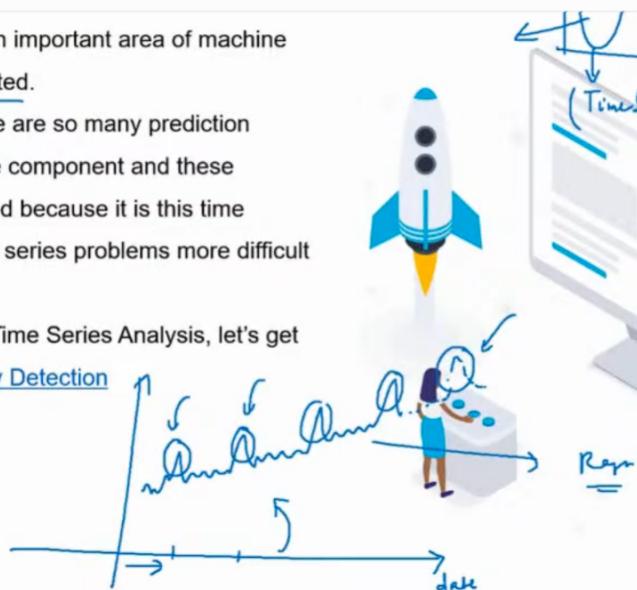


Time Series Analysis & Forecasting :-

ML → Sup → Classi, Regressn, TSF
 ML → Unsup → Clustering, Recommendation.

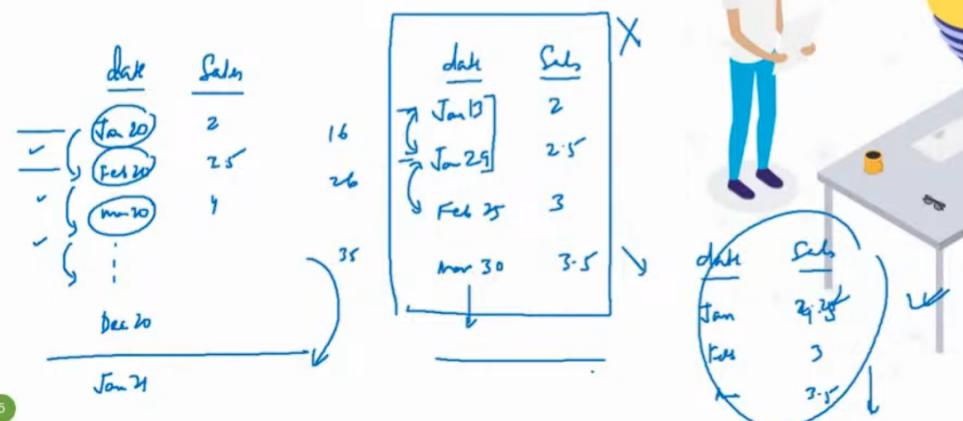
Time Series Analysis:-

- Time series forecasting is an important area of machine learning that is often neglected.
- It is important because there are so many prediction problems that involve a time component and these problems are often neglected because it is this time component that makes time series problems more difficult to handle.
- Before getting started with Time Series Analysis, let's get our basics clear on [Anomaly Detection](#)

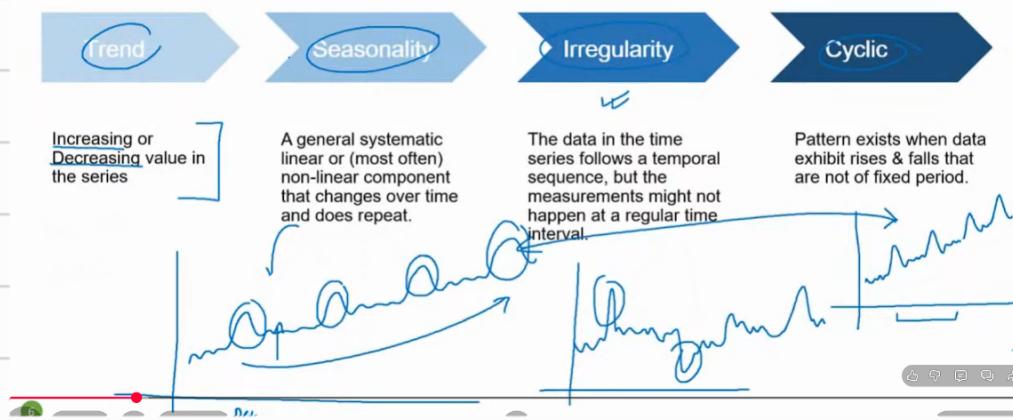


What is Time Series?

