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# Introduction to Artificial Intelligence and Machine Learning

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# What makes us human ?

- What makes us uniquely human?
- We are intelligent, what then, is Artificial Intelligence ?

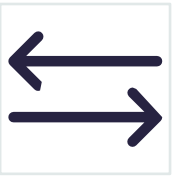
# Human Intelligence

Senses

Discover

Infer

Reason



Transfer

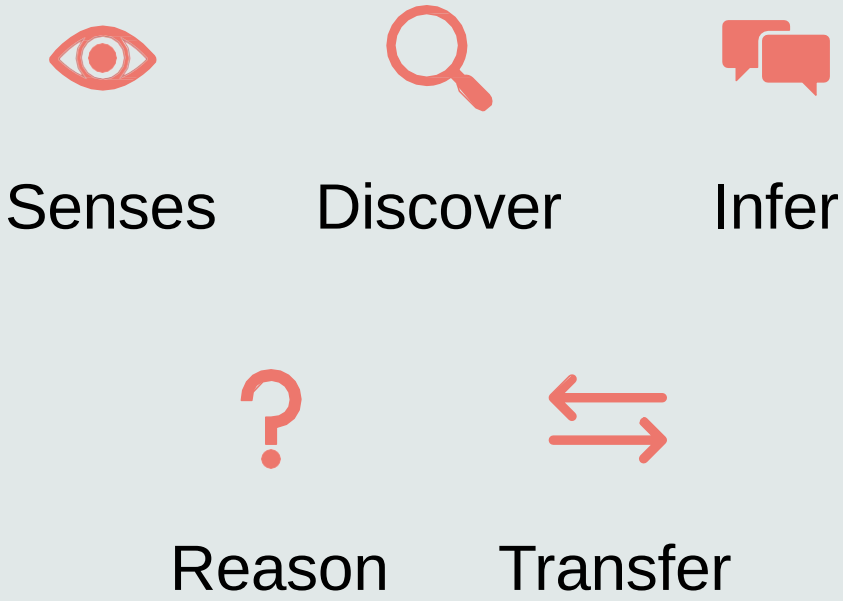
# Artificial Intelligence (AI)

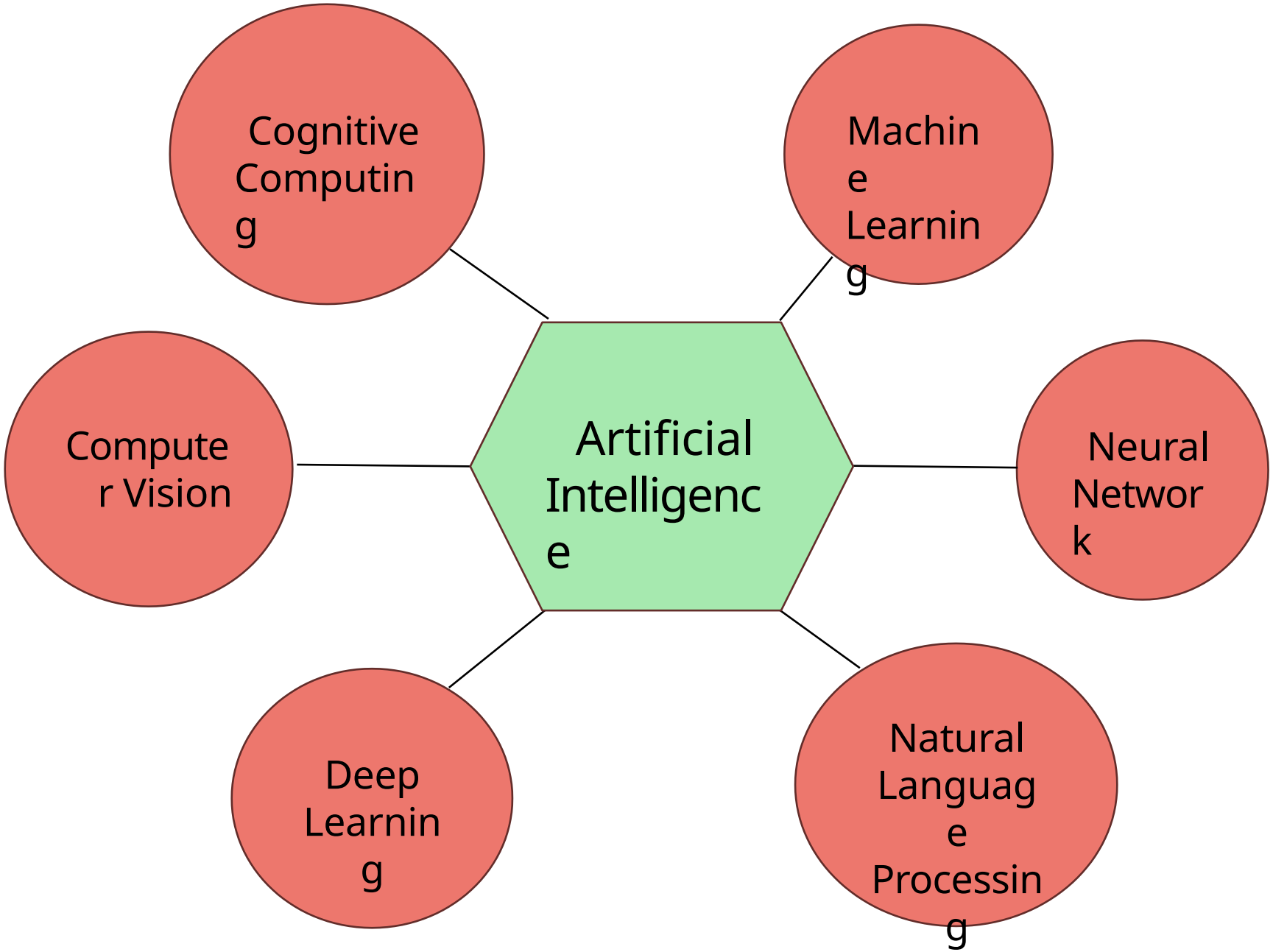
AI -

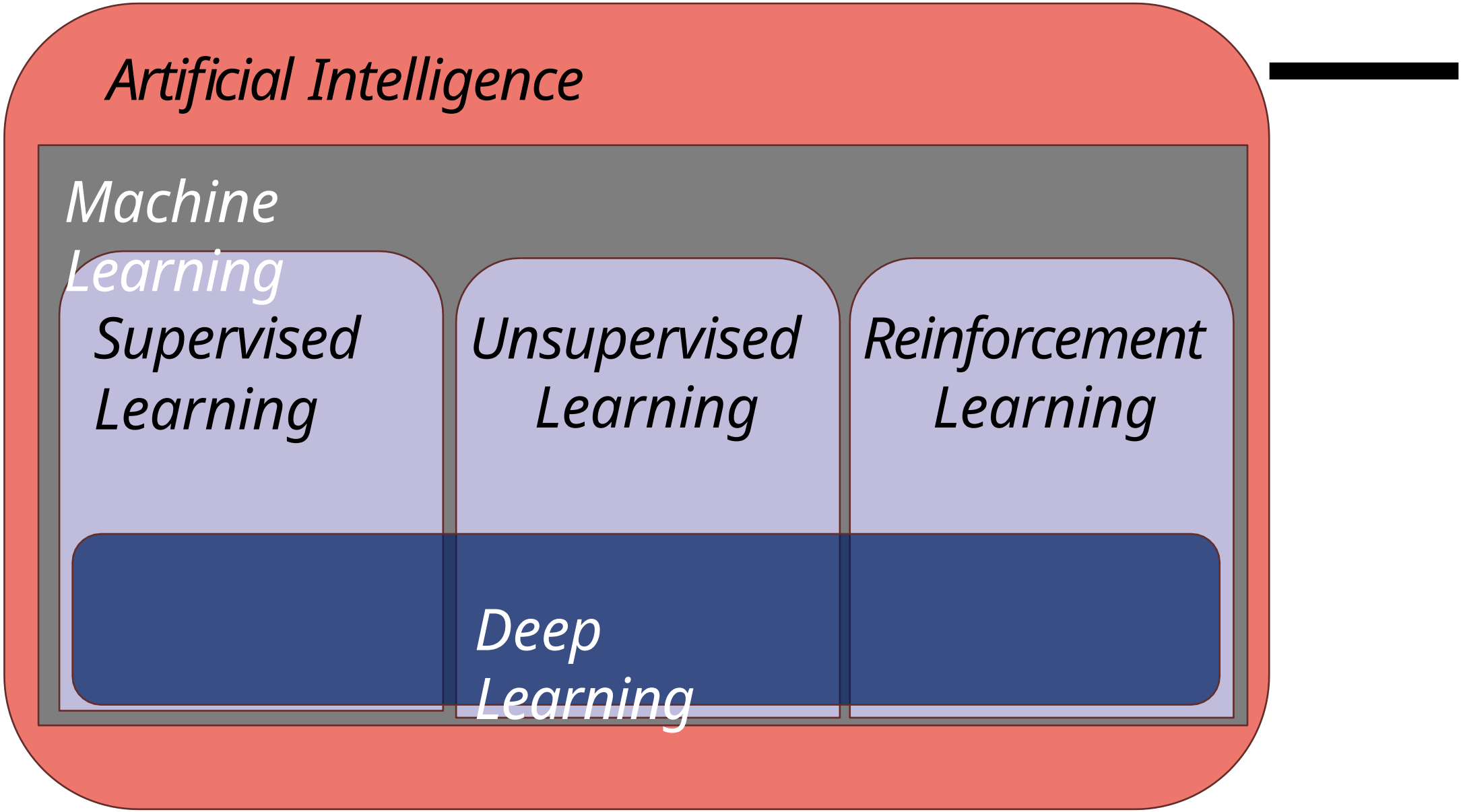
Algorithmic strategies that try to match or exceed the capabilities of humans

