Predicting Length Of Stay Using Neural Networks on MIMIC III
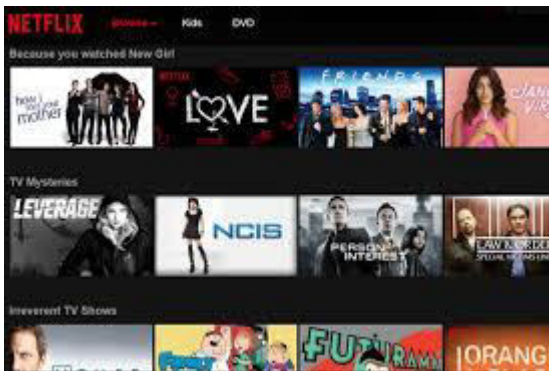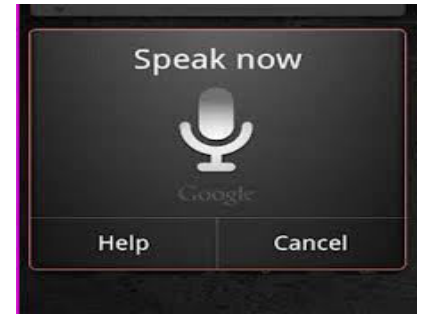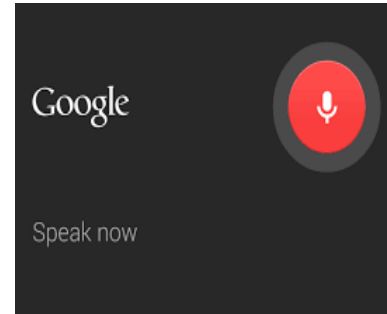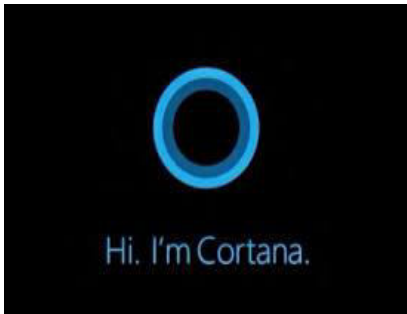
Thanos Gentimis

