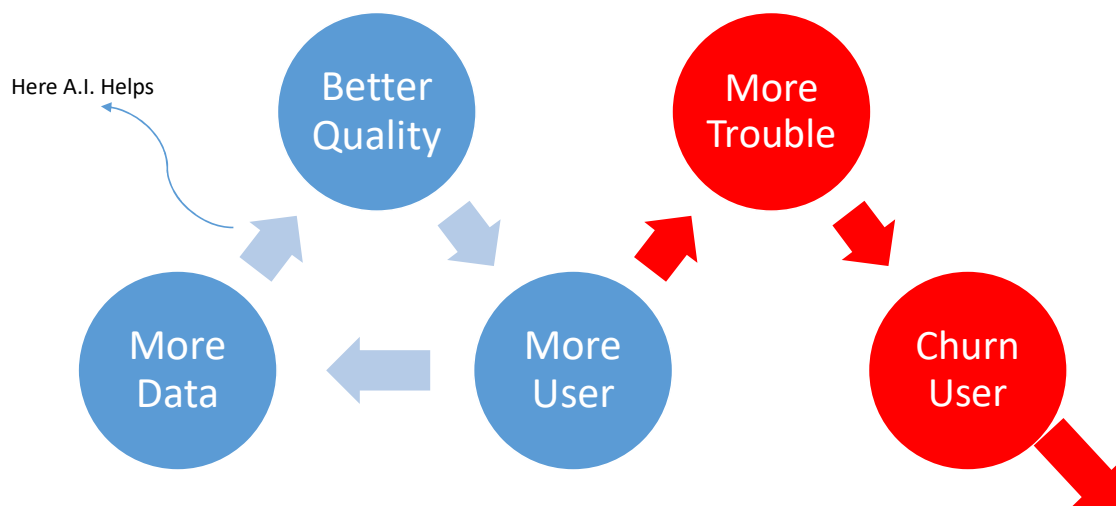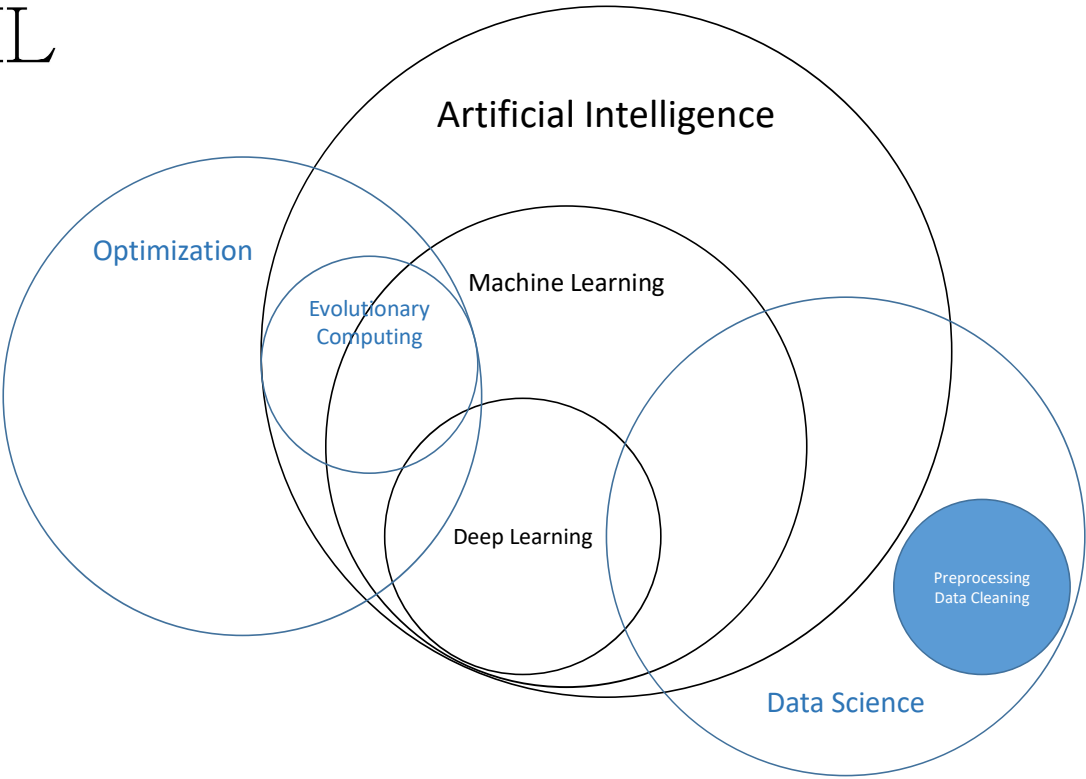# A.I. is …