**Applications Domains:**

- Computer vision
- Natural Language Processing
- Text to speech
- Motion – Robotics




Cognitive Computing
Machine Learning
Computer Vision
Artificial Intelligence
Neural Network
Deep Learning
Natural Language Processing


Artificial Intelligence
Machine Learning
Supervised Learning
Unsupervised Learning
Reinforcement Learning
Deep Learning

# Machine Learning (ML)

# Machine learning (ML)

Arthur Samuel coined the term in 1959

- "Learning" Not explicitly programmed
- Prediction or decisions based on data
- More data – more accurate results

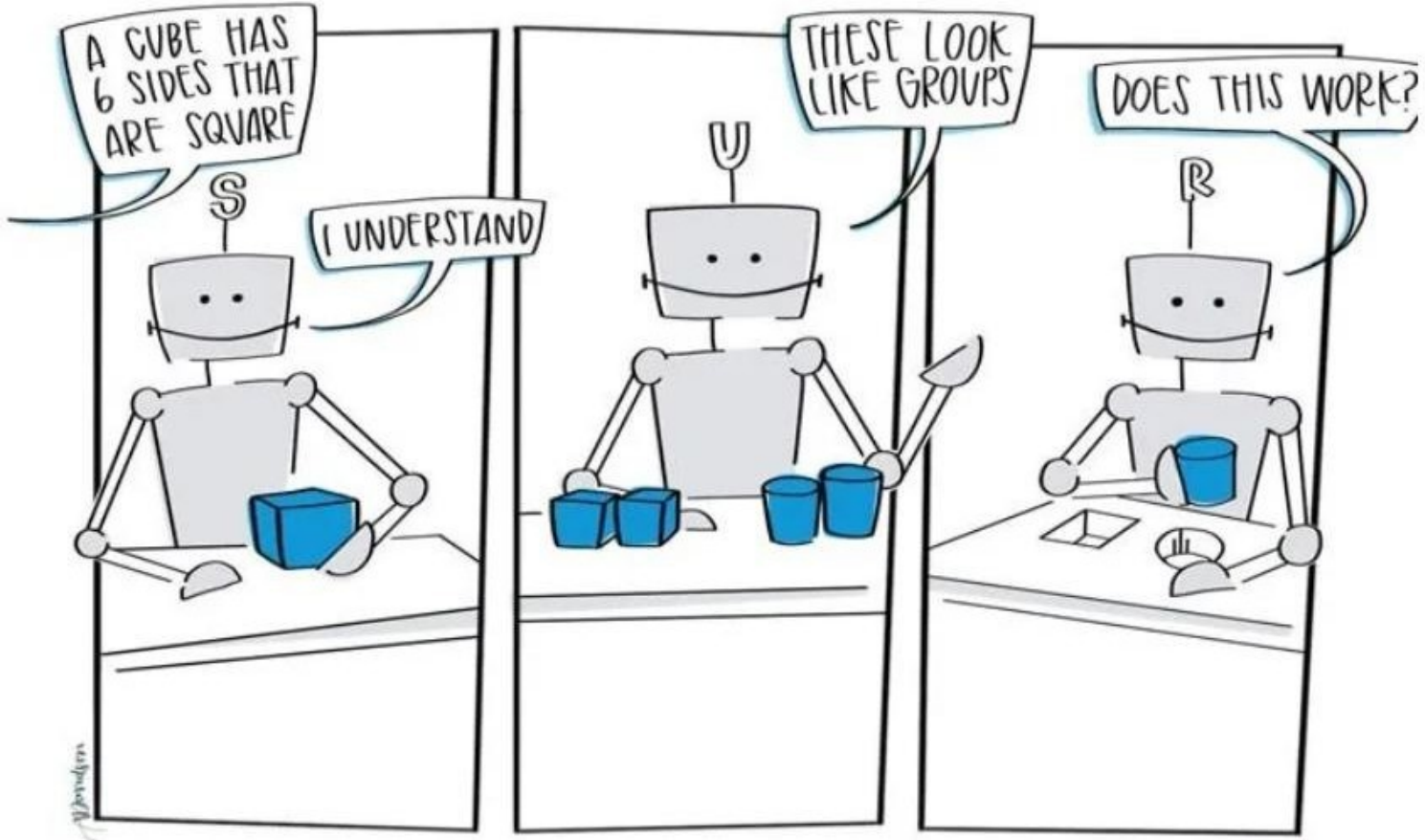
What, then, is deep learning ?

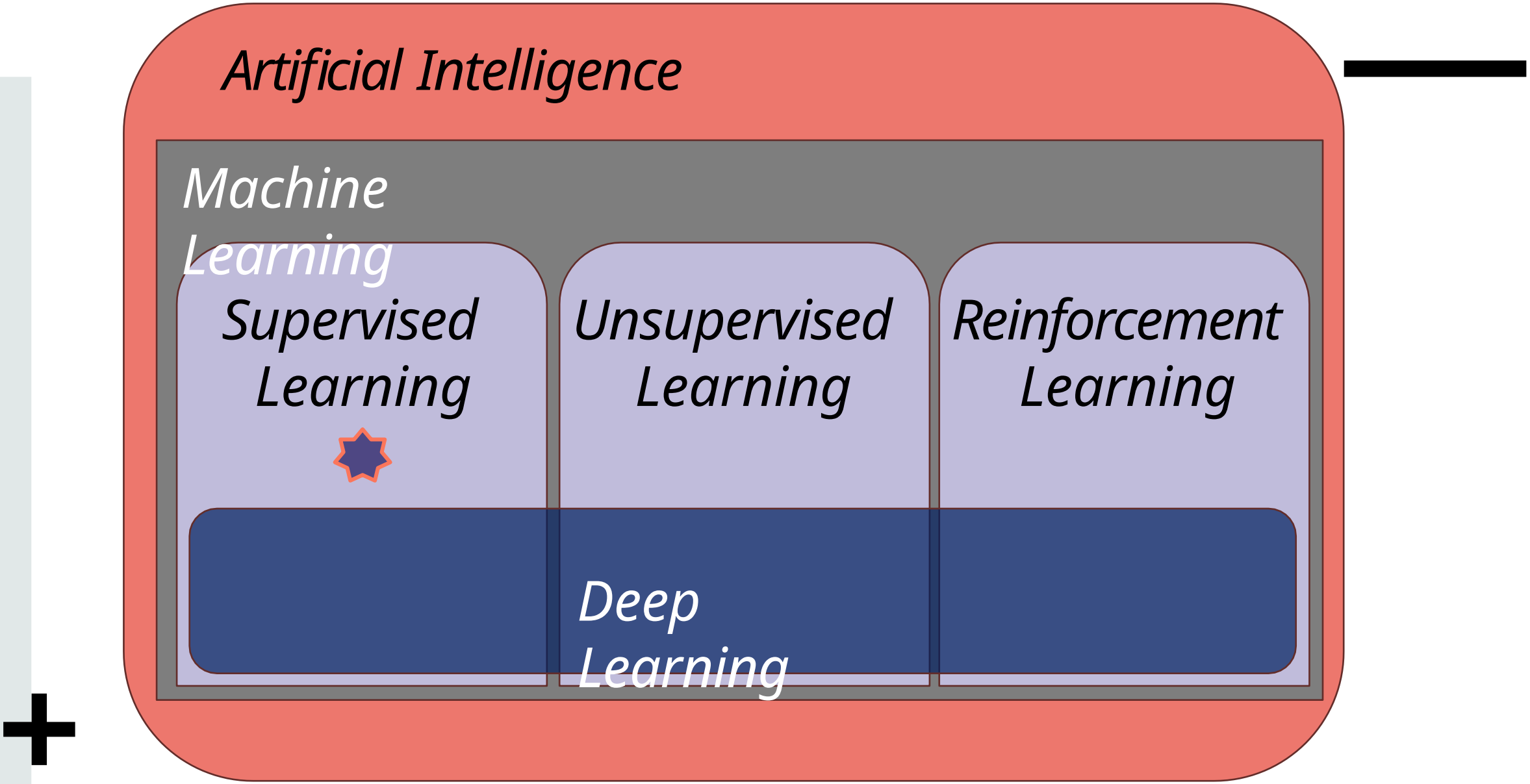
# Deep Learning (DL)

Deep learning is a subset of ML

- Neural networks – Nodes and statistical relationships between nodes to model the way our mind works
- One layer – Approximate predictions
- Additional layers – Optimize and refine for accuracy
- "Deep" - Multiple layers (More than 3 layers)
  - Eliminates some pre-processing
  - Better with unstructured data

