

# Intro in ML. Part 1

Profs E. Burnaev  
A. Zaytsev  
Skoltech

# General Structure

- **ARTIFICIAL INTELLIGENCE**

AI is the broadest term, applying to any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning)

not DS

↓ like in  
the 7 algorithms

## Data Analysis

- **MACHINE LEARNING**

The subset of AI that includes abstruse statistical techniques that enable machines to improve at tasks with experience. The category includes deep learning

**Data Mining.** ML algorithms are often used for pattern mining and extraction

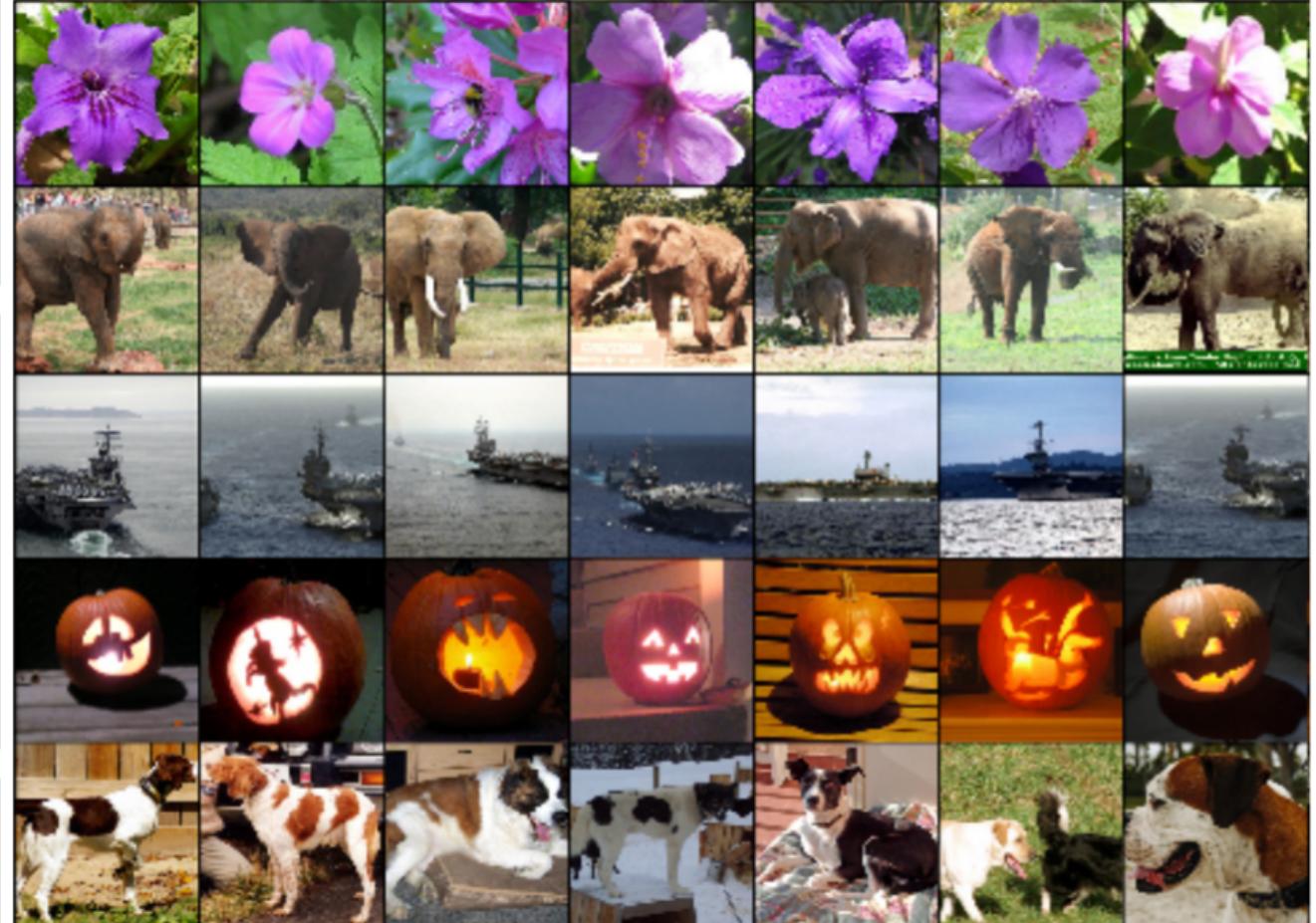
- **DEEP LEARNING**

The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amounts of data

