Machine Learning

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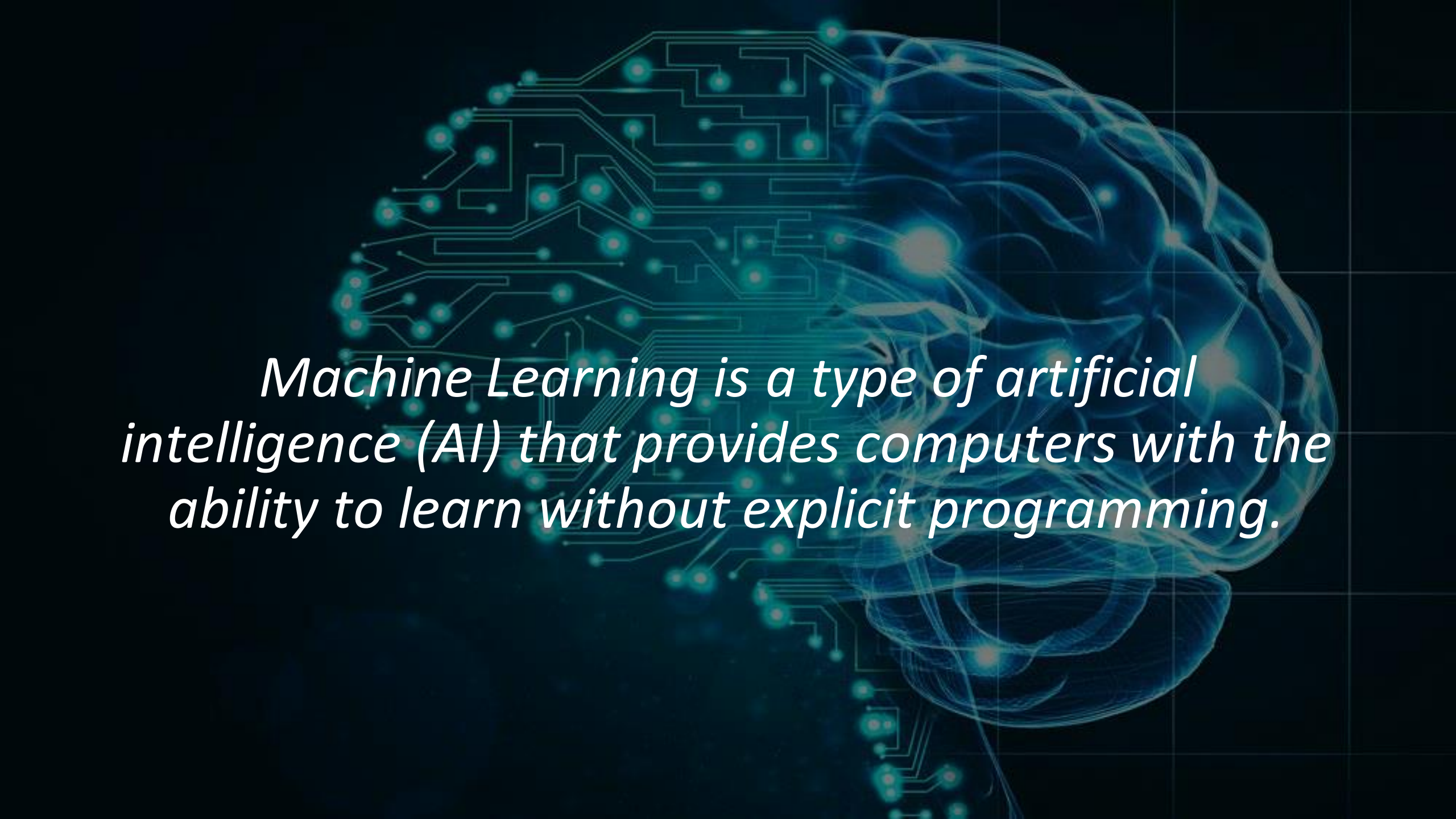
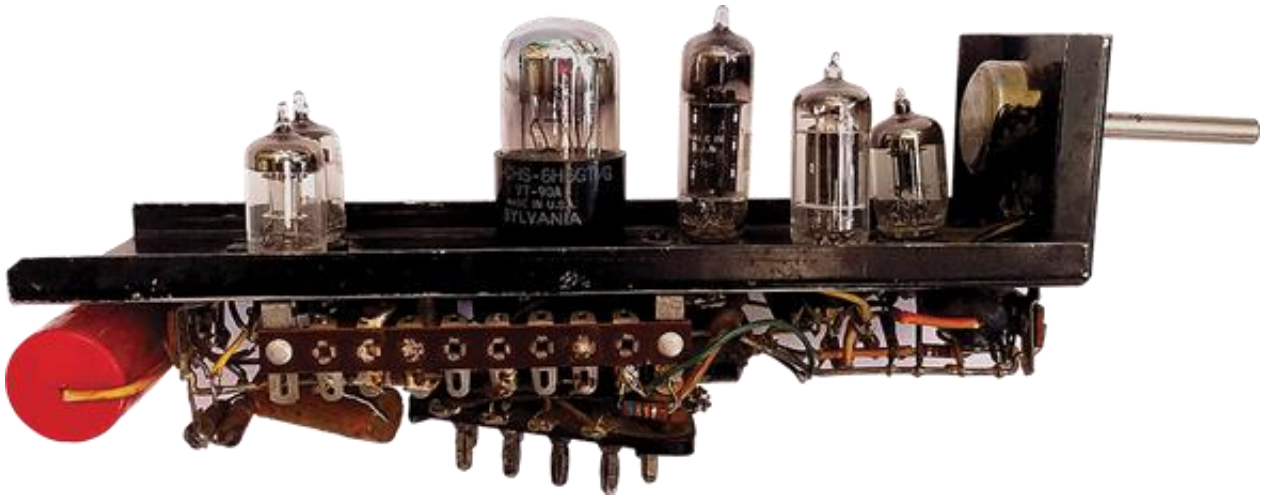