- the **simulation of human** intelligence processes by machines.
- intelligence demonstrated by **machines**
- a field, which combines computer science and robust datasets, to enable **problem-solving**.
- improving enterprise performance and productivity by **automating** processes or tasks that once required human power.
- refers to the simulation of human intelligence in machines that are programmed to think like humans and **mimic their actions**.

Why A.I.?

Here A.I. Helps

Better Quality

More Trouble

More Data

More User

Churn User

A.I. vs. ML

Artificial Intelligence

Optimization

Evolutionary
Computing

Machine Learning

Deep Learning

Preprocessing
Data Cleaning

Data Science

Machine Learning

- The use and development of computer systems that are able to **learn** and adapt **without** following **explicit instructions**, by using data and/or try-and-error.

Supervised Learning
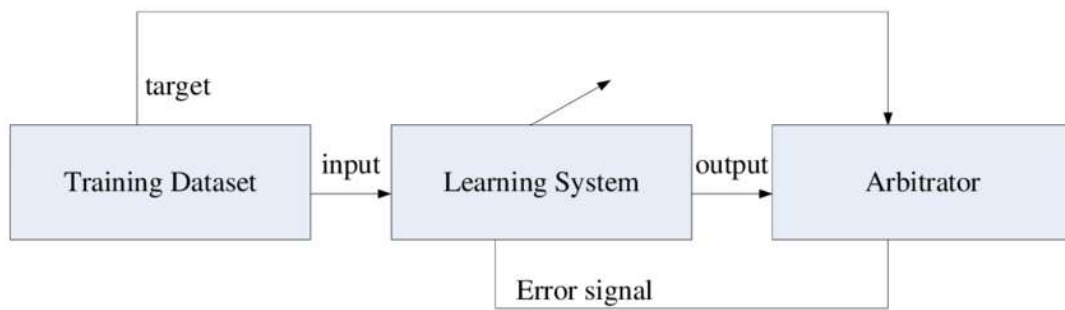
Supervised Learning Classification

- Popular Algorithms
  - Support Vector Machines
  - K-Nearest Neighbors
  - Naïve Bayes
  - Decision Trees
  - Multi-Layer Perceptron (Vanilla Neural Networks)
  - Deep Neural Networks
- Examples/ Applications
  - Spam/NSFW Filtering
  - Watermark Detection
  - Scam/Fraud Detection
  - Auto-Labeling (Text, Music, Video, Image,…) for improving search
  - Intrusion Detection
  - Text (Sentiment Analysis, News Filtering, Hashtag Suggestions, …)

Supervised Learning # Regression

- Popular Algorithms
    - Linear/Multi-variate/Lasso Regression
    - Support Vector Machines
    - Decision Trees
    - Multi-Layer Perceptron (Vanilla Neural Networks)
    - Deep Neural Networks
- Examples/ Applications
    - KPI prediction
    - Price Prediction/Estimation (Gold, Stock, Real-State)
    - Age Estimation
    - Identification/Verification
    - Auto. Scoring (Quality, Perceptibility, Popularity, etc.)

How to Solve a Classification/Regression Problem?