# MACHINE LEARNING

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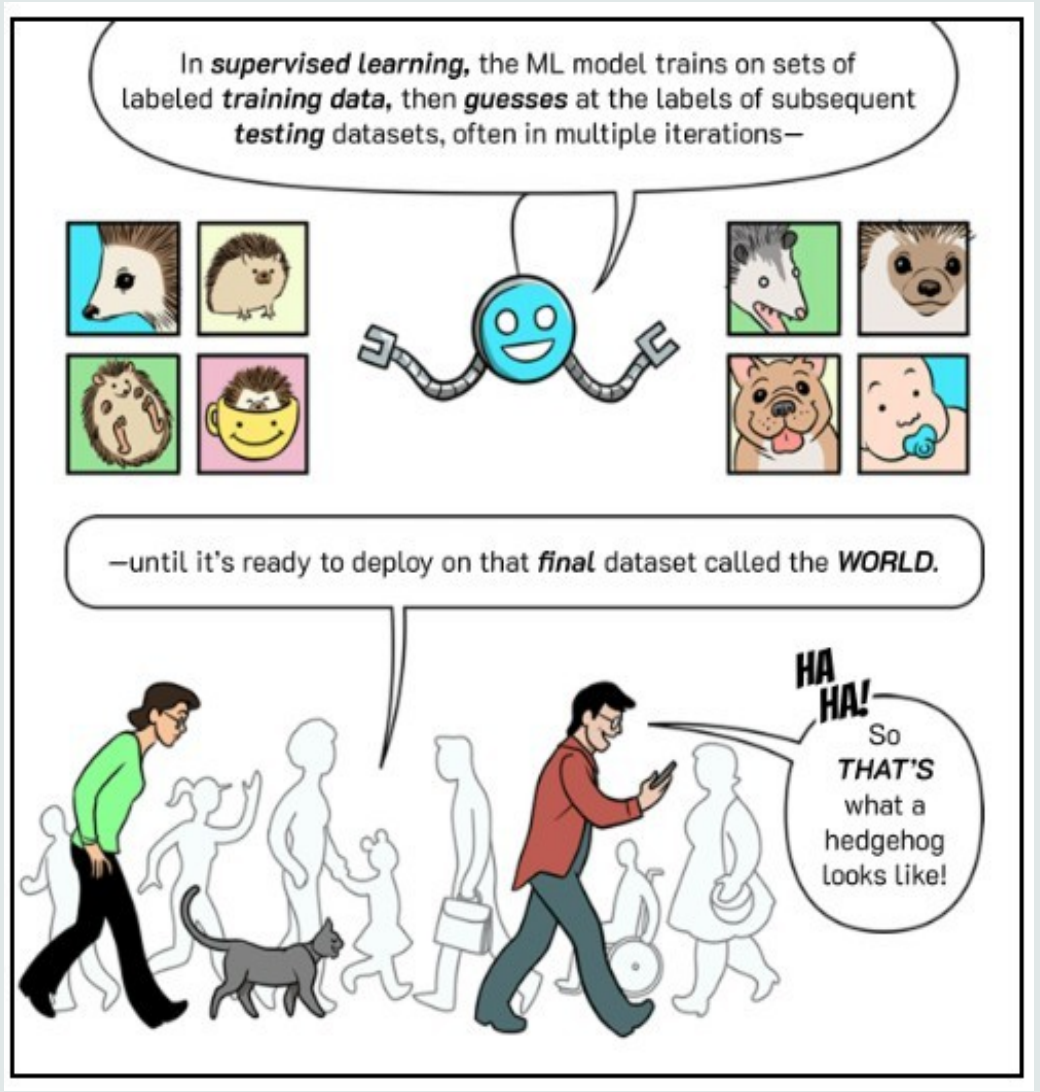
# Supervised learning

- Has a defined mapping from input to output
- The model learns this mapping from paired input/output data examples



# Some terms used

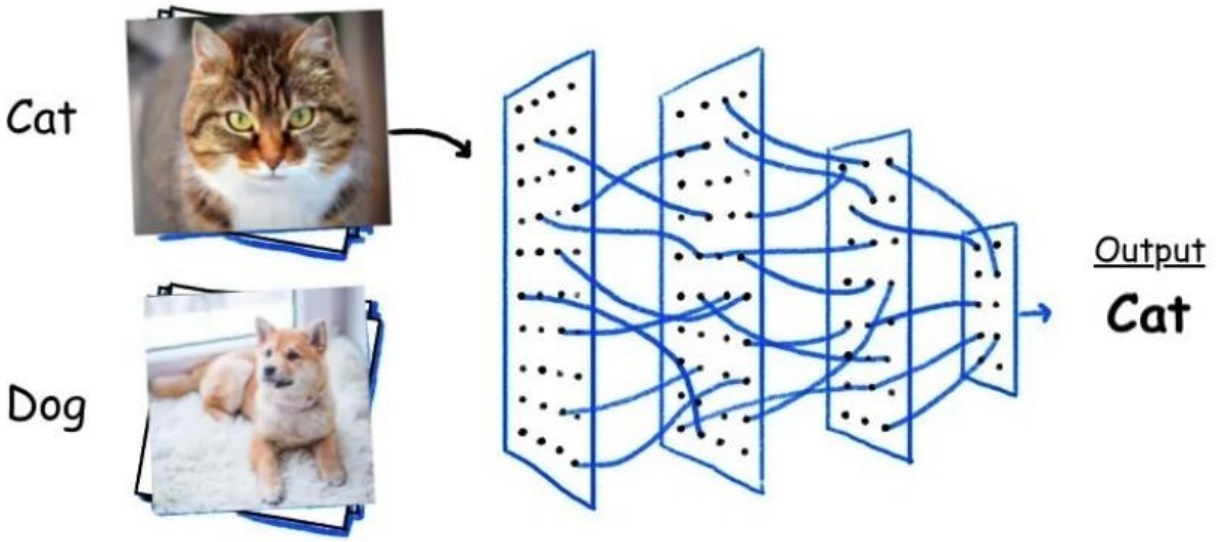
- Regression - continuous numbers as output
- Classification- discrete classes as output
- Binary classification– two classes treated differently
- Multiclass classification – Multiple classes treated differently

# Image classification

- Binary or multiple discrete classes
  - Defect detection
  - Security surveillance
  - Biometrics

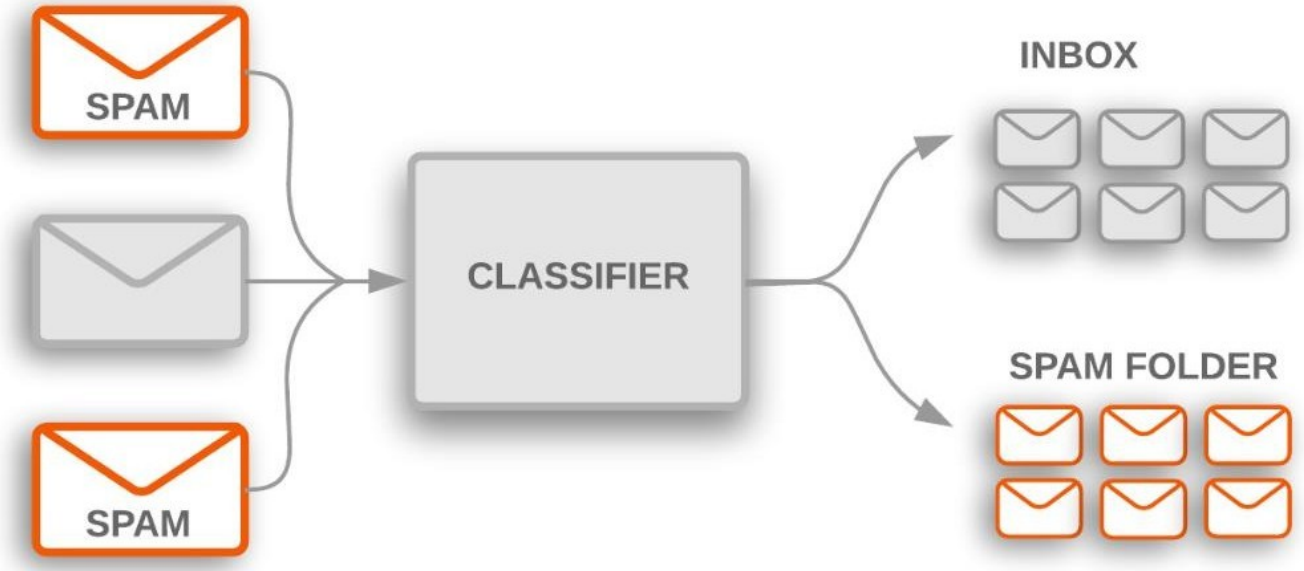
Example Classifier:

- Convolutional Neural Network



# Text Classification

- Spam detection
- Movie / restaurant reviews
- Binary classification (two discrete classes)
- Naïve Bayes, Support Vector Machines (SVM)



# Handwriting Recognition

- Postal addresses
- Banking solutions

Example Classifiers

- Convolutional Neural Networks (CNN),
- Long Short-Term Memory Networks (LSTM)

# Regression

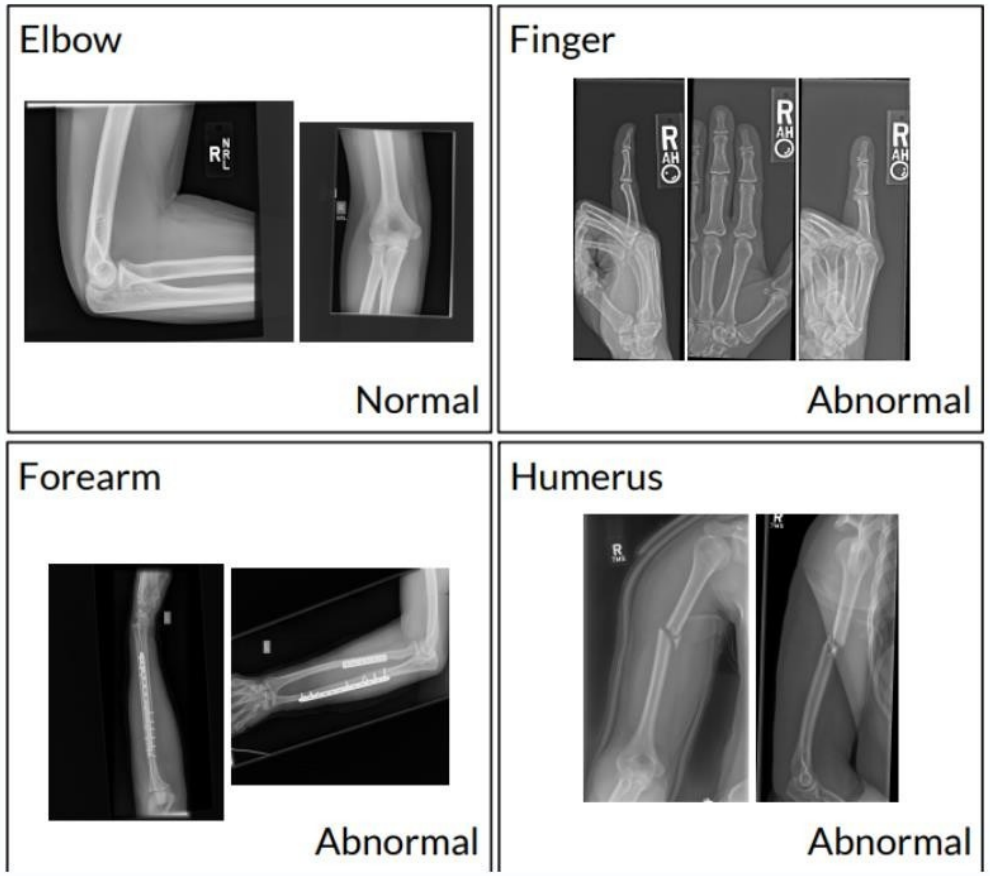
- **Real value output**
- Housing rent calculation
- Credit scoring
- Stock price forecasting
- Sales prediction
- Linear Regression, Support Vector Regressor, Neural networks