# Why everyone is talking about AI now: sometimes it works better than a human

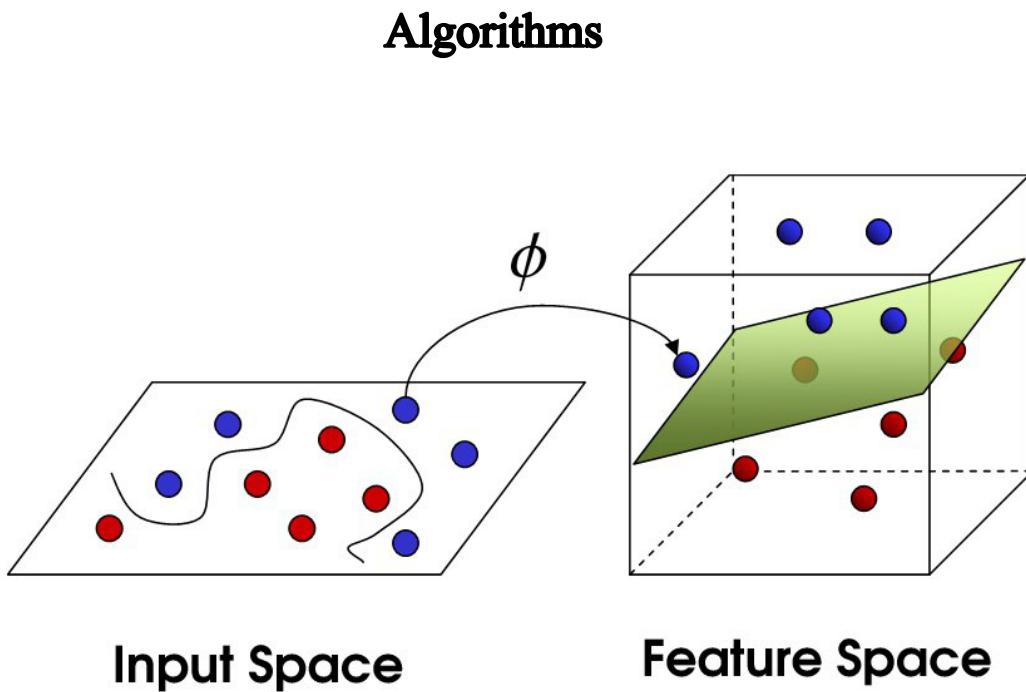
In image classification task

- human error is **5.1%**
- AI error is **3.57%**

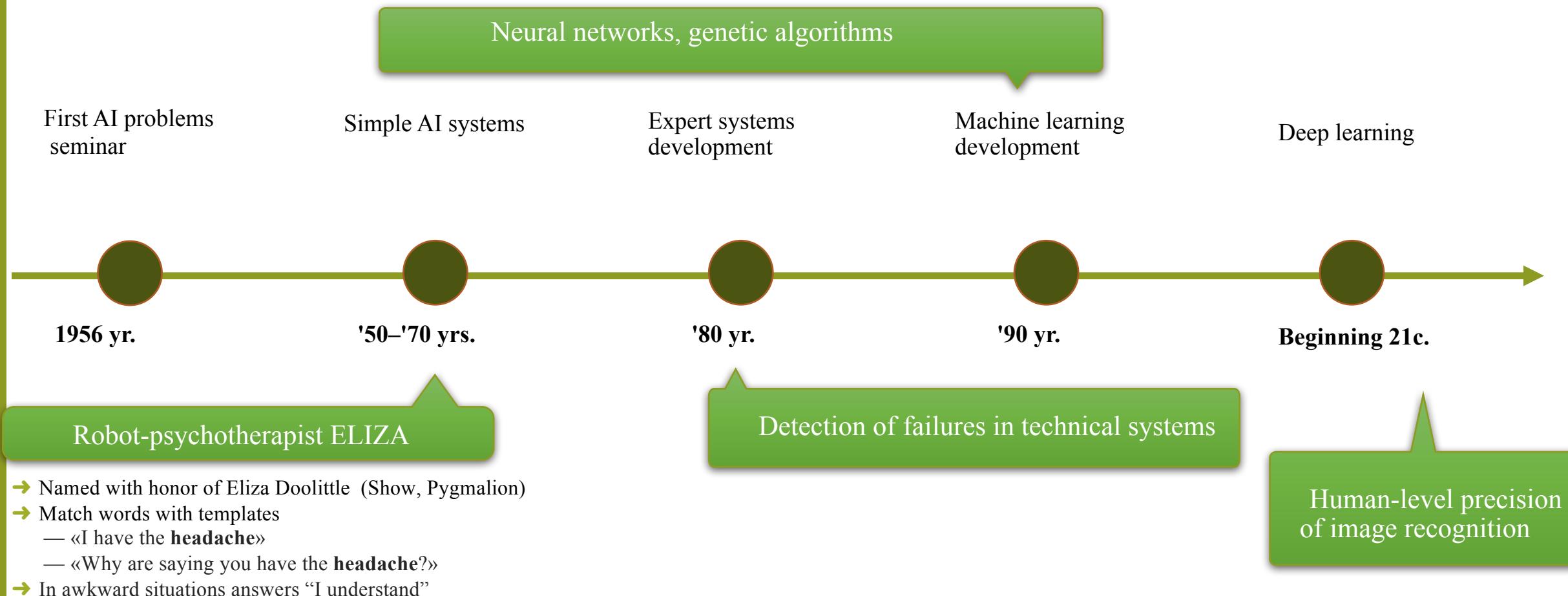


# Machine learning

**Machine learning** — set of algorithms for **pattern mining** in data

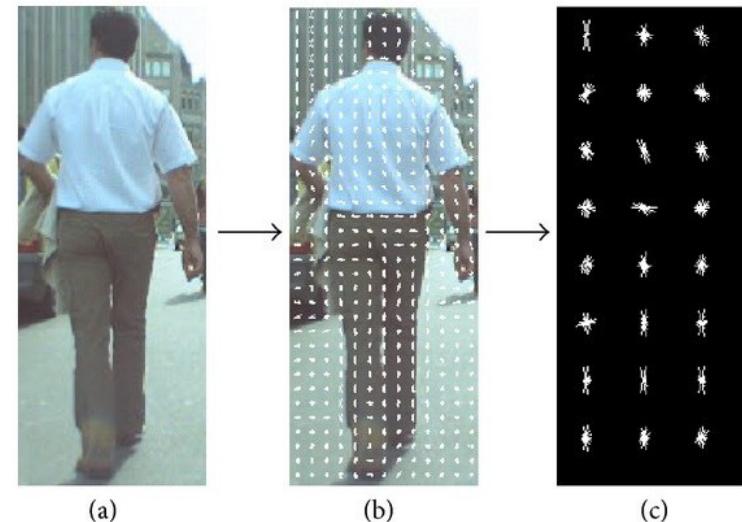
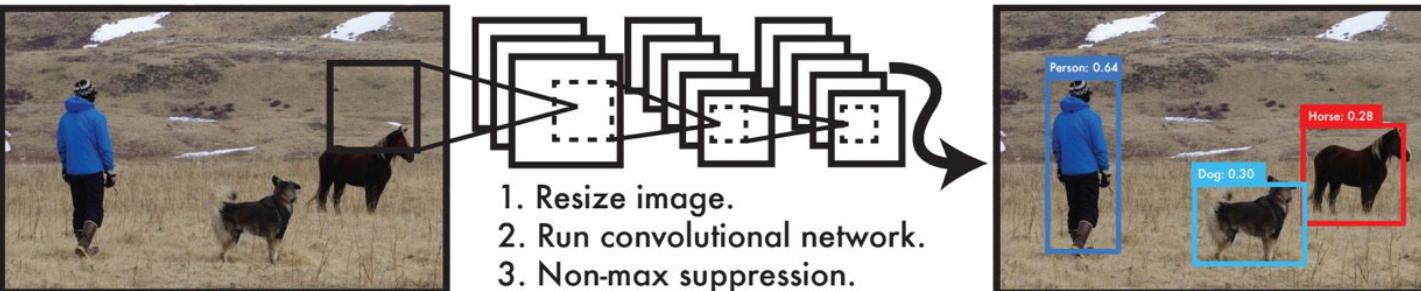


# Evolution of AI



# AI and object detection

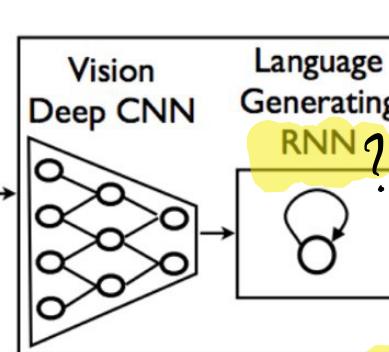
- **1970 – 1990 yrs.** — model based on similarity measure
  - Investigation of human image recognition as algorithmic process
  - Too sensitive for environment conditionals (lighting, texture, etc.)
- **2000s** — key-points detection based methods
  - Improved accuracy compared to previous approaches
  - From image to bag-of-features approach
- **since ~2012** — deep learning
  - Convolutional neural networks
  - Algorithm takes as output raw images
  - Better than human precision



# Deep learning

**Deep learning** — machine learning methods with

- auto-extraction features by
- composition of linear mappings and nonlinearities



What's an  
RNN?

Recurrent

neural  
network

Handwriting recognition.  
Speech recognition.