1. Make sure your problem is a classification/Regression problem!
2. Gather a good standard dataset
3. Label/Annotate your data by using experts or accurate people (and sometimes machine!)
4. Divide your dataset into Training/Validation/Test sets
5. Train different algorithms (models) by *Training set* and tune the models by *Validation set* to get the highest performance from each model
6. Use the *Test set* to evaluate the models and select the best trained model
7. Deploy the model and use it in your product.
8. Get more data and re-train you model during the time.

Supervised Learning Challenges

- Bad Datasets
  - Unlabeled data samples
  - Un-balanced datasets
  - Missing Values
  - Outliers
- Bad Feature Engineering
  - Irrelevant predictors (features)
  - Hard to understand
- Bad Training
  - Over-fitting
  - Under-fitting
  - Wrong model selection
  - Wrong hyper parameters setting

Supervised Learning Evaluation Metrics

- Classification
  - Accuracy
  - Precision   Confusion Matrix
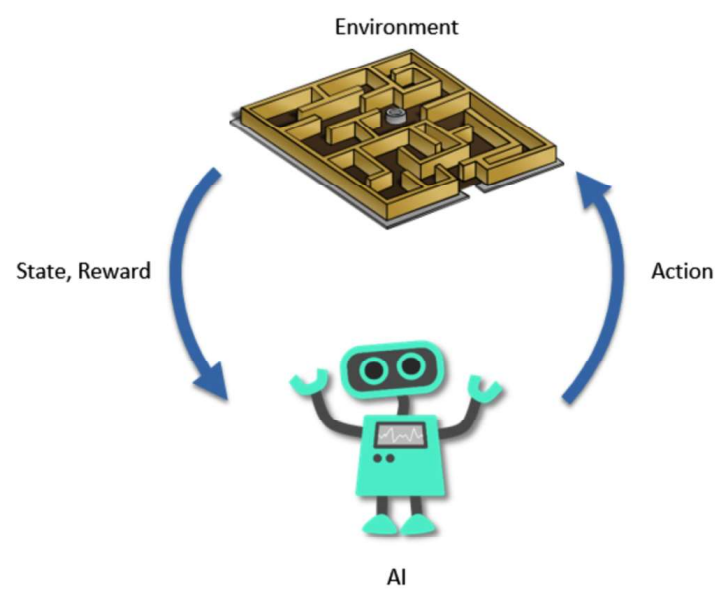 - Recall
  - F-measure
  - ROC curve
- Regression
  - Mean Square Error (MSE)
  - Root Mean Square Error   (RMSE)
  - Mean Absolute Error (MAE)
  - Cosine Similarity (for multi-output regressions)
  - Error histogram / Regression between real and predicted outputs

Un–Supervised Learning

- Clustering
  - K-means
  - FCM
  - Density-based
  - Hierarchical
  - SOM
- Feature Extraction/Dimensionality Reduction / Data Compression
  - Auto-Encoders
  - RBMs
 - PCA

Reinforcement Learning

Environment

State, Reward

Action

AI

Review

|	Supervised	Un-Supervised	Reinforcement
Needs Data?	YES	YES	NO
Needs Annotation/Labeling?	YES	NO	N/A
Needs Feedback/Supervisor?	YES	NO	YES
Applications:	• Prediction • Detection • Categorizing	• Finding patterns in data • Dim. Reduction • Turn unlabeled datasets into groups with similar members	• Robotic • Video Games • Improving Trained Models

Quiz

Problem	Supervised		Unsupervised	Reinforcement
	Classification	Regression		
Building a model that can play chess…				
Build a model that can predict what are you going to type…				
Build a model that can predict the number of passengers tomorrow for *Snap!*				
Build a model that can predict whether a flight passenger will buy the insurance or not…				
Build a model that can recommend similar products to a customer …				
Build a model that can recommend a product to similar persons …				
Build a model to predict the stock market from previous data and then improve the accuracy during the time …				