Machine Learning is a type of artificial intelligence (AI) that provides computers with the ability to learn without explicit programming.

History

- Based on “old mathematics”
  - 1800s Bayes Theorem, Least squares linear regression
  - 1900s Markov Chains

First postulations around 1950:

- Alan Touring: "learning machines"
- SNARC
- Checkers program



Timeline

- “Machine Learning” coined in 1959
  - Synonym "self-teaching computers“

- 1970s pessimism caused "AI Winter"
- 1980s Resurgence
- 1990s knowledge-driven → data-driven approach
- 2000s Boom

Groundwork

Established ideas before 2000s

- **Multi-layer networks**
  - Perceptrons
  - Convolutional neural networks
- Markov decision process
- **Nearest neighbour algorithm**
- Backpropagation
- Boosting
- **Random decision forests**
- …

Achievements

- 1979 Stanford cart
- 1997
  - IBM Deep Blue
  - First Deepfake software
- 2009 ImageNet
- 2016 AlphaGo

What is Machine Learning?

- Imitate human learning
- Use of Data and Algorithms
- Gradually improving its accuracy
- Different Approaches

- Achieve either or both
  - Classify data
  - Predict data

What is Machine Learning?

- ML vs Artificial Intelligence
  - ML imitates human learning
  - AI replaces human agent

- ML vs Data Mining
  - ML predicts with known properties
  - DM finds unknown properties

Approaches #1

Supervised Learning

- labelled input & output
- interpret pattern

e.g. image recognition

Unsupervised Learning

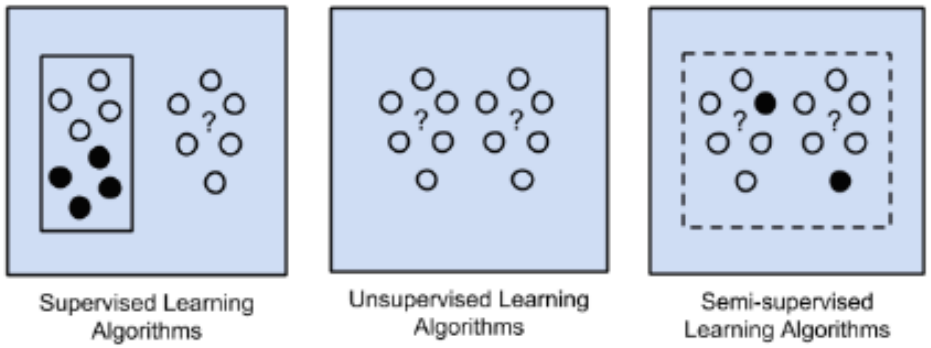
- unlabelled input & output
- find hidden pattern

e.g. product recommendations

Approaches #2

Semi-Supervised Learning

- partly labelled input
  - Easier training
  - Better accuracy



Reinforcement Learning

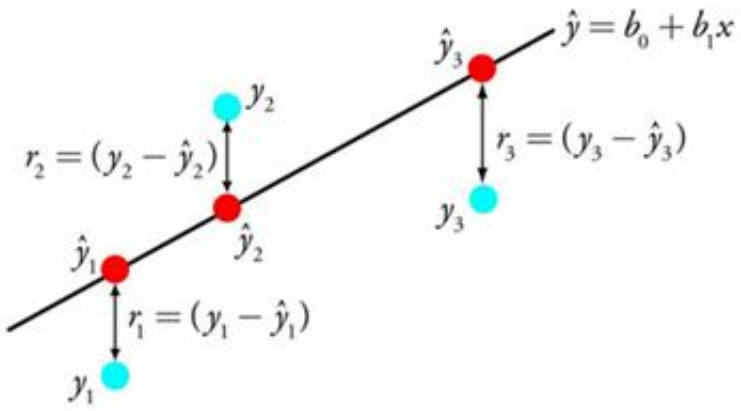
- dynamic environment
- achieve goal
- maximise reward

e.g. autonomous driving, playing games (against humans)

