A Machine Learning Model

The term, `Machine Learning`, often mystifies its nature of computer science, as its name might suggest that the machine is learning as human does, or even better.

Despite the hope that one day we could have machines that think and learn the way that humans do, machine learning nowadays does not go beyond a computer program that performs the predefined procedures.

What distinguishes a machine learning algorithm from a non-machine-learning algorithm, such as a program that controls traffic lights, is its ability to `adapt` its behaviours to new input.

And this adaptation, which seems to have no human intervention, occasionally leads to the impression that the machine is actually `learning`.

However, underneath the machine learning model, this adaptation of behaviours is as rigid as every bit of machine instructions that are programmed by humans.

So what is a machine learning model ?

A machine learning algorithm is the process that uncovers the underlying relationship within the data.

The outcome of a machine learning algorithm is called **machine learning model**, which can be considered as a `function` ◆F, which outputs certain results, when given the input.

Rather than a predefined and fixed function, a machine learning model is derived from historical data.

Therefore, when fed with different data, the output of machine learning algorithm changes, i.e. the machine learning model changes.

For example, in the scenario of image recognition, one might train a machine learning model to recognize the object in the photos.

In one case, one might feed thousands of images with and without cats to a machine learning algorithm, in order to obtain a model that is capable to tell whether there is a cat in a photo.

As a result, the input of the generated model would be a digital photo, and the output is a boolean value indicating the existence of a cat on the photo.
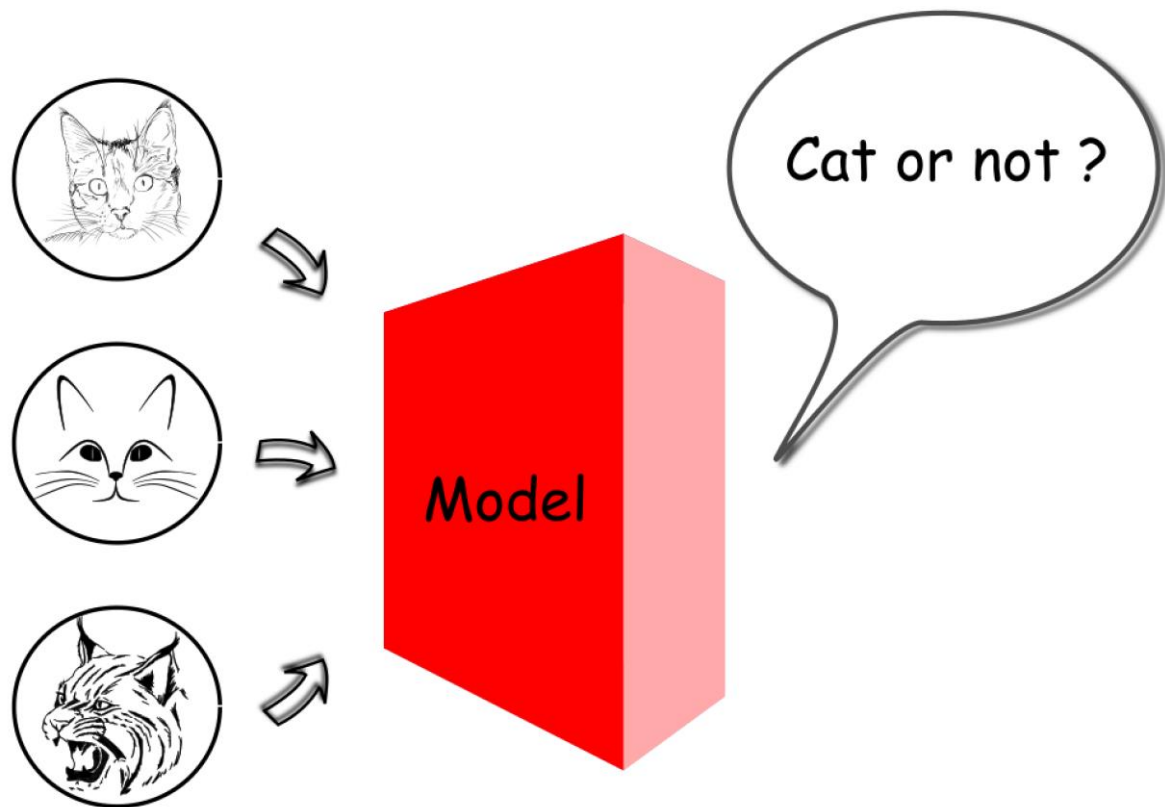
The machine learning model in the above case is a function that maps multiple dimensional pixel values to a binary value.

The task of machine learning, is to *learn* the function, from the vast mapping space.

The process of discovering the latent mapping relationship between millions of pixels and a Yes/No answer, is what we call *machine learning*, in this case.

Most of the time, what we learn at the end, is an *approximation* to this underlying relationship.

Due to its nature of approximation, one should not be disappointed to find that the results of a machine learning model is often not 100% accurate.

Before the wide application of deep learning in 2012, the best machine learning model can only achieve around 75% accuracy in the ImageNet visual recognition challenge.

Till nowadays, still, no machine learning model can claim 100% accuracy, although there are models that make fewer errors ($<5\%$) than humans in this task.