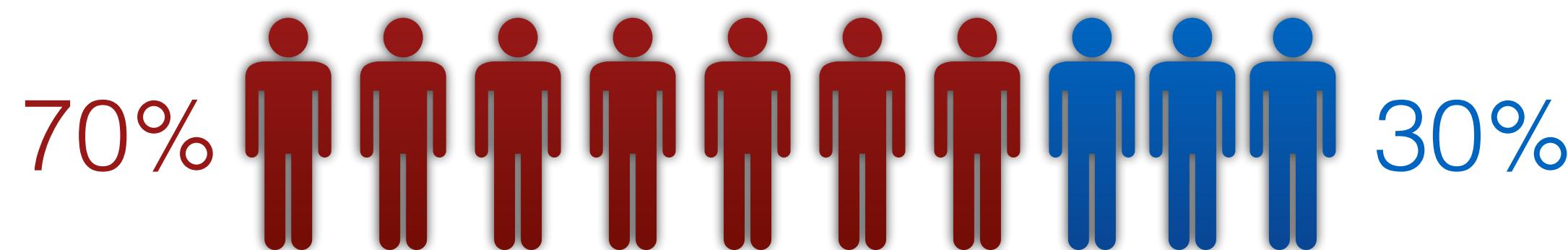


Sepsis - Key Facts

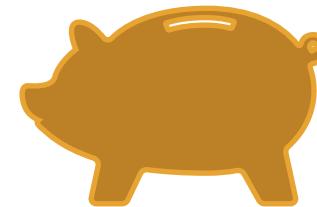
Early identification is a key

Early blood cultures and antibiotics increase survival

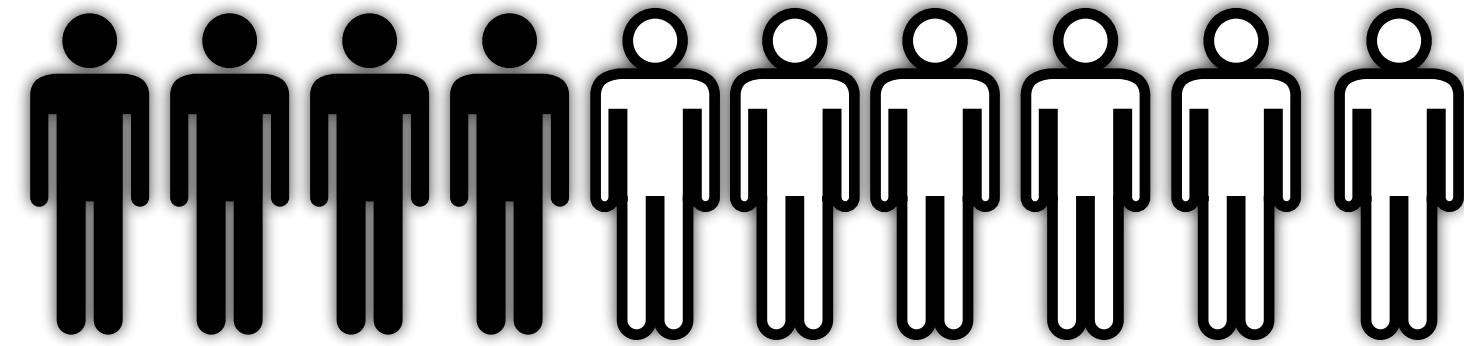
Early recognition and treatment = Reduced hospital stay and



Sepsis cases arise **in the community** and **in hospitals**.



ITU beds for patients with sepsis costs the NHS **2.5 billion pounds per year**.



36000-64000 deaths due to sepsis in the UK each year

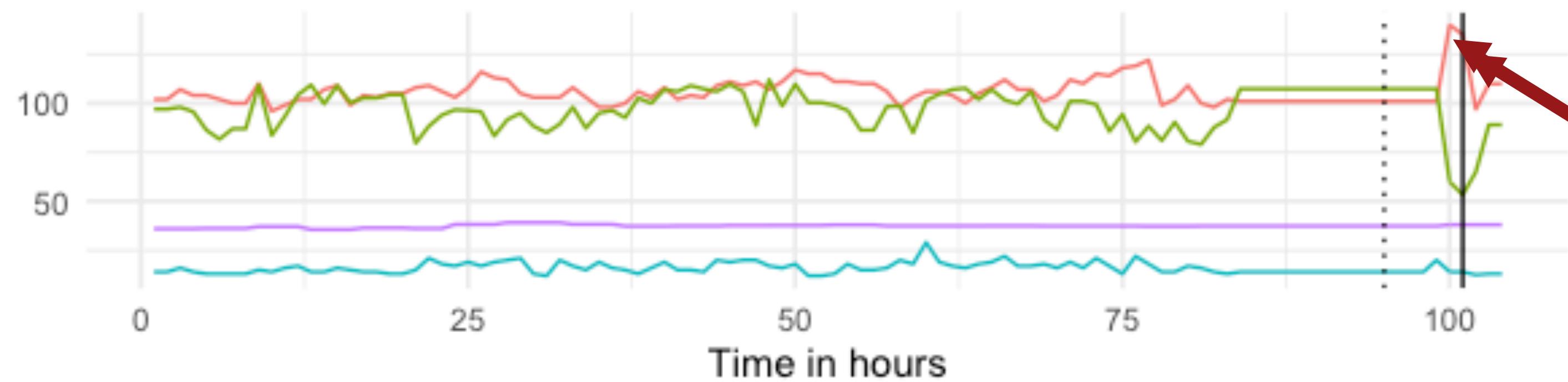


30 million people worldwide every year, potentially leading to 6 million deaths

- NHS, 2016, <https://www.aquanw.nhs.uk/resources/sepsis-key-facts/23050>
- World Health Organisation (WHO), 2018, <https://www.who.int/sepsis/en/>

