

Artificial Intelligence

What is A.I.?

- Definition: systems or machines that mimic human intelligence to perform tasks and can iteratively improve themselves based on the information they collect
- Examples:
 - Bots
 - Speech Recognition (“Hey Google”)
 - Trend Prediction (Stock Trading)
 - Recommendations
 - Auto-correct and auto-complete
 - etc.

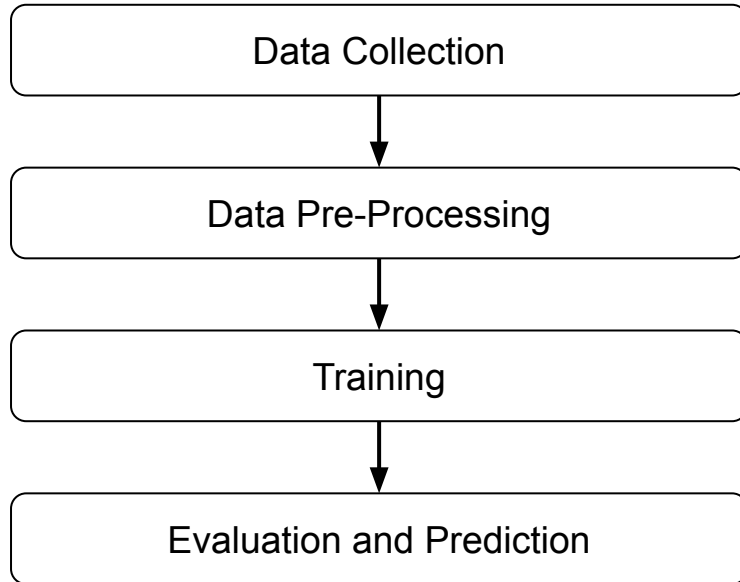
Purpose of A.I.

- The same as the purpose of computers; to automate and speed up tasks and make life more convenient and fun
 - Tasks that are *deterministic* are usually very easy to program
 - Deterministic - tasks that have a very clear “path” in making decisions and performing actions, where it is easy to identify and model all possible inputs/conditions
 - Tasks that are *stochastic* are usually very hard to program
 - Stochastic - tasks that do not have a clear “path” in decision-making and performing actions or where it is very difficult to identify and model all possible input/conditions
- A.I. helps us to model/automate stochastic tasks

Machine Learning

- A programmatic approach to use data (i.e. “experience”) to modify (and hopefully improve) performance (i.e. “learn”) on some given task(s)
- Essentially, when a program is performing a stochastic-based task, the program will inevitably make an incorrect decision (i.e. a “mistake”), when that happens how do we modify the program in order to do better next time?
 - This is modeled after how humans approach performing such stochastic-based tasks
 - Do programs make incorrect decisions for deterministic-based tasks? (assuming the program is given the proper set of instructions)
- Program is based on a “learning model”

Machine Learning Model



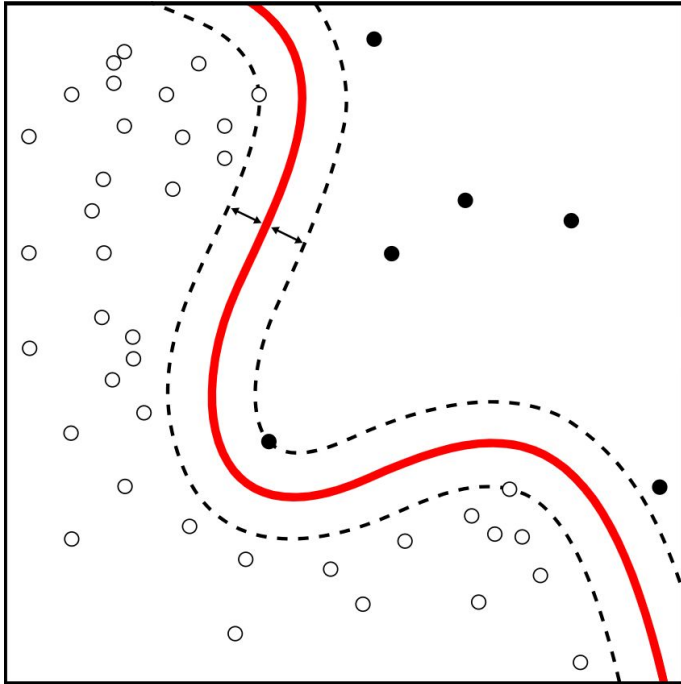
- Data Collection - gather data
- Data Pre-Processing - data conversion, formatting, labeling, etc.
- Training - the “learning” phase, use data to prepare the model
- Evaluation/Prediction - use the trained model to make decision on new data