Neural Networks
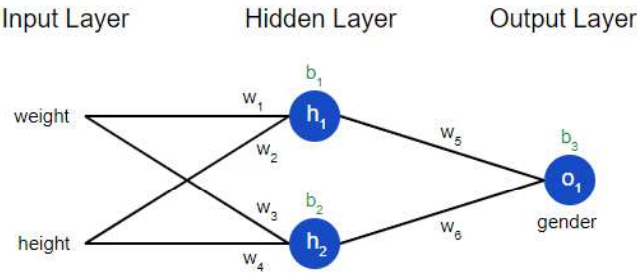
Deep Learning
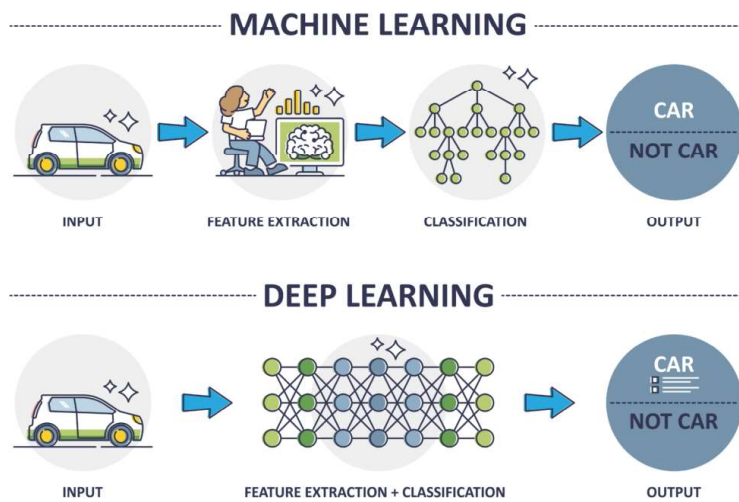
Different Fields of A.I.

- Computer Vision (Image/Video Processing + Machine Learning)
  - Image Classification
  - Object Detection
  - Image Segmentation
  - Object Tracking
  - Face Analysis (Gender, Age, Identity, Pose, Expression, etc.)
  - Image Generation (Deep Fake)
- Popular Models:
  - Convolutional Neural Networks (CNNs)
  - Generative Adversarial Networks (GANs)

Different Fields of A.I.

- Machine Listening (Audio Engineering + Machine Learning)
  - Speech Recognition (Voice to Text)
  - Music Information Retrieval (MIR)
  - Speech Synthesis (Text to Voice)
  - Speaker/Singer Recognition
  - Speech generation (Deep Face)
- Popular Models:
  - Long short-term Memory (LSTM)
  - Gated Recurrent Unit (GRU)
  - Transformers
  - Generative Adversarial Networks (GANs)

Different Fields of A.I.

- Natural Language Processing (Text Mining + Machine Learning)
  - Text Classification (Sentiment analysis, Auto tagging, Language Understanding)
  - Text Generation
  - Chat bots
  - Learn-to-rank (recommender systems)
- Popular Models
  - Word Embedding (Word2Vec, GloVe, Bert, etc.)
  - LSTMs, GRUs
  - Transformers
  - Generative Pre-trained Transformers (GPT)

Different Fields of A.I.

- MLSP (Machine Learning for Signal Processing)
  - Medical diagnosis (ECG, EEG, MRI, CT-scan, etc.)
  - Stock Markets/Crypto currencies
  - Electrical/Control/Power Engineering (Fault detection, uncertainty controlling)
  - Geography (Hyper Spectral Imaging – Remote Sensing)
  - Telecommunication/Networking (Traffic prediction, Intrusion detection, Resource Management)

Some Trending Terms

- Explainable A.I. (XAI)
- Multi-Modality
- Federated Learning
- Transfer Learning

A Fun Tool

- https://teachablemachine.withgoogle.com/