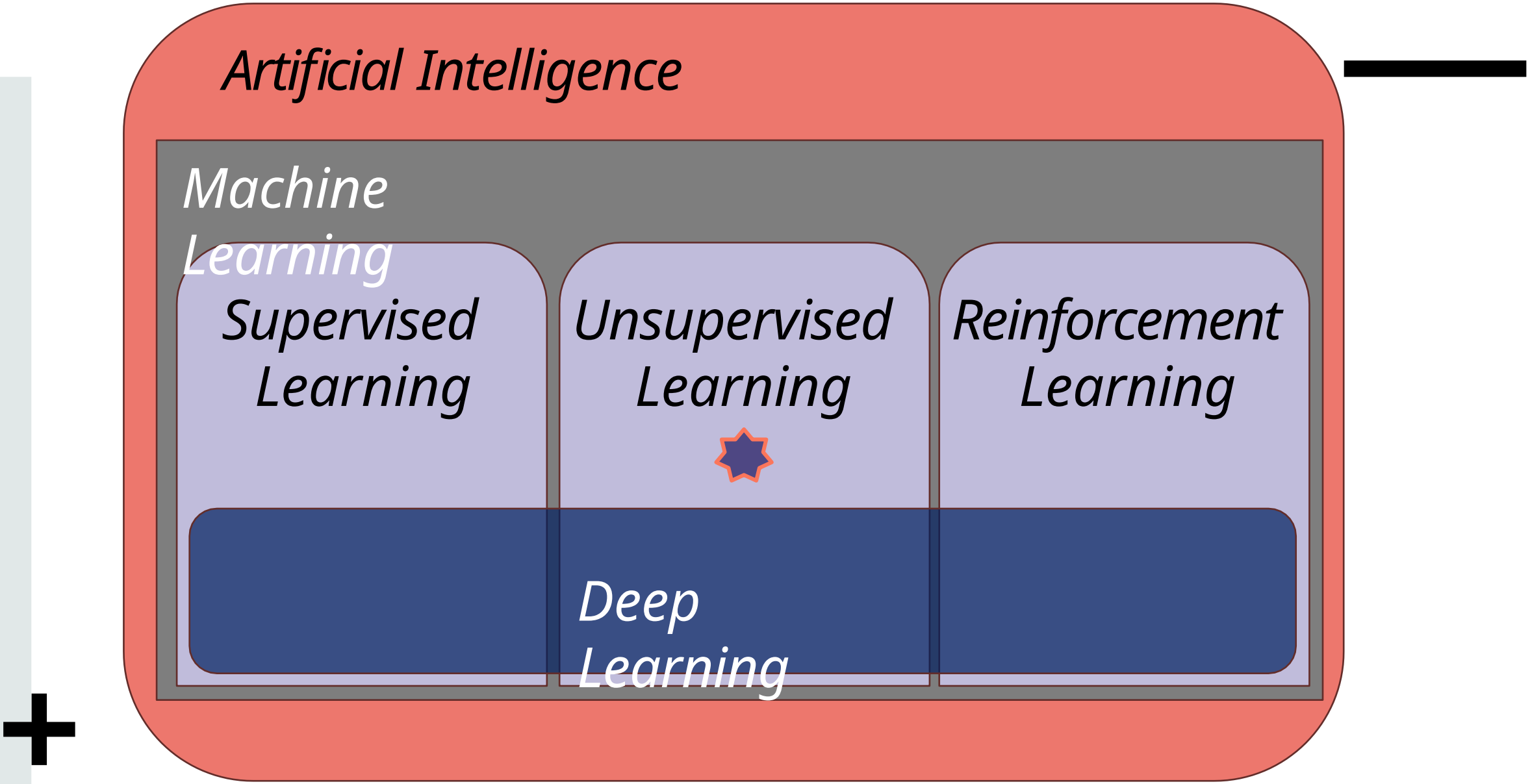
# Medical Diagnosis

- Classification – Binary or multi-class
- Prediction of severity – Regression
- Image Segmentation – Tumor
- Depends on the data and task

Classifiers

- CNN, Random Forest(RF), SVM, LSTM, CNN-LSTM

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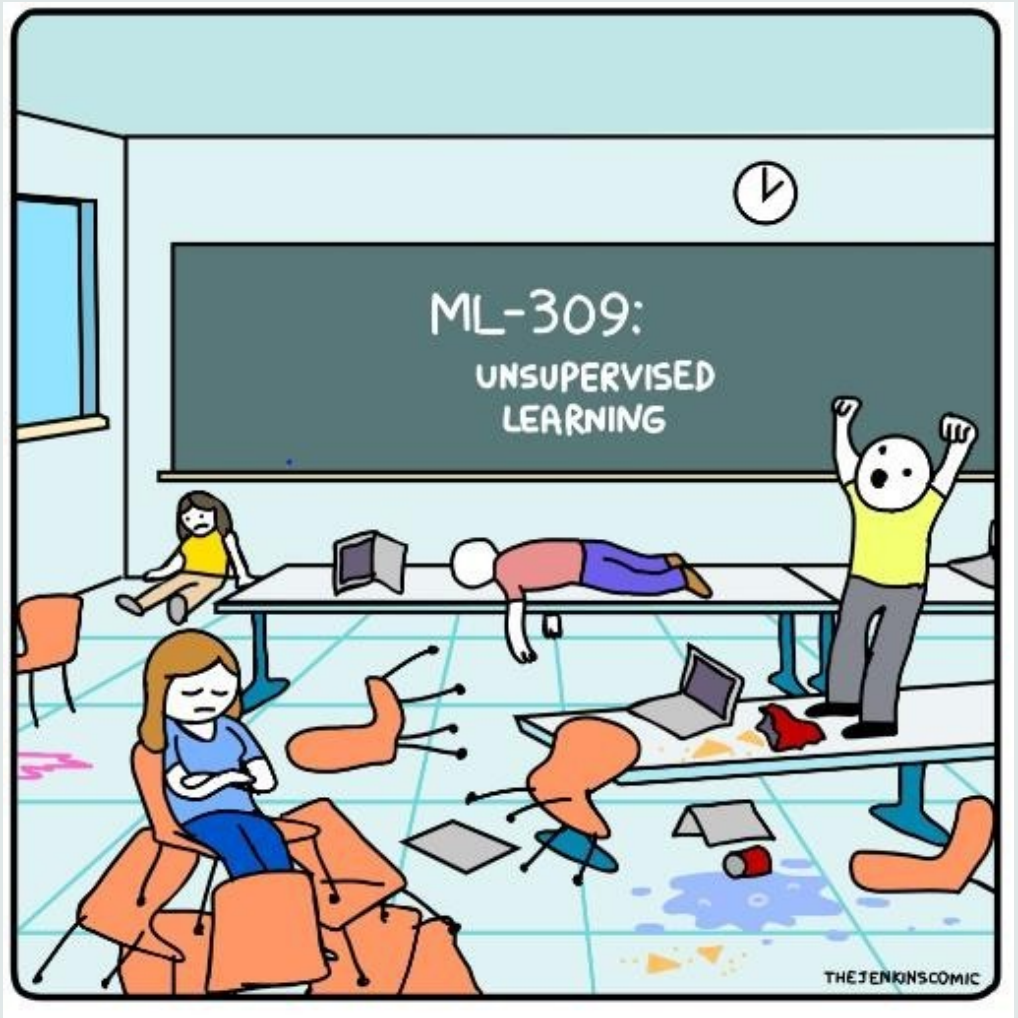
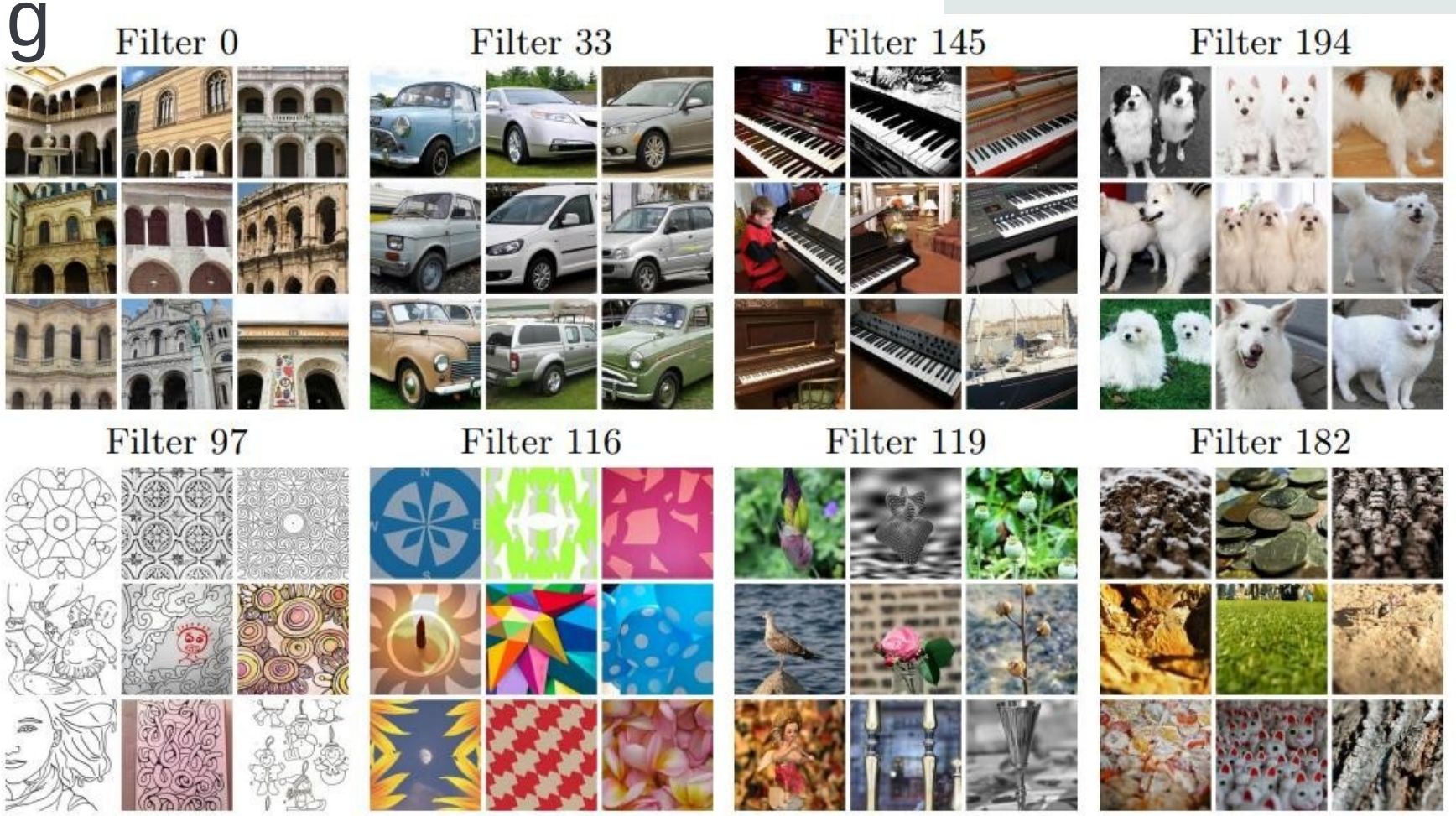
# Unsupervised learning