Machine Learning Categories

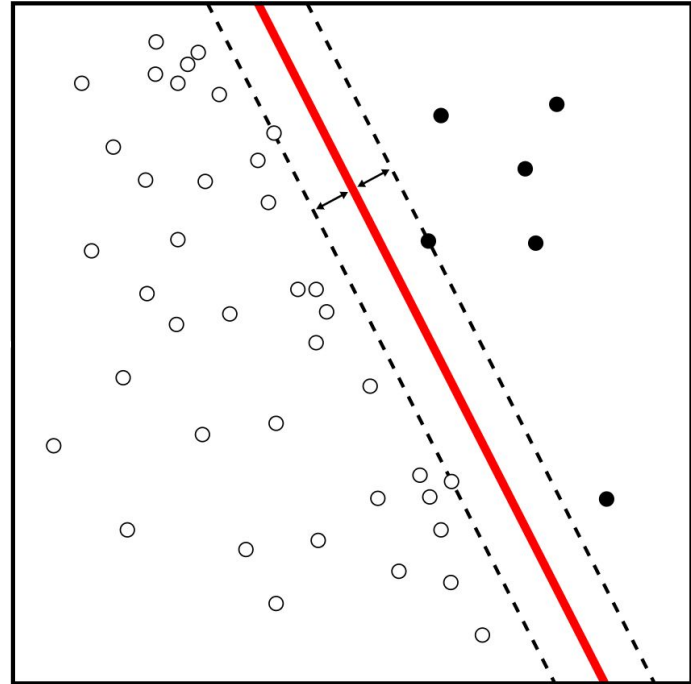
- Two main categories of machine learning models:
 - Statistical Methods vs Neural Networks
 - The primary difference lies in the Training and predictive capabilities
 - Statistical Methods - uses data to calculate a set of variables for use in a statistical equation/formula
 - Usually faster and easier to program/train
 - Has a hard time with non-linear data
 - Neural Networks - uses data to modify a set of weights/nodes; during training, the model will predict an output based on given input, if the output is correct then great, otherwise if it is wrong then modify the weights/nodes to do better next time
 - Usually takes a long time and can be difficult to program/train
 - Has a fairly easy time with non-linear data

Machine Learning Categories

Non-linear separation



Linear separation



Types of Machine Learning

- Unsupervised Learning- analyzing and using unlabeled data for training
 - E.g. - Clustering, etc.
- Supervised Learning - analyzing and using labeled data for training
 - E.g. - Classification, Linear Regression, etc.
- Semi-Supervised - analyzing and using both labeled and unlabeled data for training
- Reinforcement - data is observed/collected based on an environment, as the environment “changes” (or an object within the environment changes), the model takes action; if the action is good/desired it is “rewarded”, if the action is bad/undesired it is “punished”

Types of Machine Learning

- Linear Regression - used to model the outputs/behaviors of a set of independent variables and predict the outcome of a new independent variable; almost always supervised learning
- Classification - used to organize/categorize data into defined categories; often supervised learning, but can be unsupervised or semi-supervised
- Clustering - used to group data based on their location in some space (usually multi-dimensional); almost always unsupervised learning
- Data Generation - similar to linear regression, models the outputs/behaviors of sets of variables and their relationships with each other, based on a starting input create a new set of variables with similar outputs/behaviors and relationships
- and many more!

When will A.I. be as “smart” as humans?