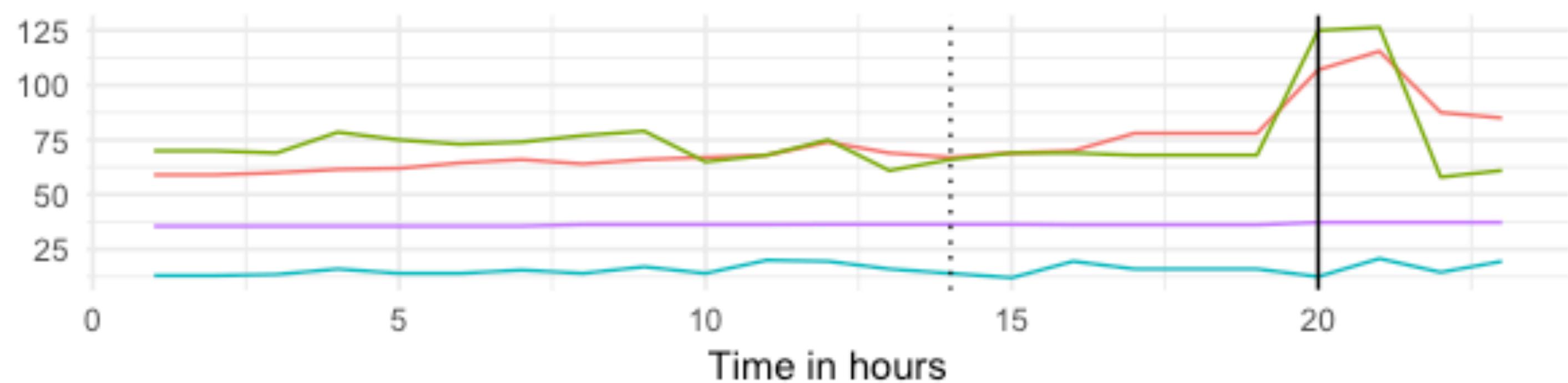
Early prediction of Sepsis from Clinical Data