Learning about a dataset without labels

- Clustering
- Finding outliers
- Dimensionality reduction
- Generating new examples
- Filling in missing data



# Clustering



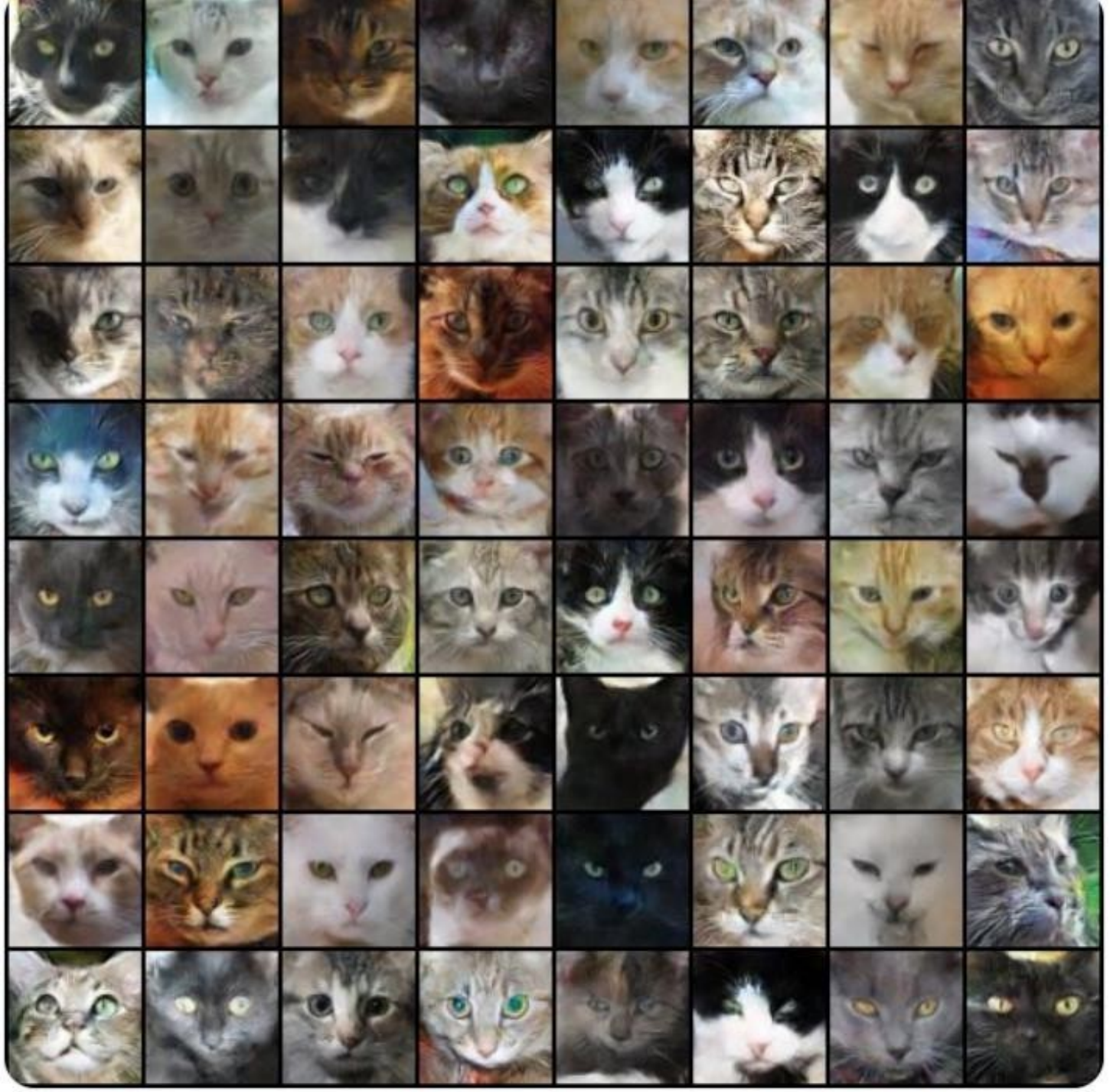

- Document retrieval
- Customer preferences – Retail
- Social media analysis
- Find patterns in data

