<u>Monitoring Machine Learning/Deep Learning Models</u>

Basically, there are different types the model learns, some of the main types are

1. Supervised Learning
2. Unsupervised Learning

In supervised learning there are

1. Regression
    a. Predictive Models
    b. Forecasting Models
2. Classification: In classification, too there are some standard evaluation metrics, which uses confusion matrix. When it comes to NLP, there are different metrics.

So now, let us look into monitoring predictive models with respect to (w.r.t) regression (predictive models):

- Typically, when you are launching the machine-learning model you will calculate the Loss Function (Ordinary Least Square (OLS), or Root Mean Squared Error (RMSE) or Mean Absolute Error (MAE)). So the smaller the loss function the better it is. So let's assume that you have got a model that has the lowest loss function and you are satisfied with the result and you have launched the model. Now comes the harder question how do we monitor the model?
    o There are several ways to monitor the model, one way is to find out the confidence interval before launching the best model and if the predictions are falling out of the confidence interval then send an alert to the model developer.
    o Statistical tests like Kolmogorov-Smirnov, Anderson-Darling, or KL Divergence tests for each predictor variable/feature can be used. Summary statistics like mean, standard deviations can also be used.

Now let us look into how we can monitor the forecasting models

- Let us assume we are using prophet model, so using this model if the observed value is outside the uncertainty level of the forecasted range say twice or thrice (you can set the threshold) then we can send an alert to the model developer.
- For models using RNN's (LSTM or GRU) we can set an alert if the residuals crosses a threshold may be two or 3 times continuously.

Now let us look into the Monitoring of classification model:

- For a classification model, let us assume that our desired metric is Accuracy. So now, for any type of classification metric we use binomial proportion confidence interval. Now with this we determine the confidence interval and if the observed accuracy falls outside the range of the confidence interval then we can set an alert and alert the model developer.