New Orleans

October 9th 2017

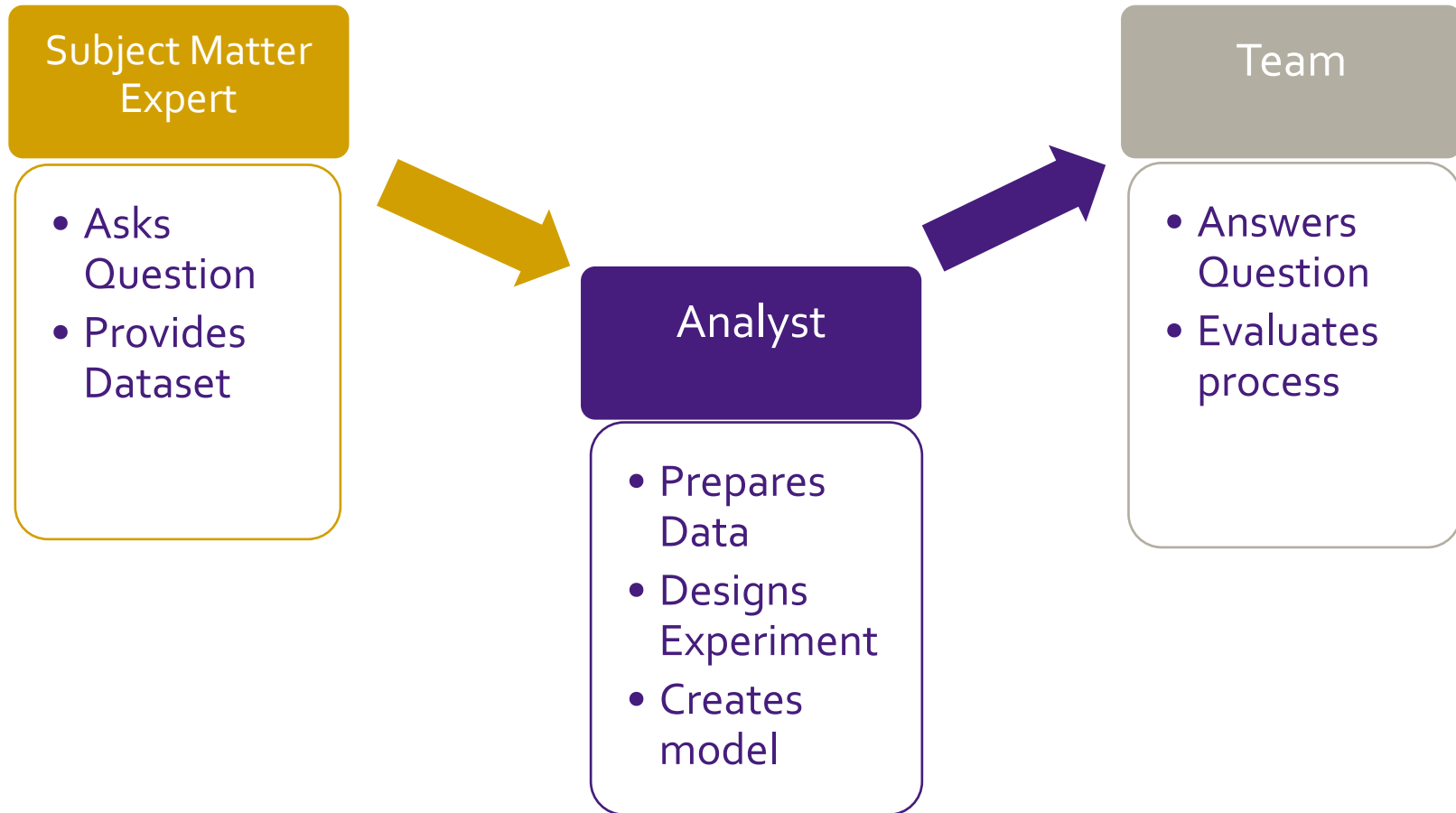# Have you used machine learning recently?
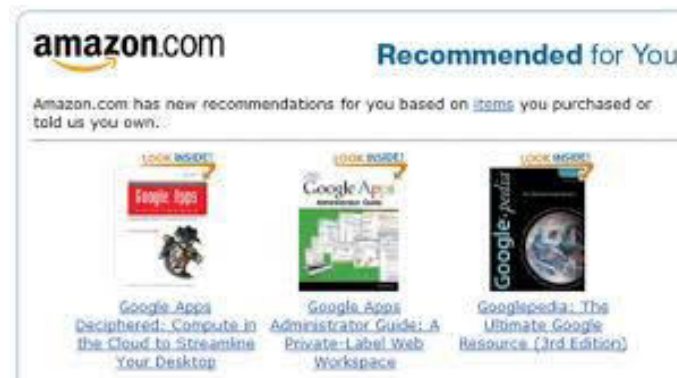
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Machine Learning is Useful

- Healthcare:
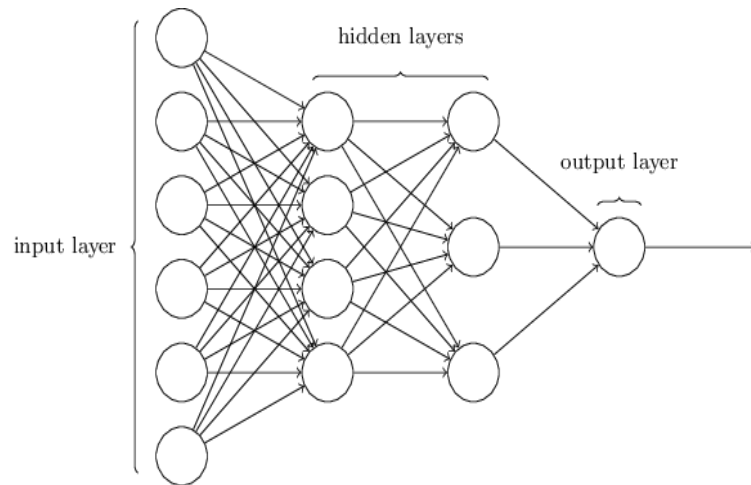 - AI assisted diagnoses (IBM Watson)
  - Health Informatics
- Banking:
  - Fraud detection
  - Risk analysis
- Safety:
  - Face recognition – intruder detection
  - Spam email detection

