**What is Machine Learning(ML):**

Machine Learning is the science of getting computers to learn and act like humans do, and improve their learning over time in autonomous fashion, by feeding them data and information in the form of observations and real-world interactions.

**Models used for Time-Series prediction:**

**1.** **ARIMA, SARIMA:**

As for exponential smoothing, also ARIMA models are among the most widely used approaches for time series forecasting. The name is an acronym for AutoRegressive Integrated Moving Average.

In an AutoRegressive model the forecasts correspond to a linear combination of past values of the variable. In a Moving Average model, the forecasts correspond to a linear combination of past forecast errors.

Basically, the ARIMA models combine these two approaches. Since they require the time series to be stationary, differencing (Integrating) the time series may be a necessary step, i.e., considering the time series of the differences instead of the original one.

The SARIMA model (Seasonal ARIMA) extends the ARIMA by adding a linear combination of seasonal past values and/or forecast errors.

**2. Exponential Smoothing:**

Exponential smoothing is one of the most successful classical forecasting methods. In its basic form it is called simple exponential smoothing and its forecasts are given by:

Ŷ(t+h|t) = ⍺y(t) + ⍺(1-⍺)y(t-1) + ⍺(1-⍺)²y(t-2) + …

with *0<⍺<1*.

We can see that forecasts are equal to a weighted average of past observations and the corresponding weights decrease exponentially as we go back in time.

**3. LSTM(RNN):**

Long Short-Term Memory (LSTM) networks are a type of recurrent neural network capable of learning order dependence in sequence prediction problems. This is a behavior required in complex problem domains like machine translation, speech recognition, and more. LSTMs are a complex area of deep learning

Long Short-Term Memory networks – usually just called “LSTMs” – are a special kind of RNN, capable of learning long-term dependencies.

**Why LSTM model?**

* Long Short-Term Memory (LSTM) can solve numerous tasks not solvable by previous learning algorithms for recurrent neural networks (RNNs).
* LSTMs are very powerful in sequence prediction problems because they’re able to store past information. This is important in our case because the previous price of a stock is crucial in predicting its future price.
* LSTMs are explicitly designed to avoid the long-term dependency problem.
* All recurrent neural networks have the form of a chain of repeating modules of neural network. In standard RNNs, this repeating module will have a very simple structure, such as a single layer.
* The repeating module in a standard RNN contains a single layer.
* LSTMs also have this chain like structure, but the repeating module has a different structure. Instead of having a single neural network layer, there are four, interacting in a very special way.
* LSTMs expect our data to be in a specific format, usually a 3D array. We start by creating data in 100 timesteps and converting it into an array using NumPy. Next, we convert the data into a 3D dimension array with X\_train samples, 100 timestamps, and one feature at each step.
* There are a couple of other techniques of predicting stock prices such as moving averages, linear regression, K-Nearest Neighbors, ARIMA and Prophet. These are techniques that one can test on their own and compare their performance with the Keras LSTM.
* This clearly shows how powerful LSTMs are for analyzing time series and sequential data.

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| **Name of the model** | **Advantages** | **Disadvantages** |
| **ARIMA** | The main **advantage of ARIMA** forecasting is that it requires data on the time series in question only. First, this feature is advantageous if one is forecasting a large number of time series. Second, this avoids a problem that occurs sometimes with multivariate **models**. | Some major disadvantages of ARIMA forecasting are: first, some of the traditional model identification techniques for identifying the correct model from the class of possible models are difficult to understand and usually computationally 10 expensive. |
| **Exponential Smoothing** | **Exponential smoothing**is very simple in concept and very easy to understand.  **Exponential smoothing** is very powerful because of its weighting process. | **Exponential smoothing** will lag. In other words, the forecast will be behind, as the trend increases or decreases over time.  **Exponential smoothing**will fail to account for the dynamic changes at work in the real world, and the forecast will constantly require updating to respond new information. |
| **LSTM(RNN)** | The principal advantage of **RNN** over **ANN** is that RNN can model a collection of records (i.e., time collection) so that each pattern can be assumed to be dependent on previous ones. | **LSTMs** take longer to train.  **LSTMs** require more memory to train. |