A Patient p000078



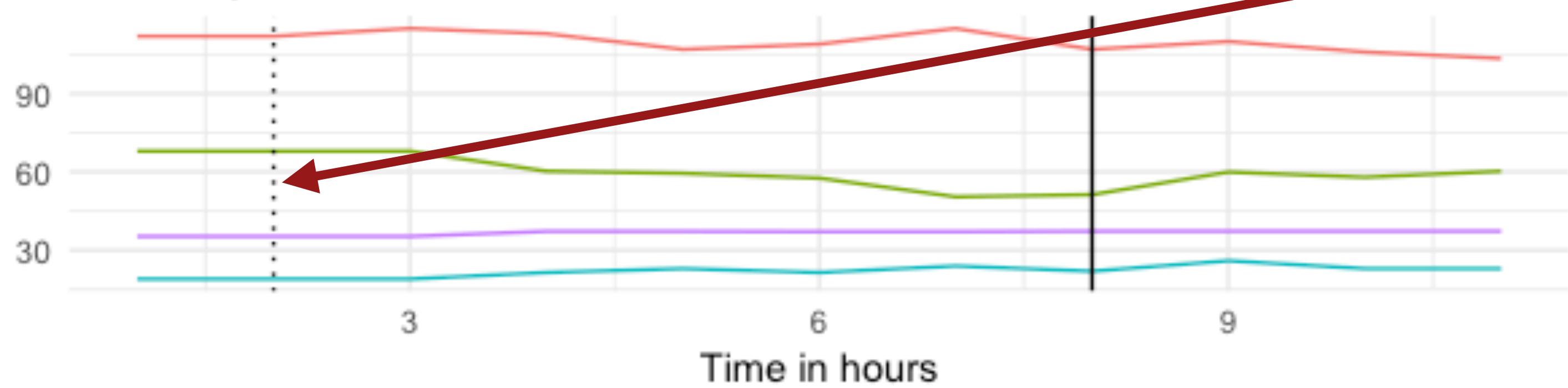
current time
where sepsis is
reported

B Patient p001461



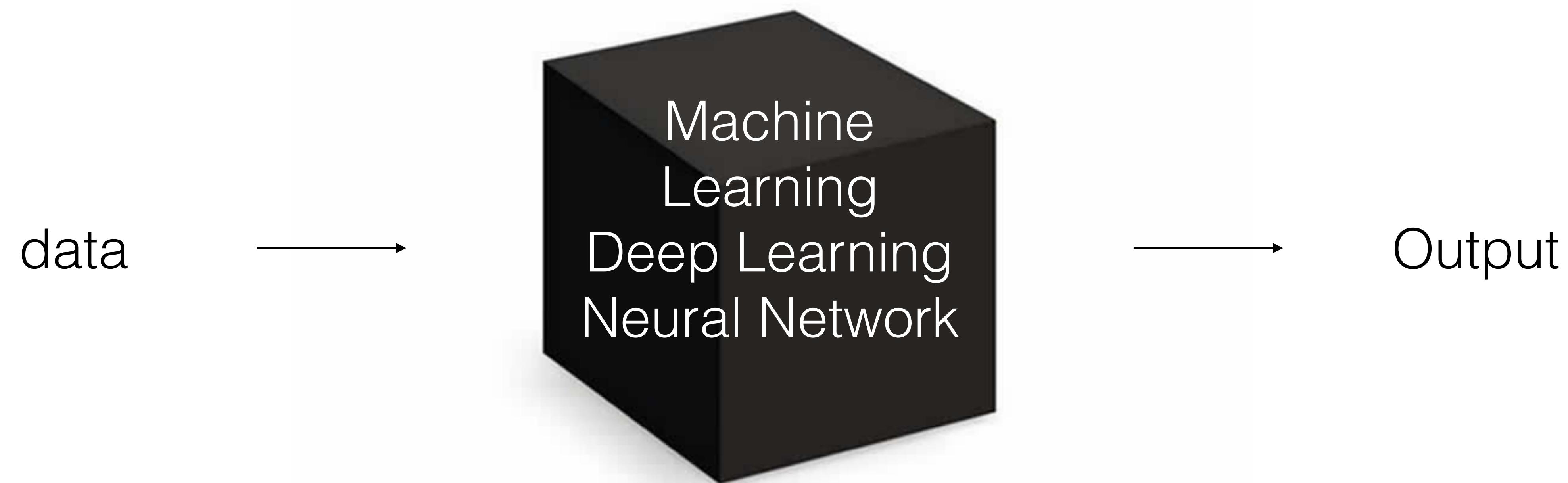
desired
prediction six
hours in
advance

C Patient p000384



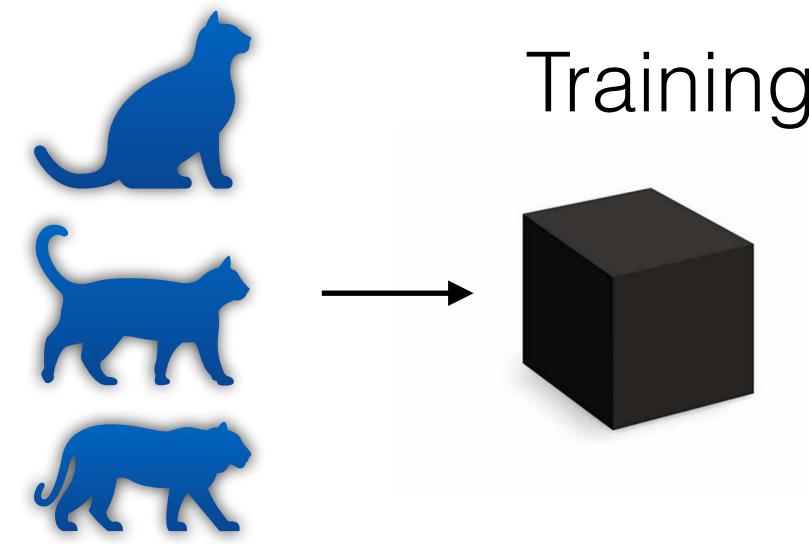
Machine Learning

A black box ?

