1. 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?

Answer:

The code that do not involve any manually created algorithms to preform certain task can be learned. Consider a task to classify diseases present in leaves. This problems requires a dataset containing different images of diseased leaves along with their labels. Traditional approach to classify leaves would include feature engineering each leaves and analysing the patterns present in the leaves and deciding what disease occurred in new leaves.

Another approach is the use of CNN where each image is fed into the network and the neural network automatically performs feature engineering and provides output to the unseen data. In this approach, we can improve our learning automatically increasing the number of hidden layers, tweaking hyperparameters. With this method, our code include heuristic design choices as they are capable to learn themselves without the need of additional processing.

2. 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.

Answer:

There are many problems that lacks automation. Talking about a specific problem is the weather prediction. Weather prediction is so unpredictable as there are not any rules or pattern that helps in providing exact information about the weather. There may be information related to geographic data, satellite information that are helpful in predicting weather information, but those information are not always correct.

3. 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)?

Answer: Algorithm is the set of rules and data is something that we can learn from. So, we can relate algorithm and data like this: using a set of rules to the data so that we can learn from that data.

With respect to artificial intelligence, algorithm helps to find the best parameters for our model that is using the data.

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

Answer: There is a lot of area where end-to-end training approach can be applied. Talking about engineering, end-to-end training approach can be applied on self driving cars, where network can be trained to learn how to drive. In the case of econometrics, end-to-end training approach can be applied to predict the stock data.

Chapter Summary

Deep learning is the part of machine learning that mimics human brain. It is used to solve complex problems in the paradigm of classification, detection, segmentation, translation and many more. Deep learning have grown rapidly and many developments have been done using deep learning. Some include self-driving cars, disease diagnosis, recommendation systems, agents that are capable to beat world champions (Reinforcement Learning) and many more.

Why machine learning is important? Well, machine learning techniques learns from the experience. For every problem, there is a data associated with that data. Machine learning system tends to learn patterns from that data and use that pattern to provide decision on unseen instances.

For any machine learning problem, there requires data. We use the data into our model and check whether our model is good enough for unseen instances. If that’s not the case, we’ll update our model using various optimization techniques.

The key component to machine learning is data, models and algorithm. Data is the features that our machine learning model uses to learn. Model uses data to perform computations and learns the features from the data. Objective function determines how good or bad our model is and lastly algorithms helps to optimize our model by minimizing the objective function.

There are various type of machine learning namely supervised, unsupervised, interacting with environment and reinforcement learning. Supervised learning consists of both inputs and labels. The input data are often called as features. While predicting the price of any house, the area of house, number of storey are called as features as machine learning model use these features to learn and apply to new data. Supervised learning include regression, classification, tagging, searching, recommender systems and sequence learning. Example of supervised learning:

- Predict plant disease, given a leaf image
- Predict customer flow next month based on this month’s data

Another type of machine learning is unsupervised learning which contains only inputs i.e, features but not the labels. Our model need to learn only with inputs and apply those learned patterns to the new data. Unsupervised learning includes PCA, clustering, GANs, probabilistic graphical methods.

Reinforcement learning deals with an agent that interact with an environment and take actions. With every action, there is a reward associated with it. Example of reinforcement learning is the AlphaGo problem that beat World Champions of board game Go.

With the availability of large amount of data and computation power, deep neural networks have became main area of research for many researchers. Also with the availability of many methods such as DropOut(Srivastava et al., 2014) (help to prevent overfitting), attention(increase memory and complexity without increasing learnable parameters) deep learning is a go to area for research.

References:

- https://en.wikipedia.org/wiki/Deep_learning
- https://d2l.ai/chapter_introduction/index.html