Name: Akshay Ramesh Nadgire
Email: akshay.n15@gmail.com
Date: 07-Aug-2020

Exercise

Q1. Which parts of code that you are currently writing could be “learned”, i.e., improved by learning and automatically determining design choices that are made in your code? Does your code include heuristic design choices?

Ans: I was working on automating fraud detection for a money transfer company. We were using a set of rules to determine whether a given transaction is fraud or not. These rules were heuristically designed. By looking at past actual fraud transaction data, a better system can be learned to detect frauds.

Q2. Which problems that you encounter have many examples for how to solve them, yet no specific way to automate them? These may be prime candidates for using deep learning.

Ans: Language translation, human-to-human communication, being an exam invigilator. These are some examples where you can teach a human to do it but these can be coded using first principal.

Q3. Viewing the development of artificial intelligence as a new industrial revolution, what is the relationship between algorithms and data? Is it similar to steam engines and coal (what is the fundamental difference)?

Ans: Algorithm gives steps to adjust the model’s parameters to minimize the loss by using the data. Algorithms and data are not similar to steam engines and coal. Machine learning algorithm’s performance increases as it sees more data and accumulates experience. This may not be the case with steam engines and coal.

Q4. Where else can you apply the end-to-end training approach? Physics? Engineering? Econometrics?

Ans: Engineering seems to be a good starting point. Such as autonomous driving vehicles, where we would need a model to be trained end-to-end to take visual input and drive the car.

Summary

ML should be used when a problem can not be solved using first principles programming. ML is the study of powerful techniques that can learn from experience ["*Dive into Deep Learning*"].

ML algorithms accumulate more experience using observation data and its performance improves. Whereas traditional programs built using first principles programming performs according to hard coded business logic and we need to learn from experiences and modify the logic.

In ML approach, a program with randomly initiated parameters learns the best set of parameters using the data to improve its performance.

Below are key components of ML:

1. Data: It can be fixed-length or varying length data. Deep learning algorithms need large datasets.
2. Models: Deep learning model consists of many successive transformations of the data that are chained together top to bottom ["*Dive into Deep Learning*"]. DL models learn many layers of computation which transform the data from input to output. It learns many features from the input.
3. Objective function: It is a measure of how good or bad our ML model is performing. We try to minimise loss by tuning the parameters using training data. This loss is calculated using objective function and is function of model parameters.

Kinds of ML

1. Supervised Learning: Here we learn the best parameters of the model using historical data where features and labels are present for each example.
    a. Regression: The target is real-valued number
    b. Classification: The task is to predict in which category a given example belongs.
    c. Tagging: It is a multi-label classification problem where an example may belong to many classes.
    d. Search and Ranking: Information retrieval problem with ranking the items based on relevance score.
    e. Recommender System: It is learning the user profile and suggesting items to users based on their likes and dislikes.
    f. Sequence learning: Input is sequence of input and output is also sequence.
2. Unsupervised Learning: Here data contains only features.
    a. Clustering: Given data, group it into relevant clusters.
    b. Causality: Finding the relation between various features.
    c. GANs: Way to synthesize the data.
3. Reinforcement Learning: Here we have an agent which interacts with the environment and based on that takes an action. Then the agent will receive a reward based on the action it took and the aim of the agent is to maximise this reward.