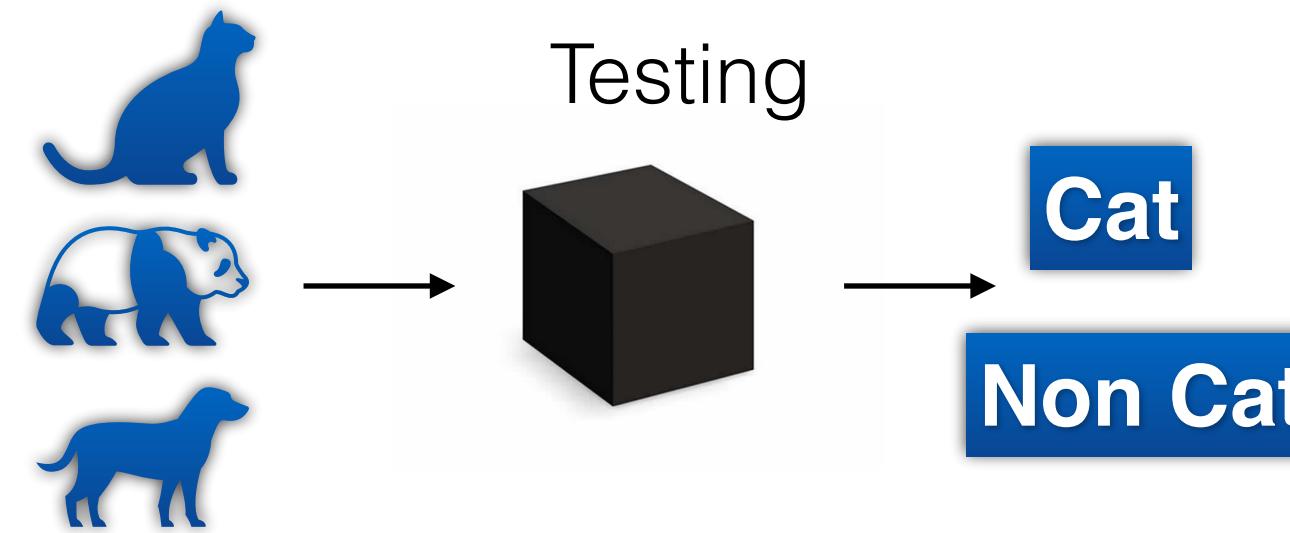


Supervised Learning

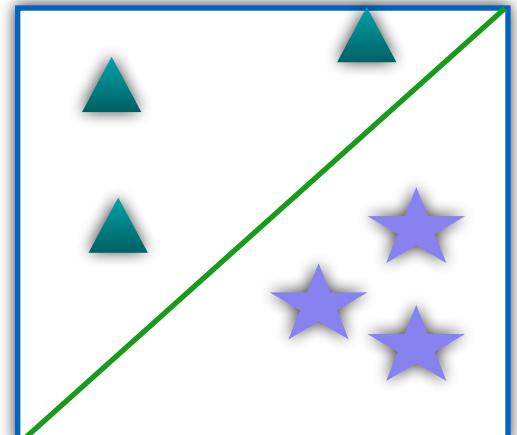
Label Cats



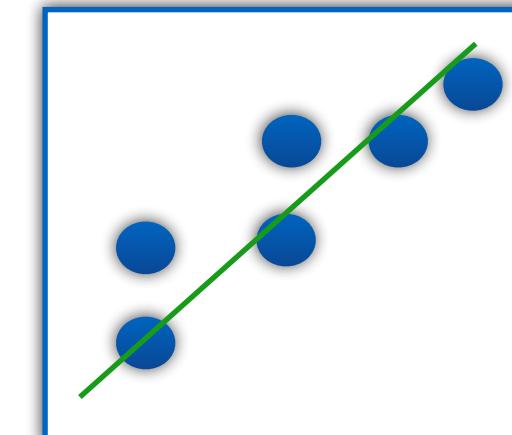
Testing



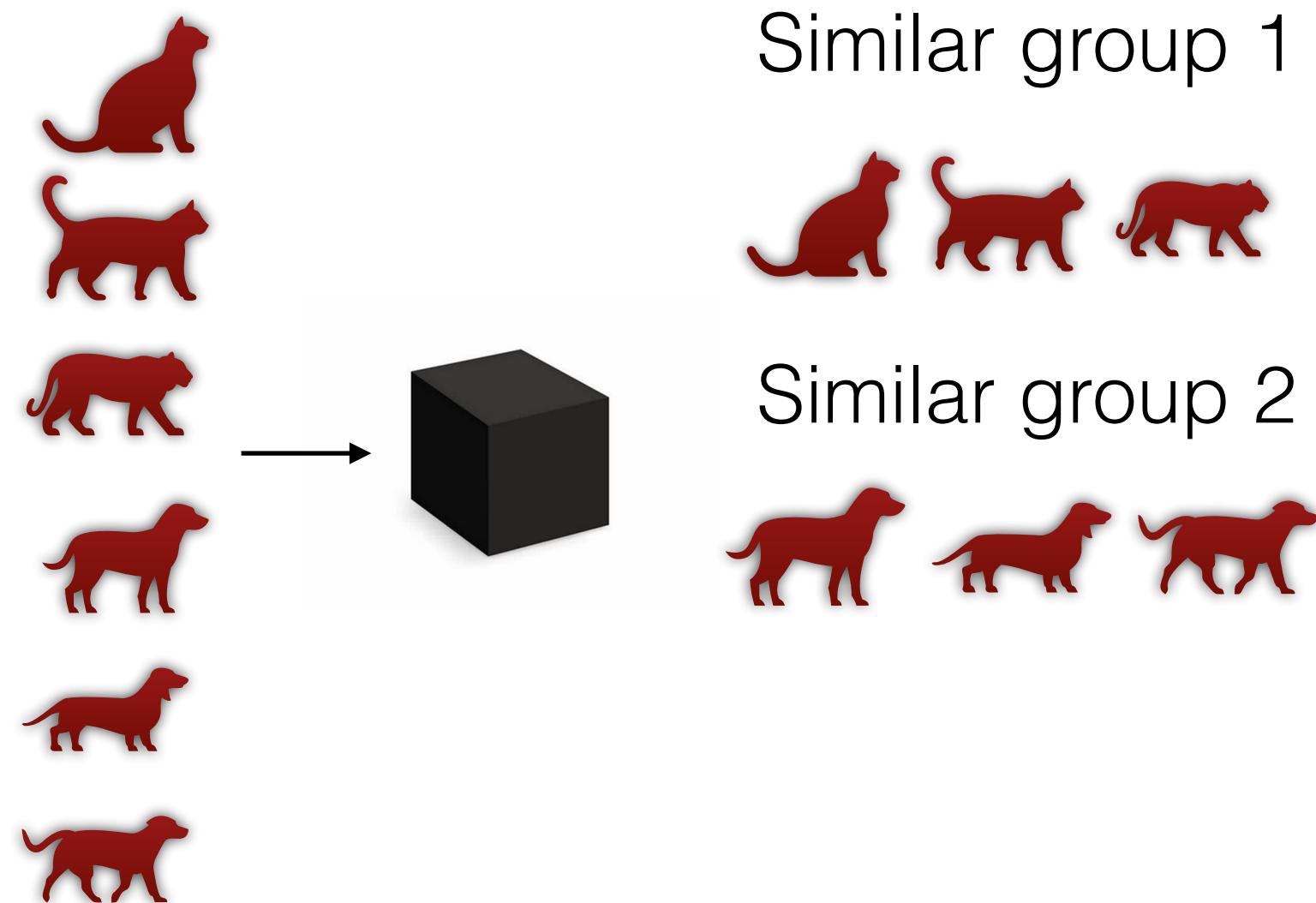
Classification



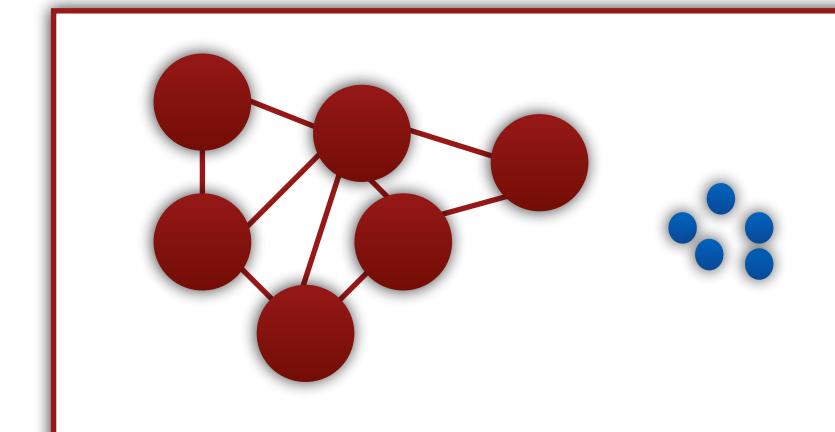
Regression



Unsupervised Learning



Anomaly detection



Reinforcement Learning

Cake analogy, NIPS 2016, Yan Lecun, Facebook AI Paris

“If intelligence is a **cake**, the bulk of the **cake** is unsupervised learning, the icing on the **cake** is supervised learning, and the cherry on the **cake** is reinforcement learning”

Supervised Learning

Decision Trees

Do you like sushi?