# Finding outliers

- Banking alert systems
- Surveillance
- Network traffic anomaly

Classifiers

- SVM, Autoencoders

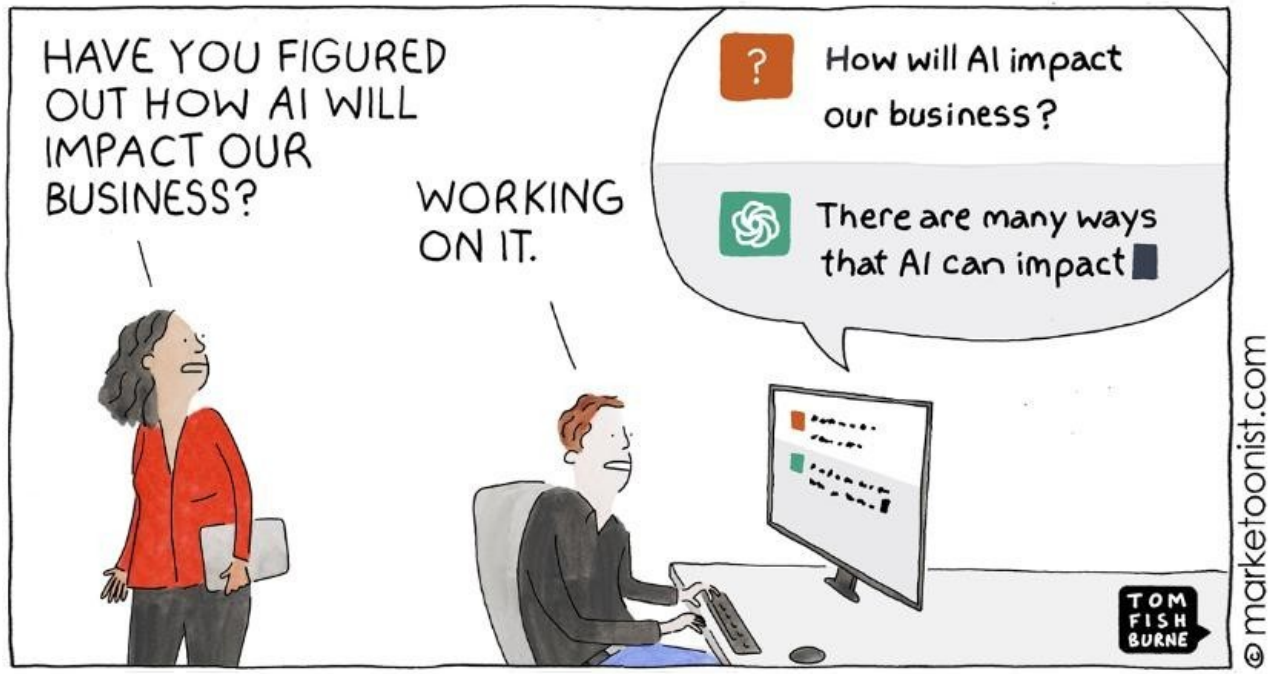


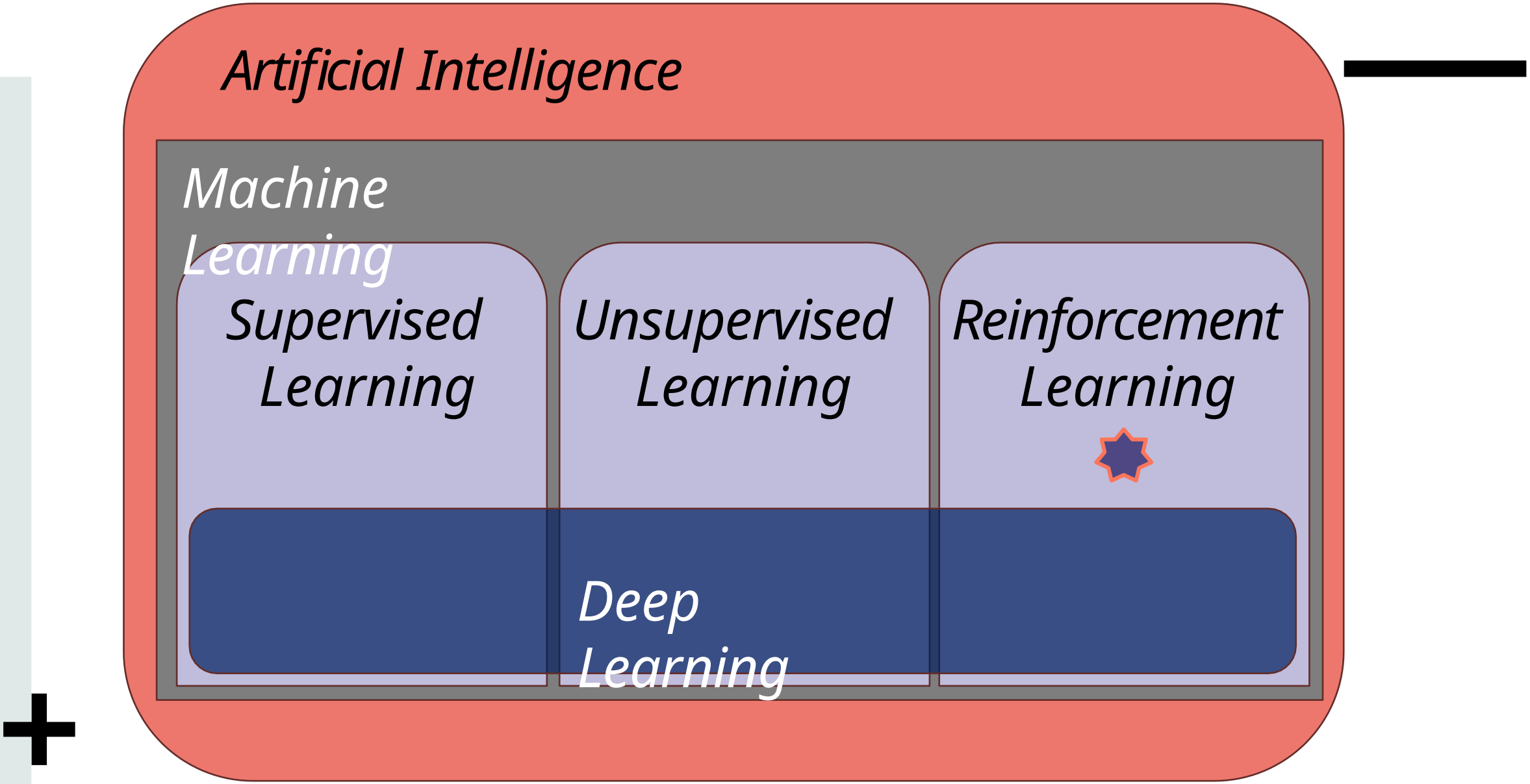
# Meow Generator

- Generated realistic images of cats in 2-3 hours
- Used Cat dataset (https://web.archive.org/web/20150703060412/http://137.189.35.203/WebUI/CatDatabase/catData.html)
- Different types of GAN used in a semi-supervised manner

# Generative AI : Some examples

- Chat GPT, Bard
- The search suggestion on internet browsers
- Tools like Grammarly that suggest edits and text generation
- Image generation (GANs)
- Translations
- Music generation – IBM Watson Beat
- Art, video and game design
- Data augmentation

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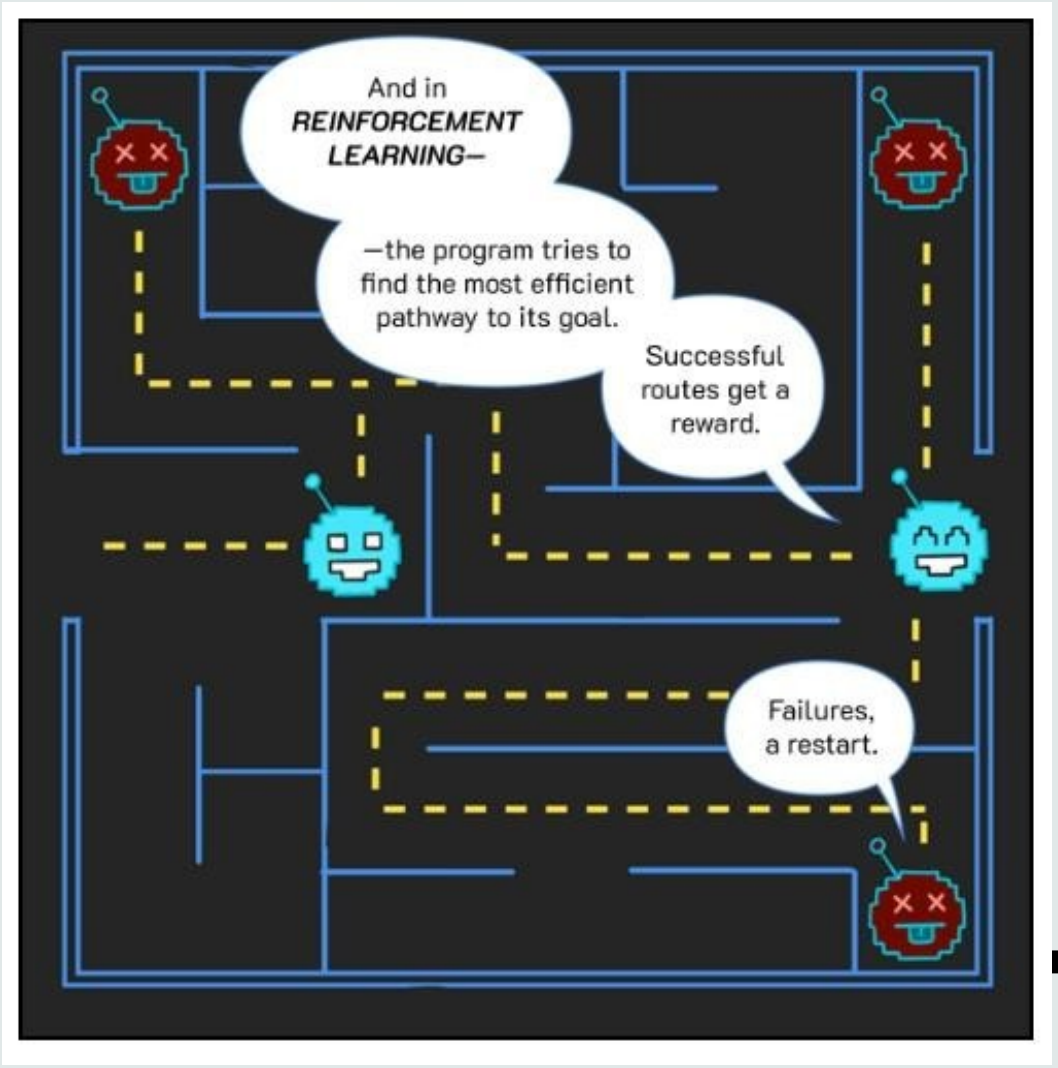
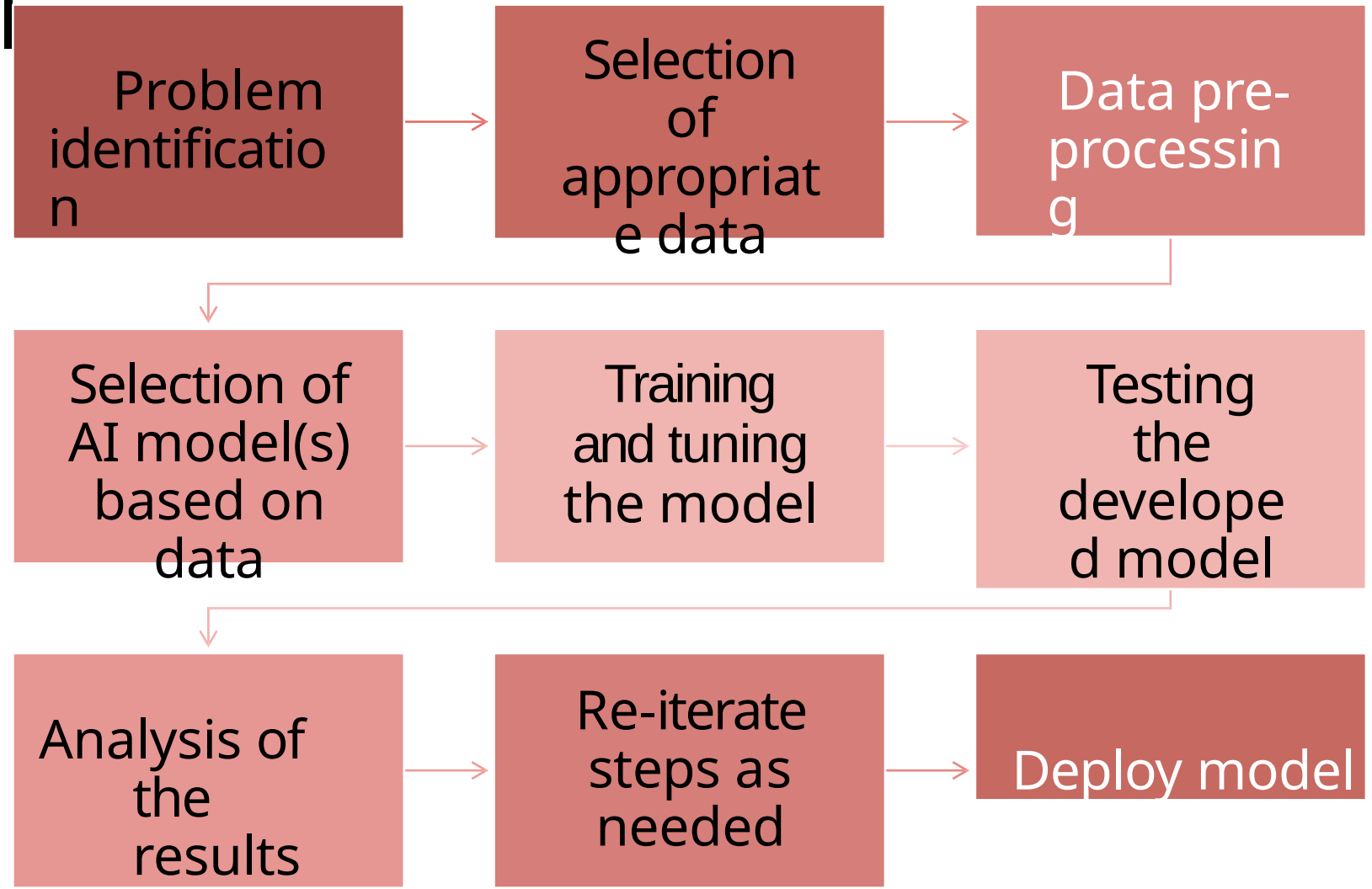
# Reinforcement learning (RL)