Classic Research Approach

Subject Matter Expert

- Asks Question
- Provides Dataset

Analyst

- Prepares Data
- Designs Experiment
- Creates model

Team

- Answers Question
- Evaluates process

Machine Learning Approach

Data Warehouse
- Data Collection
- Data Coming in

Analyst
- Clustering
- Trend Analysis
- Machine Learning
- Outlier Detection

Subject Matter Expert
- Explains Trends
- Evaluates Outliers
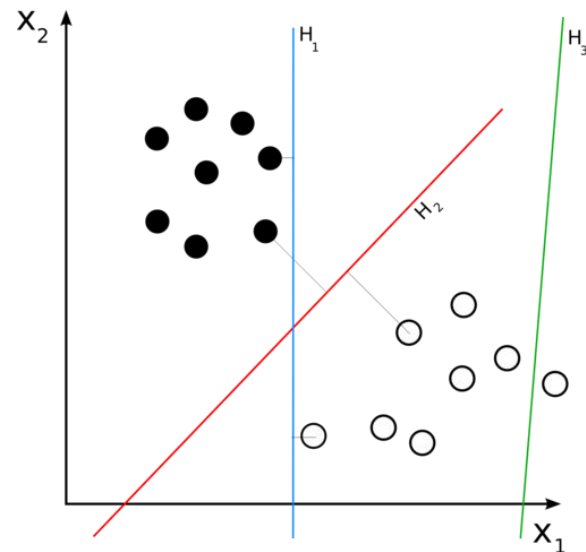- Asks the right questions