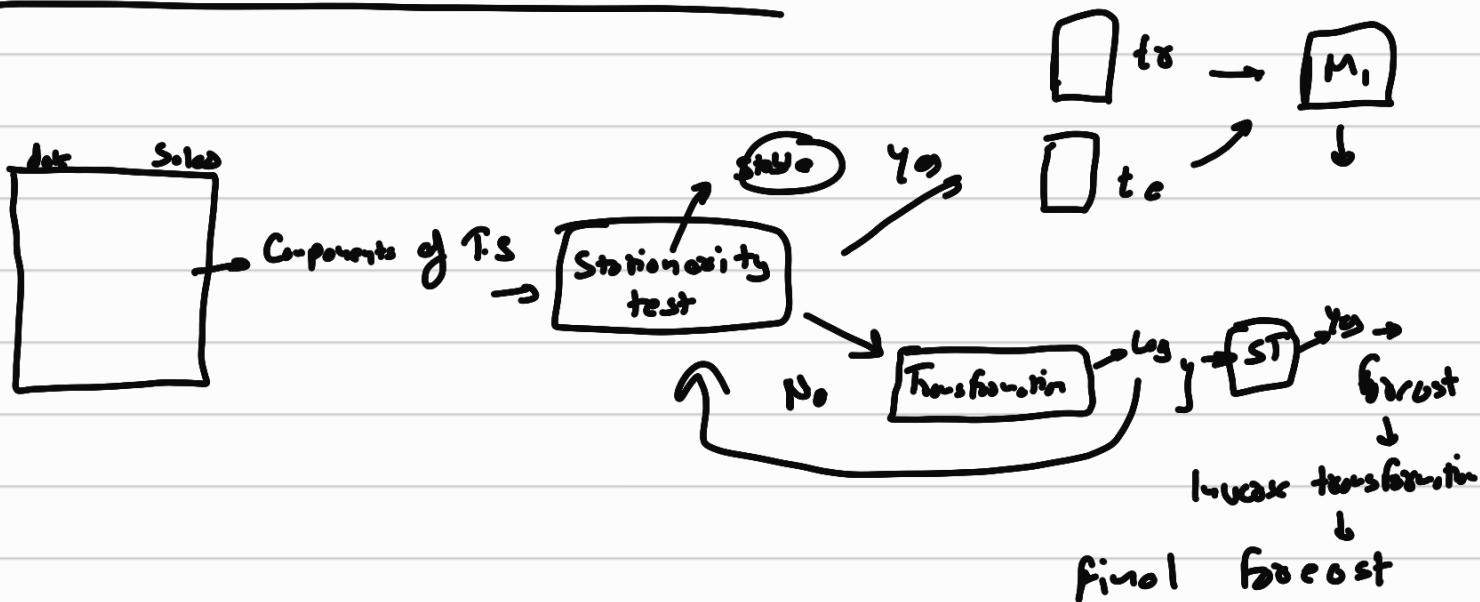
It is a series of observations taken at specified times basically at equal intervals. It is used to predict future values based on past observed values.



Components of Time Series



T.S Model flowchart :- Dickey Fuller Test



TS \rightarrow Stationarity \rightarrow Statistical properties
doesn't change over time.

\rightarrow Mean
 \rightarrow Std dev

T.S Algo

- ① ARIMA \rightarrow AR, MA, ARMA, ARIMA } We don't use now
- ② SARIMA, SARIMAX } We don't use now
- ③ GARCH } Very traditional
- ④ HOLT'S Winter }

- (5) Facebook Prophet
- (6) LSTM
- (7) Bi LSTM
- (8) GRUs

Testing TS Stationarity



Satyajit Pattnik

There are many methods to check whether a time series is stationary or non-stationary.

1. **Look at Plots:** You can review a time series plot of your data and visually check if there are any obvious trends or seasonality.
2. **Summary Statistics:** You can review the summary statistics for your data for seasons or random partitions and check for obvious or significant differences.
3. **Statistical Tests:** You can use statistical tests to check if the expectations of stationarity are met or have been violated.

You can split your time series into two (or more) partitions and compare the mean and variance of each group. If they differ and the difference is statistically significant, the time series is likely non-stationary.