Regression Algorithms

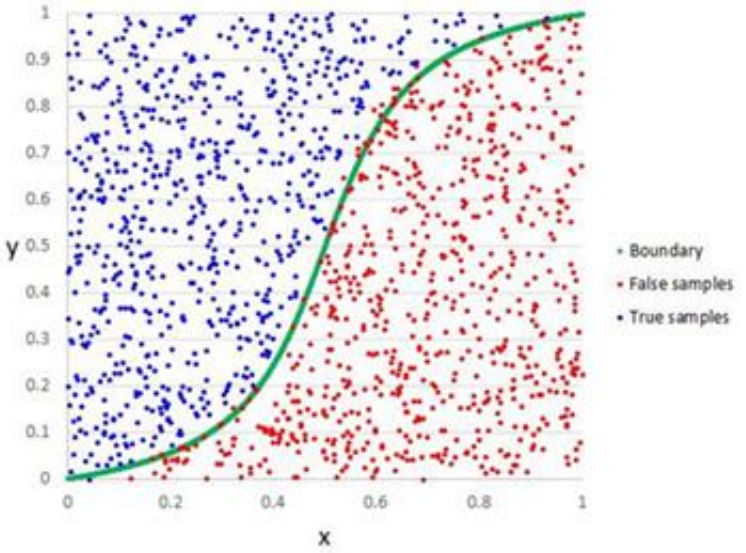
Linear Regression

- remove correlated variables
- remove noisy data
- minimize error of the model

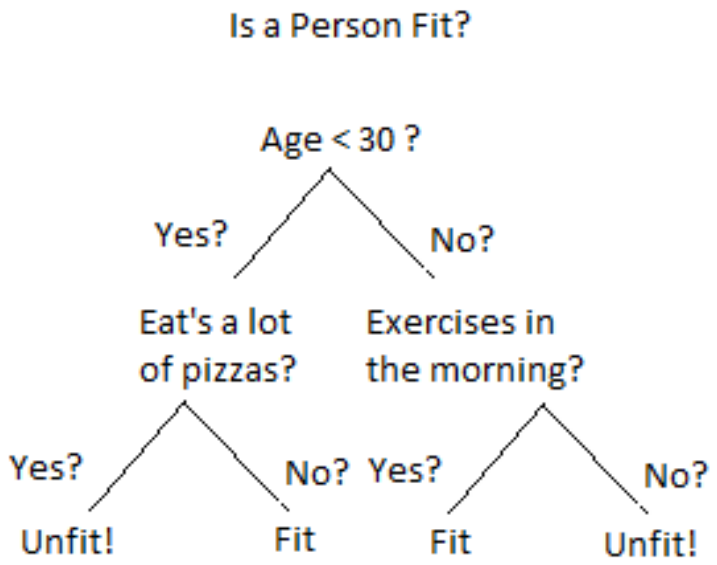


Logistic Regression

- mainly used in binary classification problems
- get weights of input variable
- Output predicted non linear function
- Works best with elimination of correlated data



Decision Tree

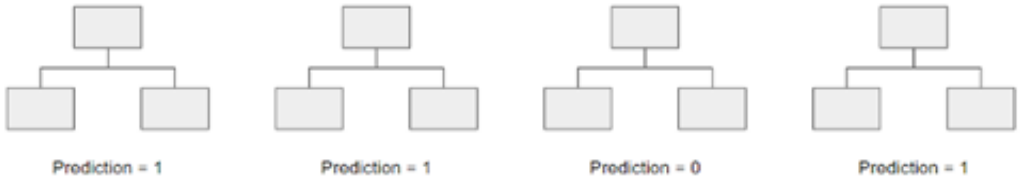


- square represent nodes
- accuracy increases with nodes
- decission is choosen -> leaves
- intuitive easy to build -> fall short on accuracy

$$H[X] = -\sum_{i=1}^{n} P(x_i) \log P(x_i)$$

IG = E(Parent) - $\sum w_i$ E(child$_i$)