Machine Learning Tools

- Neural Networks

- Support Vector Machines

How I use Neural Networks

Individual Neuron

Neural Network Description
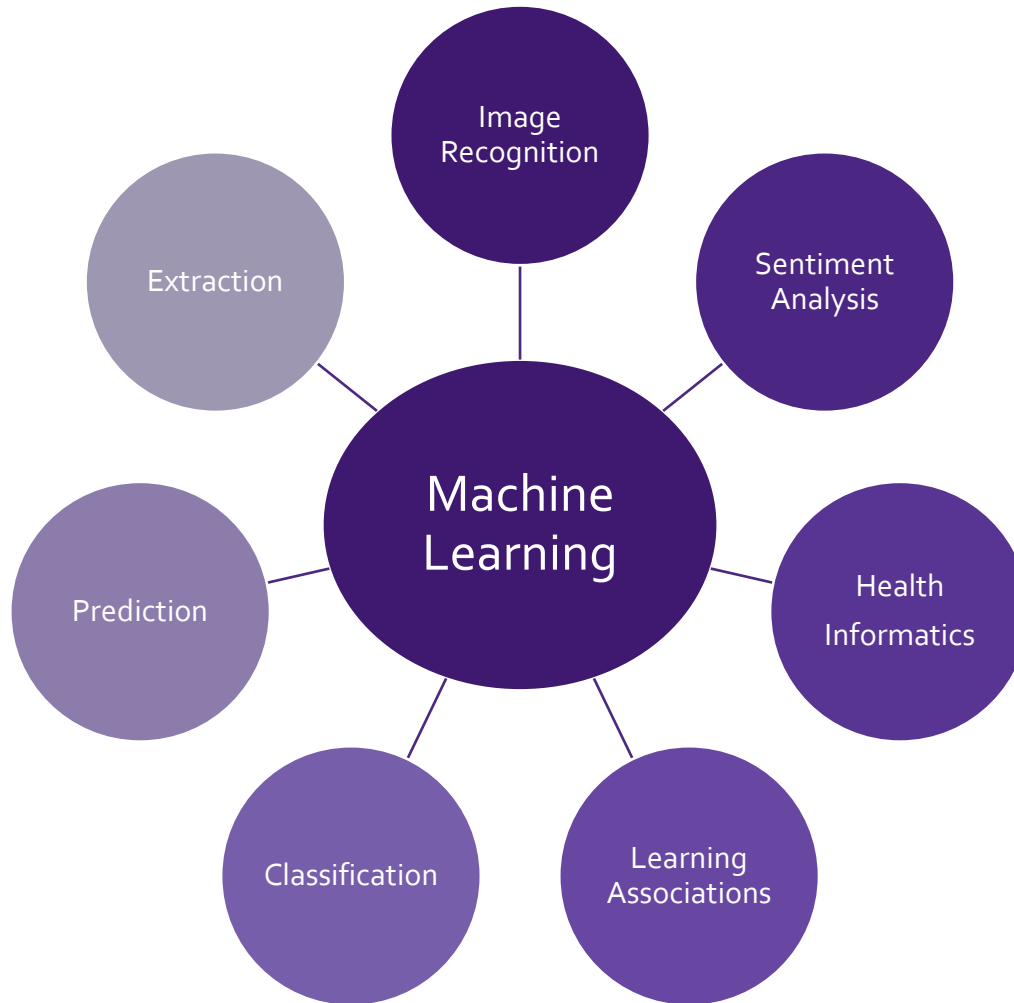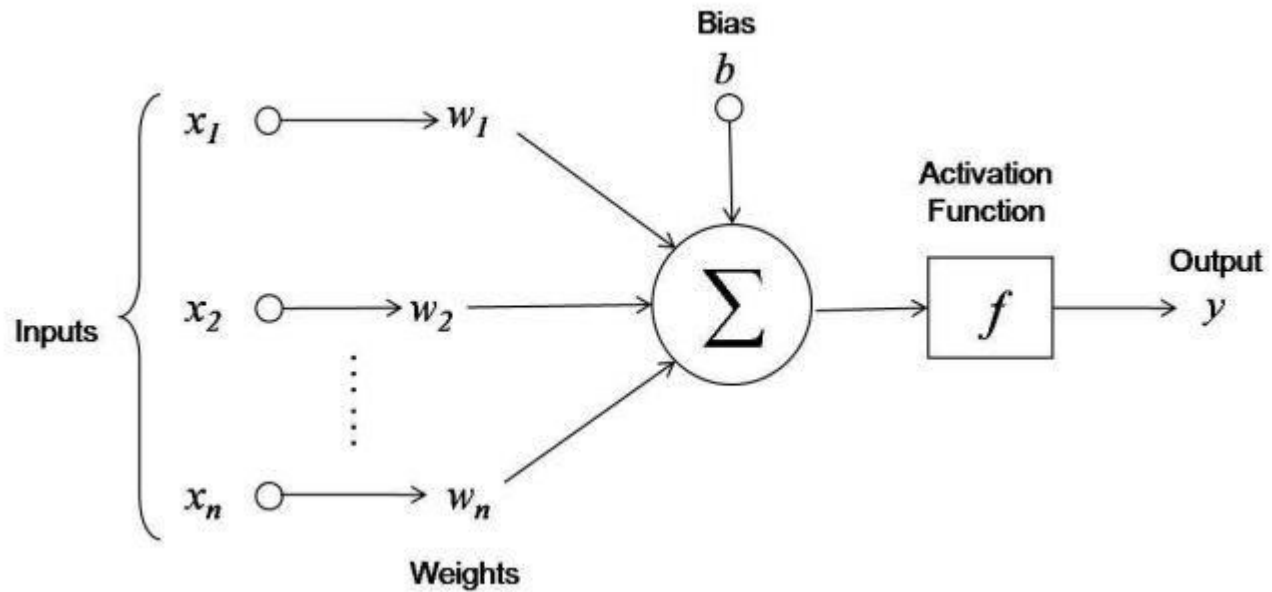
- Functions used:
  - ➢ Linear
  - ➢ Multi-quadratic
  - ➢ Gaussian
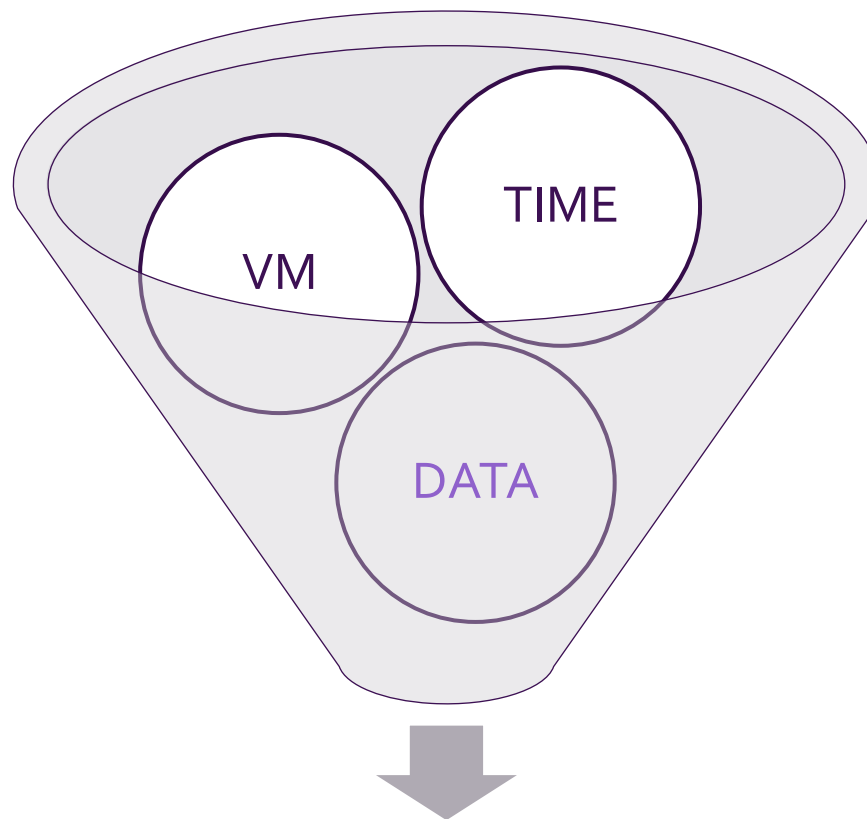 - ➢ Logistic
  - ➢ ...