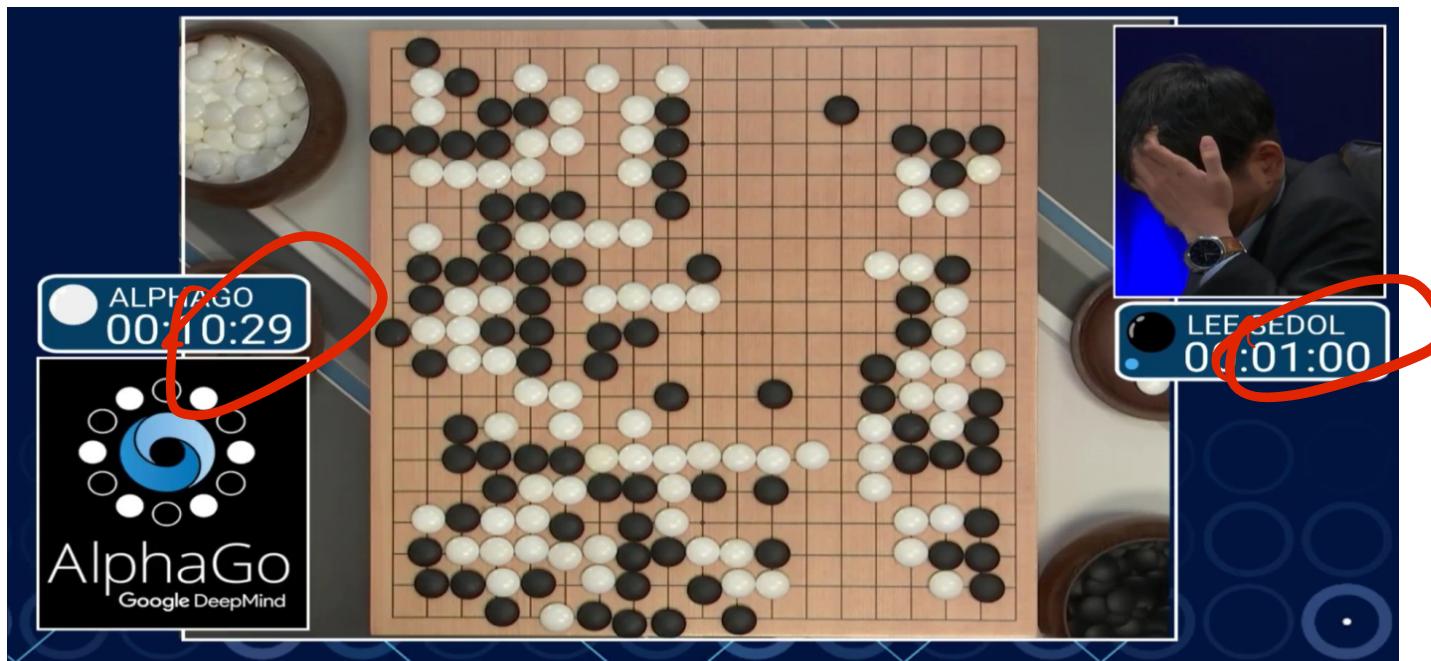
# AlphaGo

## → Neural network, playing the Go game

At the Go game there is  $10^{171}$  combinations of possible positions (at the chess  $10^{43}$ , atoms  $10^{80}$ )

## → March'16 — victory over the world champion

## → Learned with both: history of human games and self-playing



# Deep learning is not silver bullet

## Deep Learning fits to several cases:



Economic growth has slowed down in recent years .

Das Wirtschaftswachstum hat sich in den letzten Jahren verlangsamt .  
Economic growth has slowed down in recent years .

La croissance économique s' est ralentie ces dernières années .

### Images

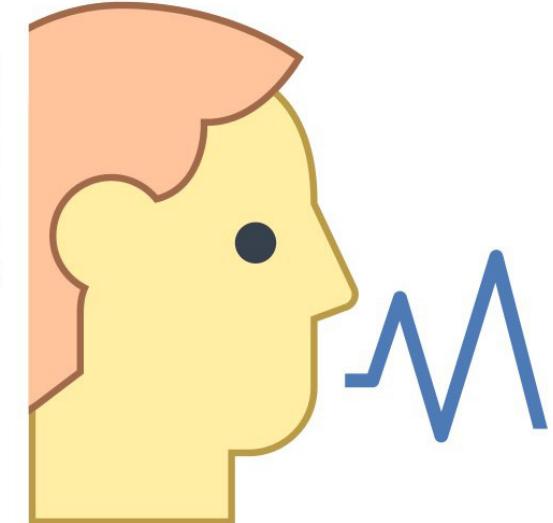
- What is on the image?  
(Recognition)
- Where is the object?  
(Detection)

### Text

- Summarize text
- Translation

### Sound

- Speech recognition
- Sentiment analysis





# Buzzwords: what is Big Data?



## → Big data benefits

- More data – better accuracy
  - The quantity turns into quality
- Storage & computation patterns became more apparent*

## → Growth of computing powers

- HPC *high performance computing*
- GPU

## → Problems

- Calculation-greedy
- Huge storage systems