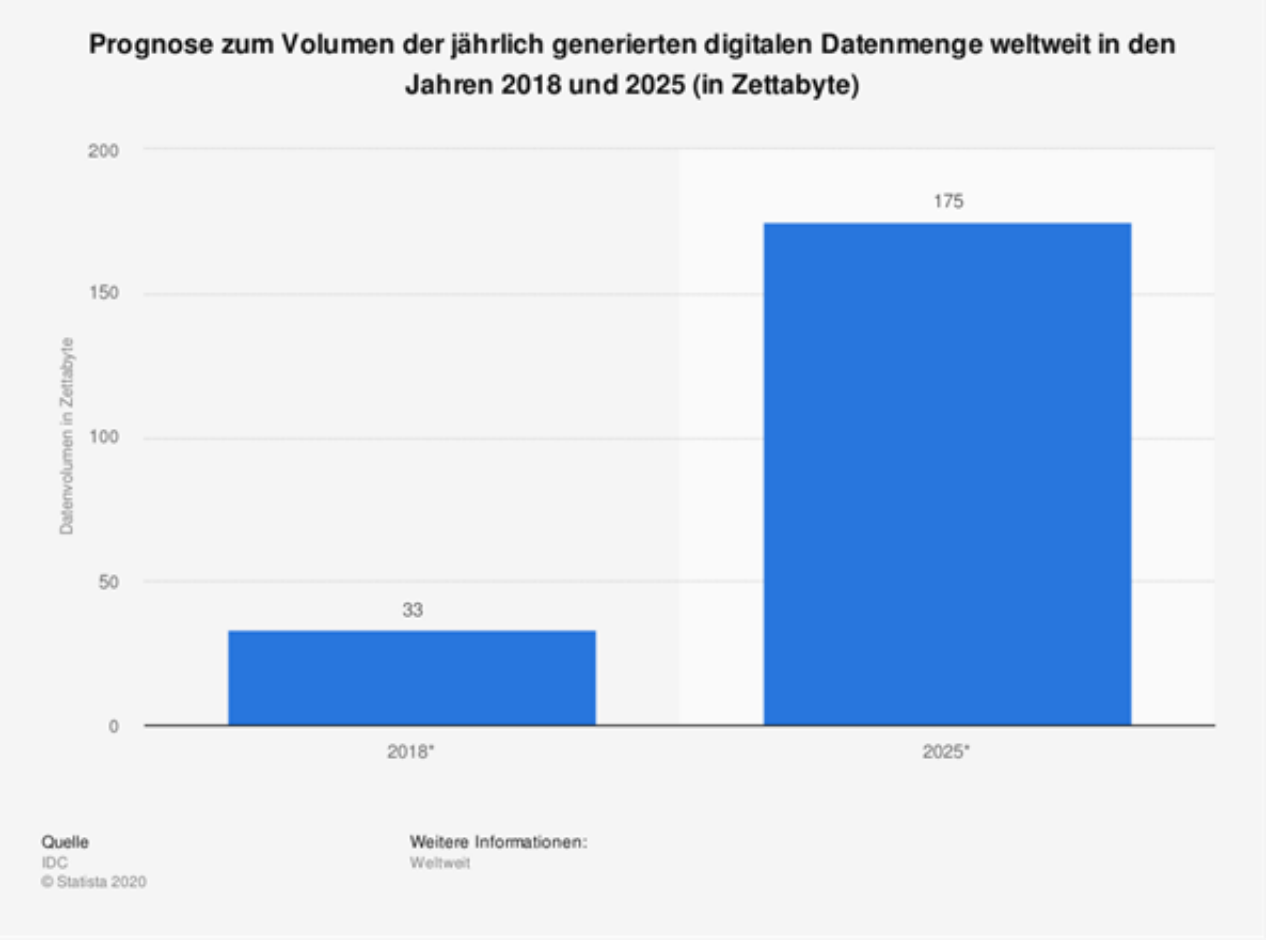
Random Forest



- build up on multiple decission trees
- randomly selecting subsets of variables each step
- model selects all predictions of each tree
- „majority wins“ model
- risk of individual error reduced

Why Machine Learning?

- exponential data growth
- information must be obtained
- Decisions must be made



Applications of Machine Learning

Data Analytics
(large DBs)

Natural Language
Processing

Computer Vision

Robotics

Product
Recommendations

Future Predictions

Trend will continue

applied in more and more areas

Basis of further technologies
(AI, Autonomous driving,
Recommender Systems)

Practical Part

- System capable offering users new tariffs
- Data from previous tariff changes available
- Classification problem

- Goal -> System capable of analyzing customer and making predictions

- Tested 3 Models (Decision Tree Algorithm, Random Forest Classifier, Logic Regression)

Now we will show you in detail what we did!