Obvious Questions-Obvious Answer
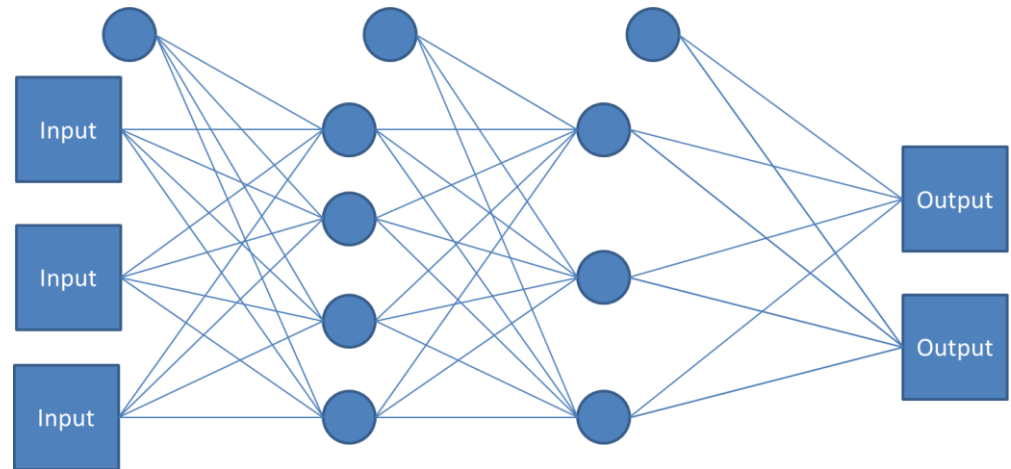
- What is the right architecture?
- Which are the right functions?

TRY ALL OF THEM!!!!!!!!!!!

Calculations, Calculations Everywhere!

VM

TIME

DATA

Best Configuration

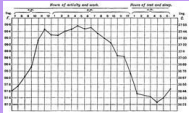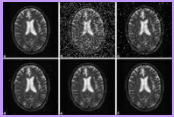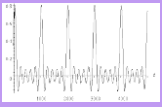# MIMIC III database

46.000 patients

26 data tables

4+ Millions of rows in some tables

100+ input variables

Images and time-series

Connections between variables

Given specific health indices and characteristics of a patient right after a stay at the ICU, predict the total length of stay at the hospital.