- A set of states
- A set of actions
- A set of rewards
- Goal:  take actions to change the state so that you receive rewards
- You don’t receive any data – you must explore the environment yourself to gather data as you go



# *Steps in implementing an AI model*

# Steps in implementing an AI model



# Problem identification & Data curation

**Problem Identification**

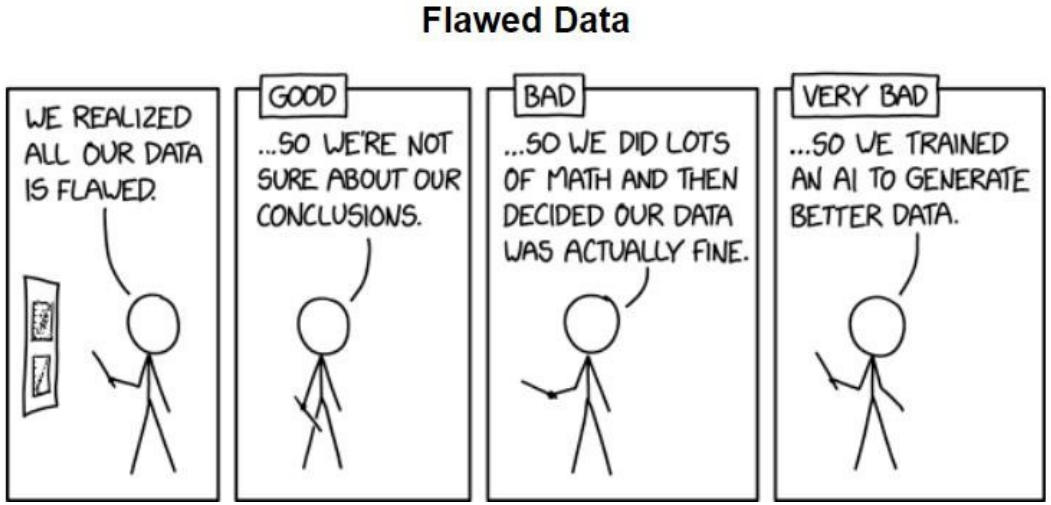
- Experts in the field
- Personal experience
- Literature survey
- Data curation

**Data curation**

- Data collection in person
- Public repositories
- Private repositories
- Simulated data
- Synthetic data

# Data pre-processing

- The specific steps depend on the type of data used
- Size of the dataset
- Visualize the data and labels
- Data cleaning – Remove duplicates or bad samples
- Noise removal



# Data pre-processing

- Distribution of data across the classes

**Imbalanced data results in a model biased towards the majority class**

- Data augmentation
- Resizing the data to meet the model's requirements
- Dividing the data into train, test datasets

# Choosing the AI model

1. Problem statement and type of data

Classification, Regression, Segmentation, Augmentation, Feature extraction, etc.