Yes

No

1. Do you know how to use chopsticks ?

Yes 70%

No 30%

Yes

No

Yes 60%

No 40%

2.1. Are you asian ?

2.2. Are you healthy ?

Yes

80%

Yes

No

Yes

No

3.1. Do you watch manga ?

3.3. Are you pesco-vegetarian ?

Yes

No

Yes

90%

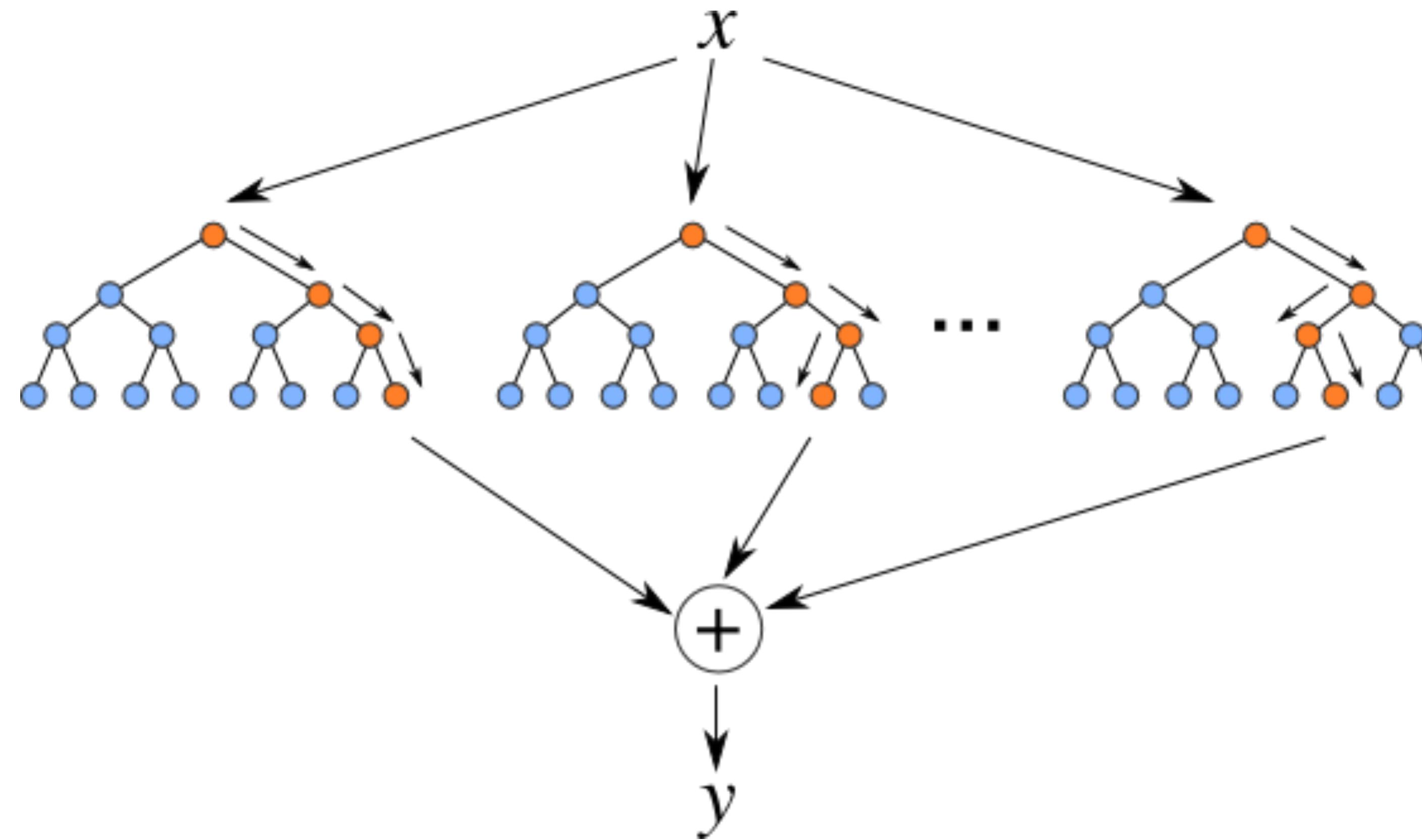
Yes

No

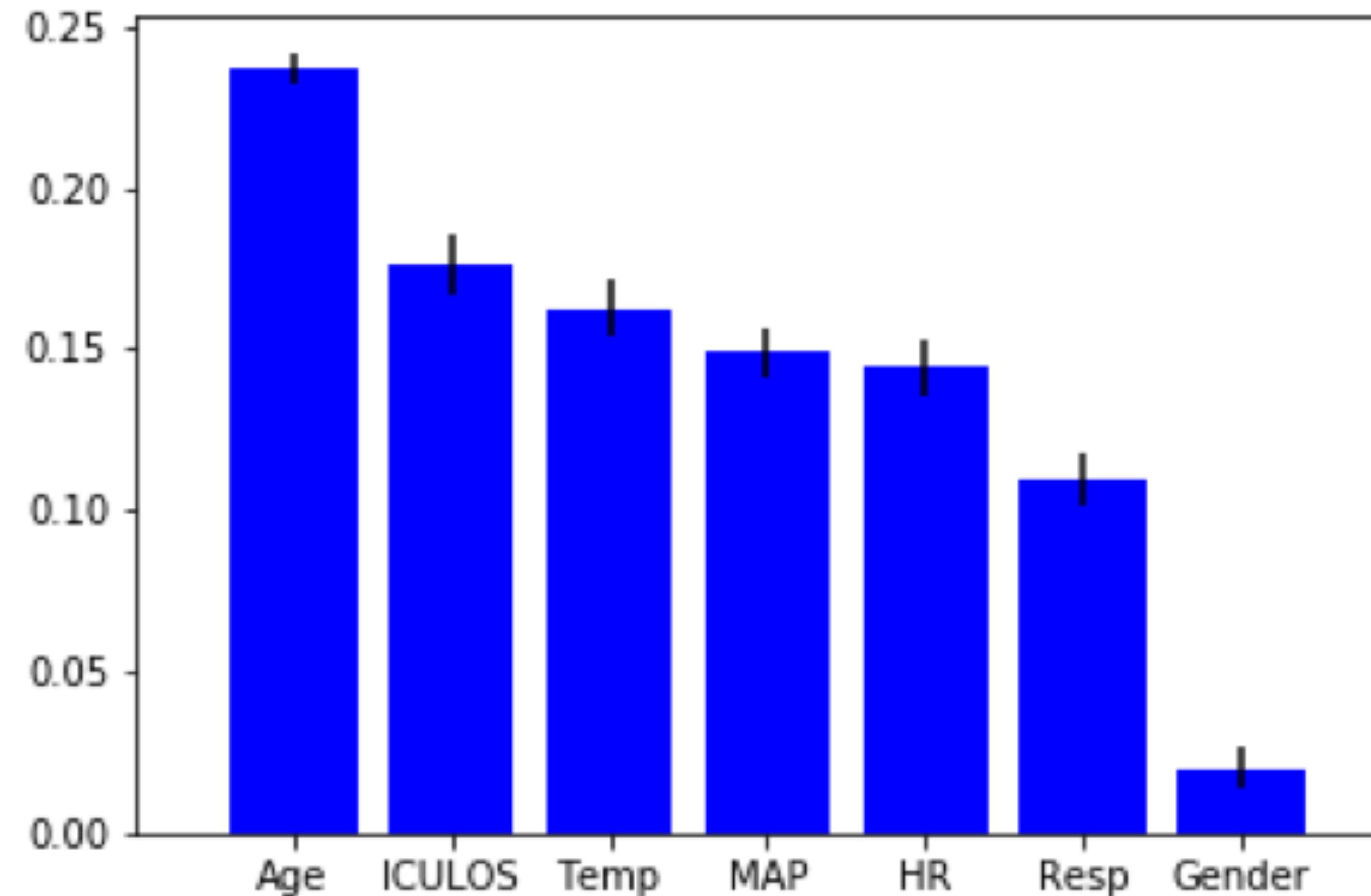