Neural Networks at work

Age	Gender	ICU LOS	SI	Vitals	Notes		Long Stay
34	M	12D	1		The patient suffered ..	…	N
50	F	13D	2		High blood pressure …	…	Y
60	M	1M	12		3 cc of Benadryl…	…	Y
…	…	…	…	…	…	…	…
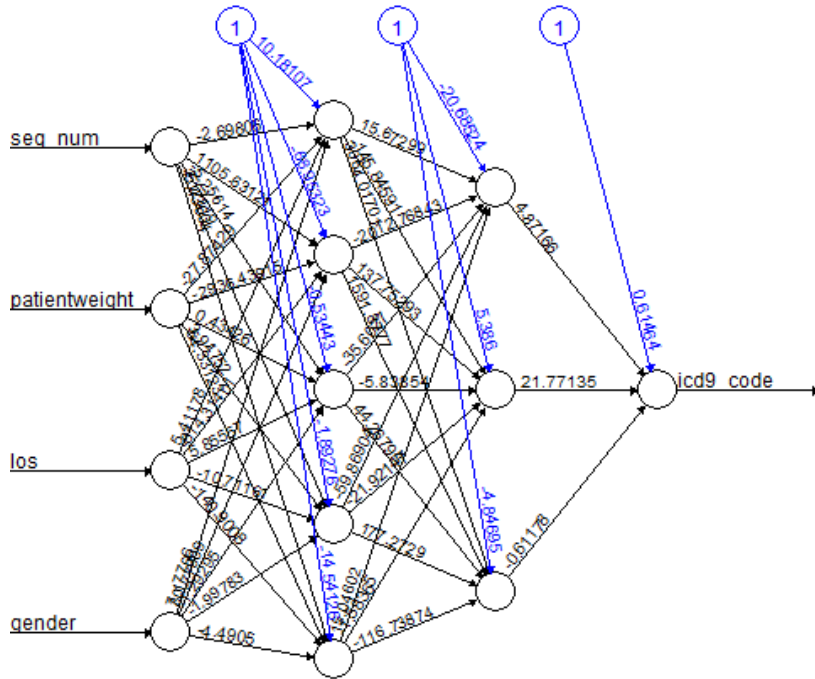
Error: 9.849108   Steps: 35408

- Predicting comorbidities
- Predicting death
- Predicting sepsis
- Predicting Cancer
- Predicting Length Of Stay (LOS)

Short vs Long Stay
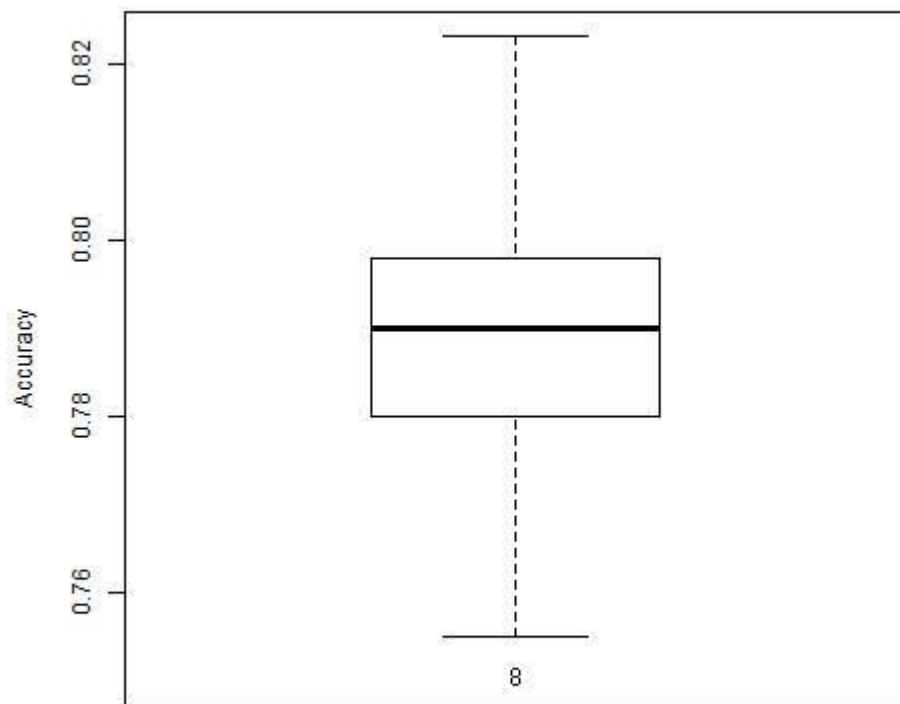
- 79% Accuracy
- Increase:
  - Number of input variables (37)
  - Size of input data (200,000 stays)
  - Specific diseases

New Results

- Aortic Aneurysm (92%)

- Transient Ischemic Attack (90%)

- Increase overall Long/Short prediction (87%) ??

- Predict length of stay +-2days (85%)

Final Remarks

Different Way of Thinking

Great at Prediction

Bad at "telling a story"

Perfect for Collaboration

Interests-Potential Collaborations

Interested in
Health Informatics (Any data, any question)
Precision Agriculture and machine learning
Sentiment analysis (twitter data)
Price analysis (commodities)
Networks (Topological Data Analysis)

THANK YOU!

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