Time series – SVM, RF, LSTM, 1D-

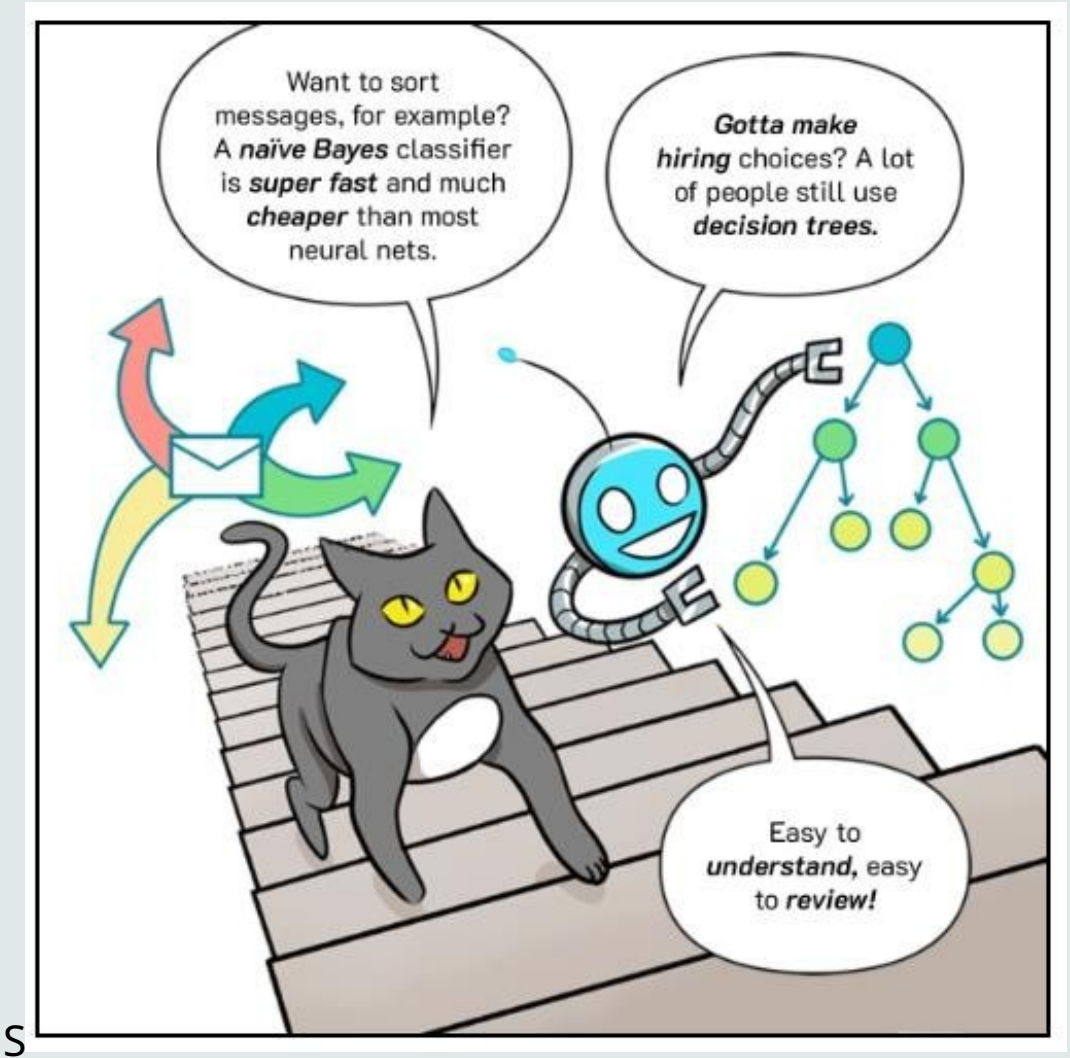
CNN, Images – SVM, CNN

Features – LR, SVR / SVM, RF, MLP, NB, DT

2. Computational capacity

Simpler model or may need dimensionality reduction

3.Try various models to choose best fit or go for ensemble

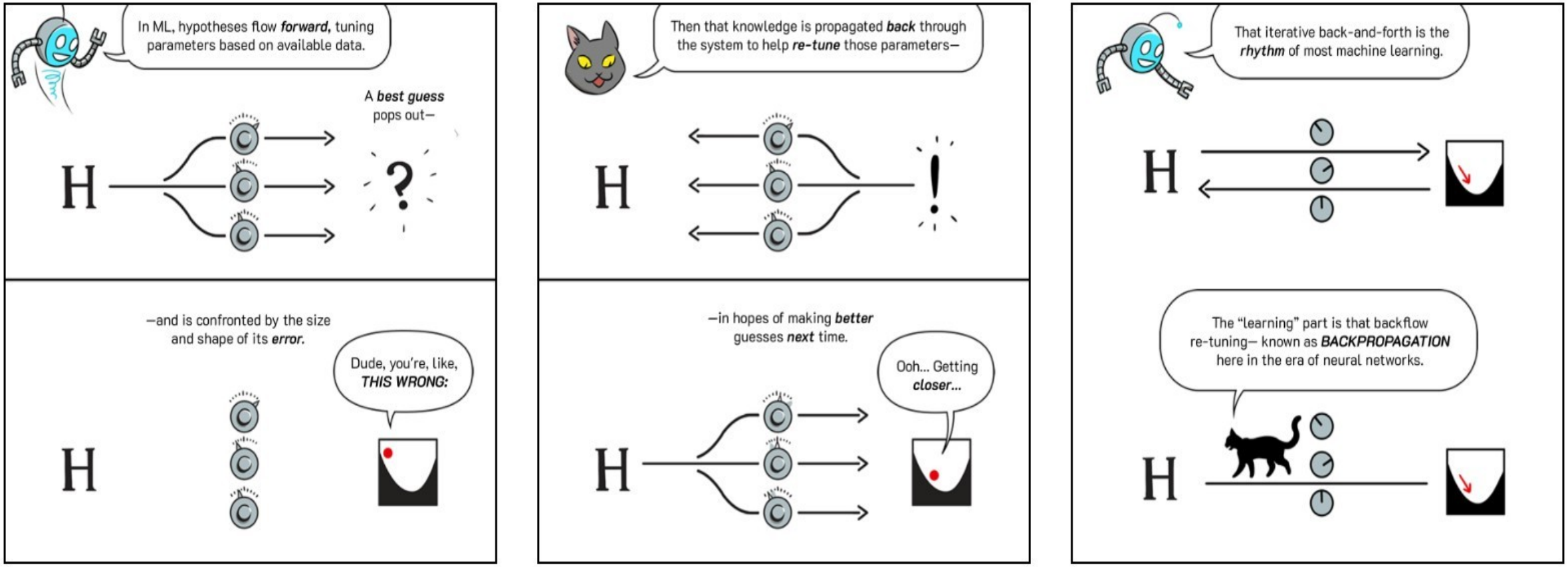



So

# Training the model

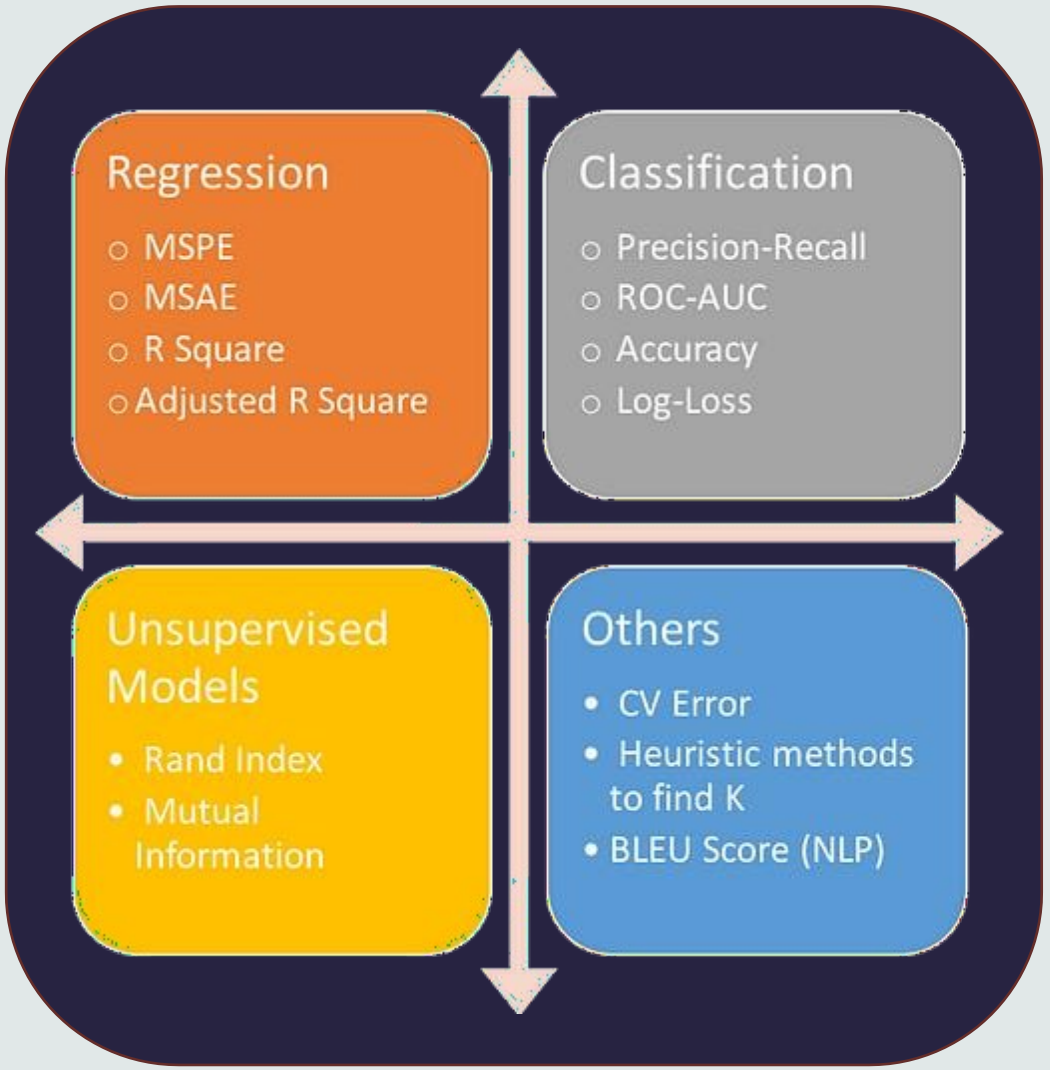
- The data split as part of the training subset is passed onto the chosen AI model
- A small portion of the data is retained as the test data, which is used to test the model's learning

# Training or "learning"



# Testing the model

- Choose model appropriate evaluation metrics
- Testing on the hold-out data



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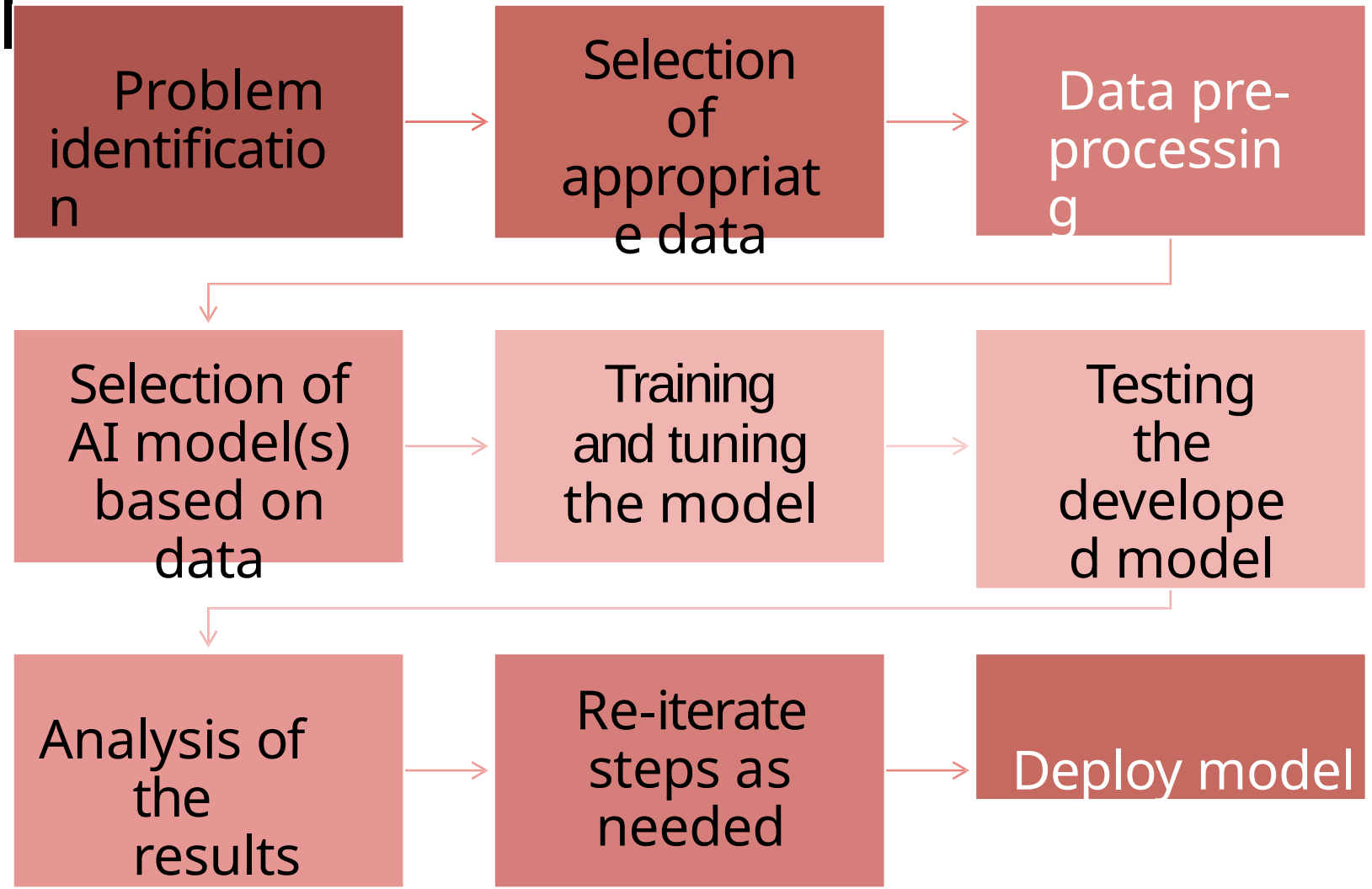

*Thank you!*

Now it's your turn!
Continue your journey into
the world of machine learning...