Yes

70%

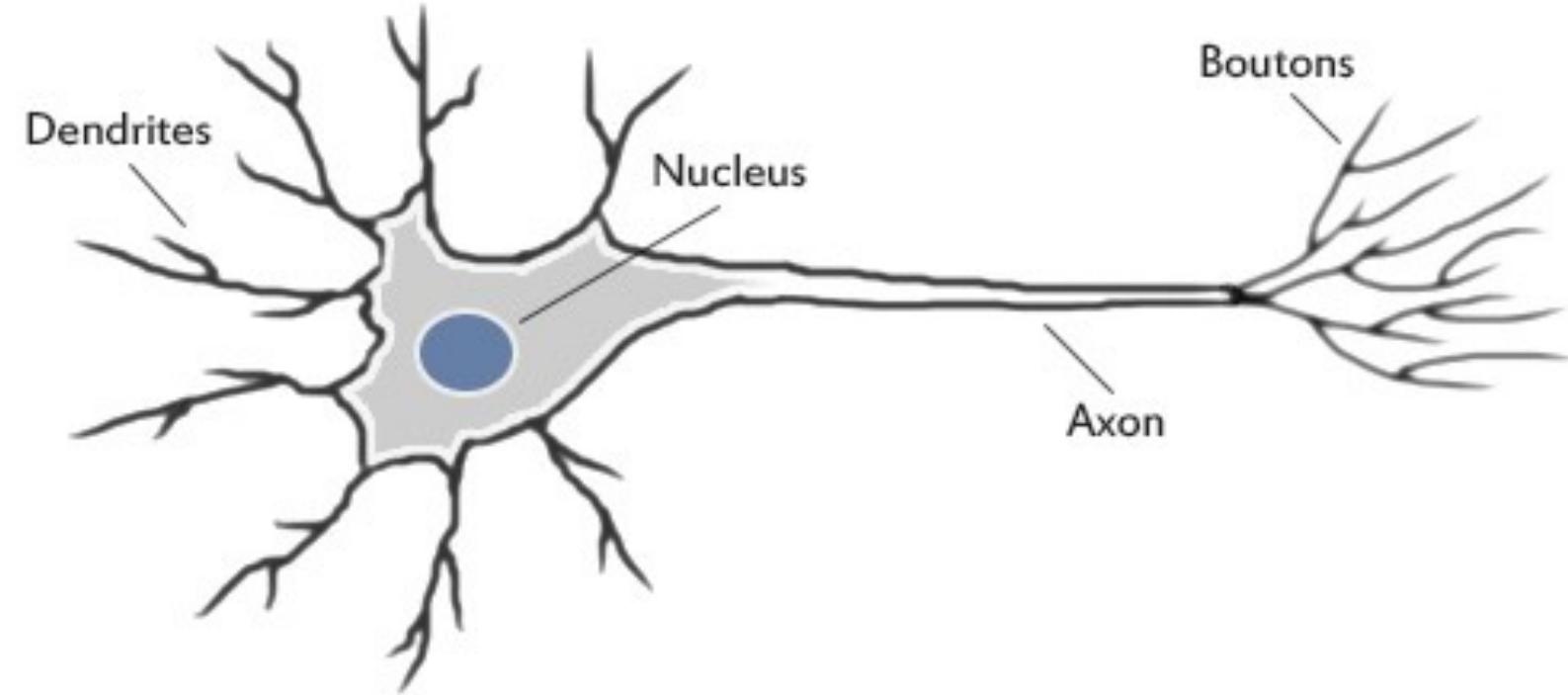
Random Forests



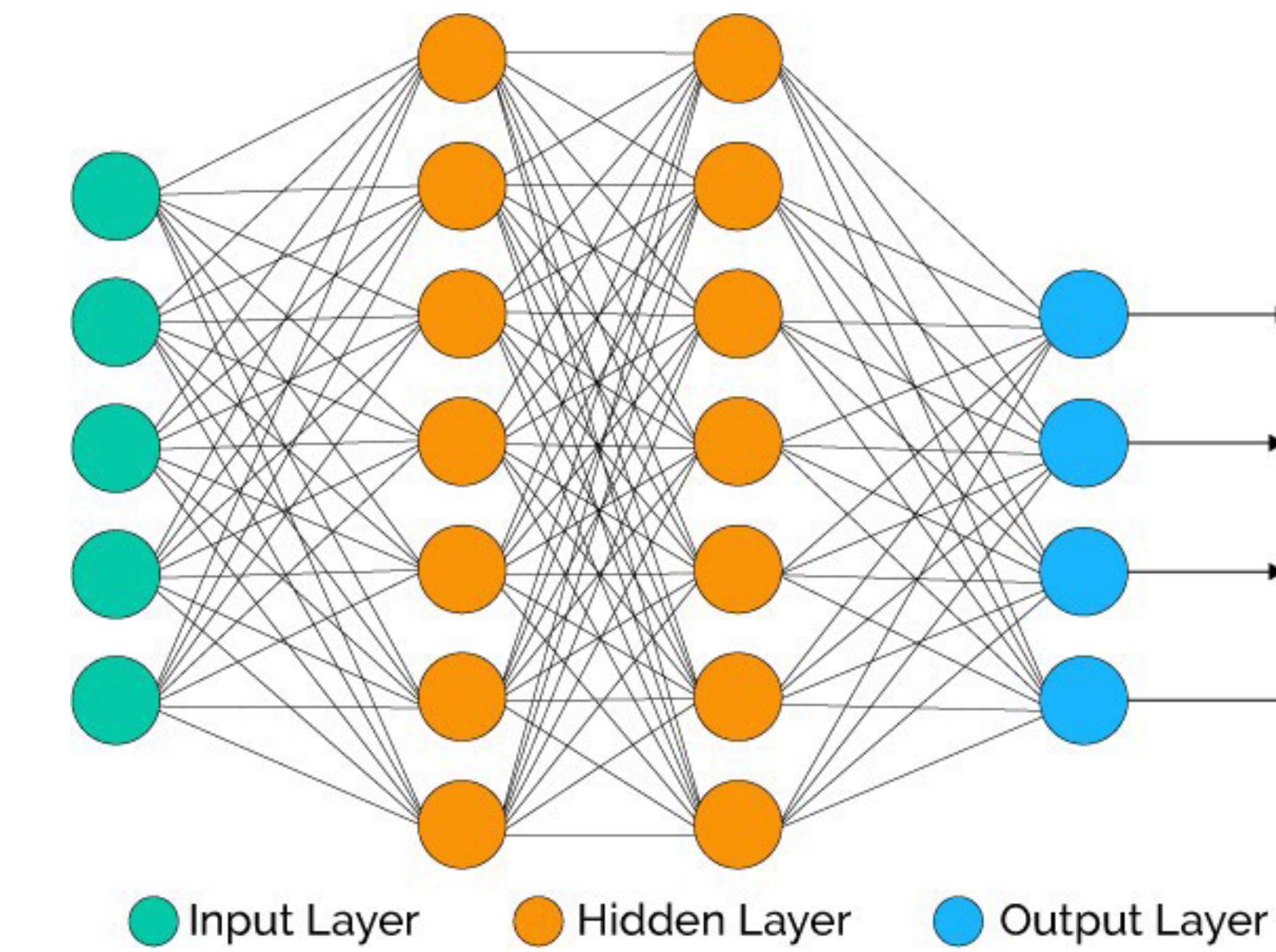
Random forest feature importance



Neural Network (NN)



A Neuron in the Brain

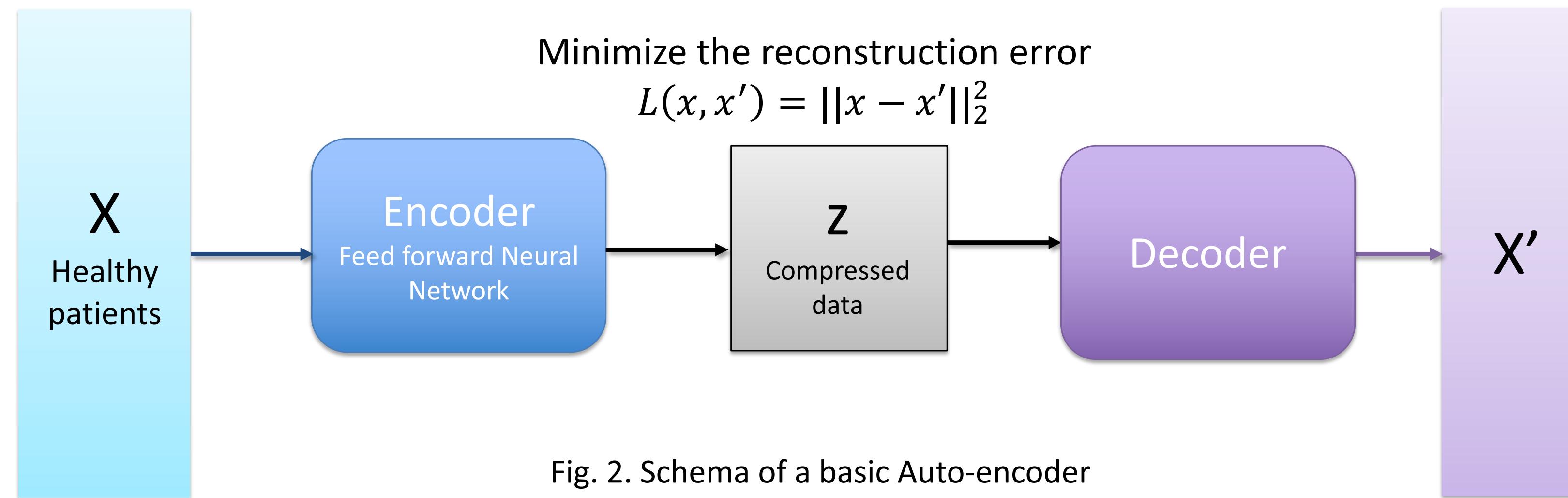


Artificial NN

Unsupervised Learning

Auto-encoders

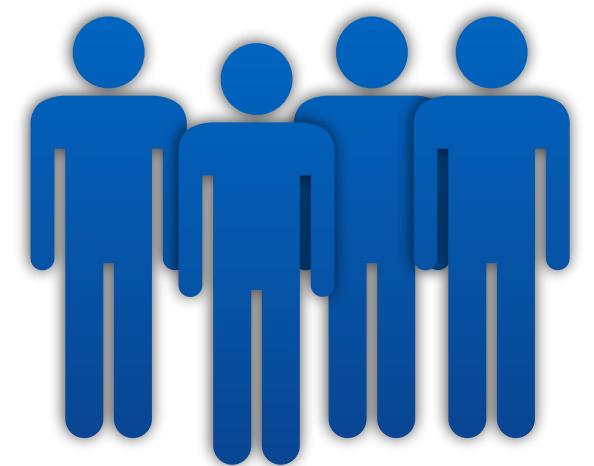
- Neural network
- Unsupervised learning
- Learn a compressed representation of an input



Sepsis



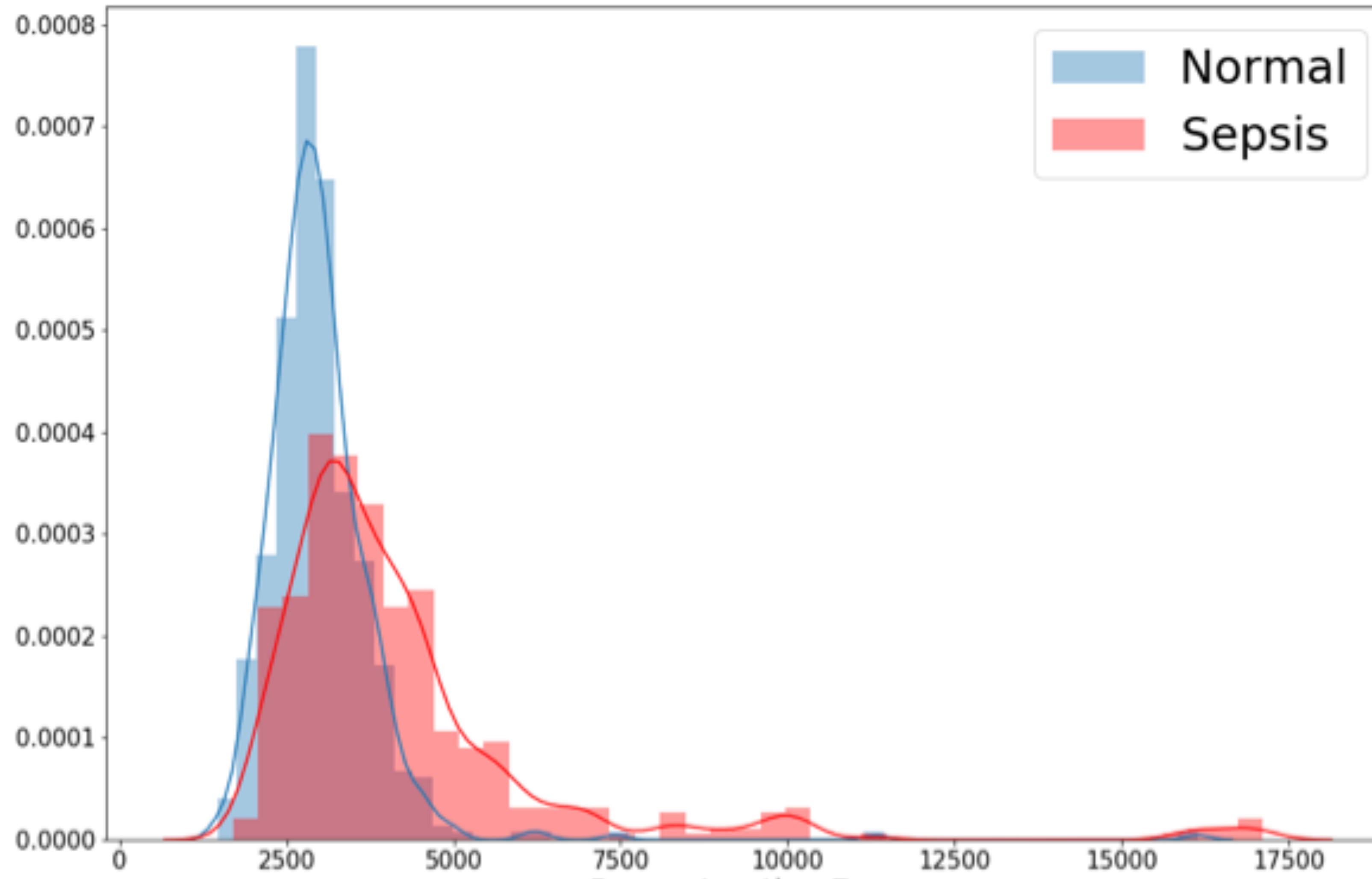
Auto-encoder NN



Healthy

What about the
reconstruction error ?

Reconstruction Error for test dataset using the Auto encoder



Additional Information

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Sepsis challenge

- The PhysioNet Computing in Cardiology Challenge 2019

<https://physionet.org/content/challenge-2019/1.0.0/>



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Some papers

- Breiman, Leo. 2001. “Random Forests.” *Machine Learning* 45 (1): 5–32
- Rumelhart DE, Hinton GE, Williams RJ. Learning representations by back-propagating errors. *Nature* October 1986;323(6088):533–536.

Presentation here :

<https://github.com/ineskris/PopUpUniversity2019>