Testing TS Stationarity



Satyajit Pattnik

The null hypothesis of the test is that the time series can be represented by a unit root, that it is not stationary (has some time-dependent structure). The alternate hypothesis (rejecting the null hypothesis) is that the time series is stationary.

- **Null Hypothesis (H_0):** If failed to be rejected, it suggests the time series has a unit root, meaning it is non-stationary. It has some time dependent structure.
- **Alternate Hypothesis (H_1):** The null hypothesis is rejected; it suggests the time series does not have a unit root, meaning it is stationary. It does not have time-dependent structure.

We interpret this result using the p-value from the test. A p-value below a threshold (such as 5% or 1%) suggests we reject the null hypothesis (stationary), otherwise a p-value above the threshold suggests we fail to reject the null hypothesis (non-stationary).

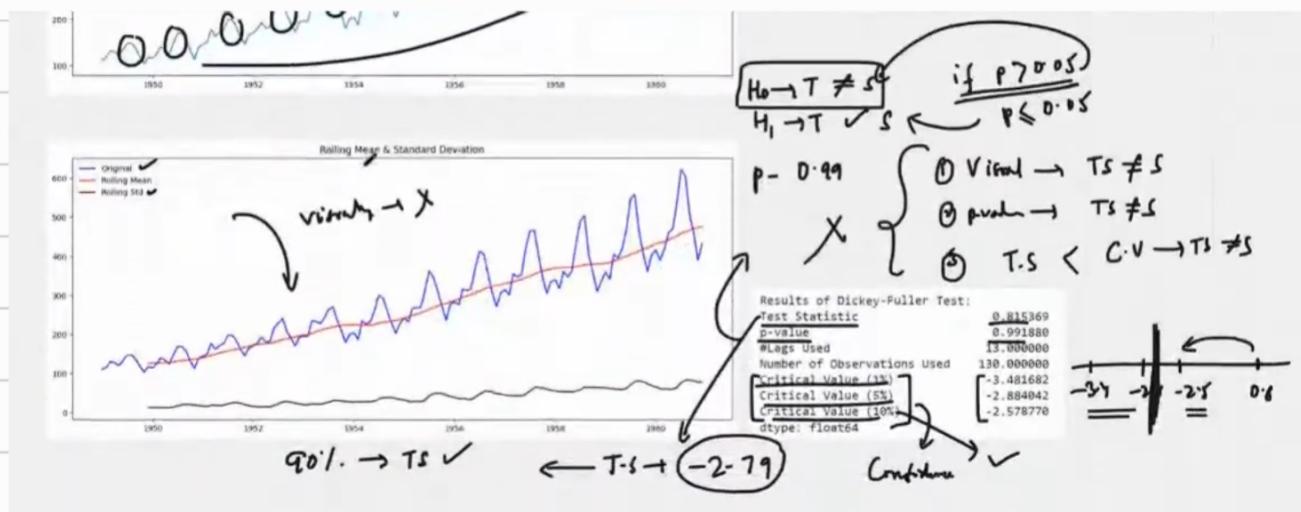
- **p-value > 0.05 :** Fail to reject the null hypothesis (H_0), the data has a unit root and is non-stationary.
- **p-value ≤ 0.05 :** Reject the null hypothesis (H_0), the data does not have a unit root and is stationary.

$H_0 \rightarrow Ts \neq \text{Stationary}$

$H_1 \rightarrow Ts = \text{Stationary}$

$P > 0.05 \rightarrow \text{Accept } H_0$

$P \leq 0.05 \rightarrow \text{Reject } H_0, \text{ Accept } H_1$



Transformation technique :-

- ① Log
- ② dLog
- ③ t Log
- ④ M.A
- ⑤ Diff
- ⑥ Log + Diff

After
Port technique
do S.T

ARIMA(p, d, q) \rightarrow AR, MA, ARMA

AR	diff	MA	$d=0$	$q=0$	$p=0$
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How we find p, d, q ?
 \rightarrow HPO

- 1 Manual
- 2 Random Search
- 3 Grid Search

You can not use API to predict 7-day forecast from today it will bad results.

Facebook Prophet :-

Pip install PyStan
Pip install prophet

- ① Don't use Outliers
- ② Don't use Seasonality
- ③ Add Holidays.
- ④ Add Uni, Multi regressor
- ⑤ $\text{daily} \rightarrow \text{Month}$
 $x \qquad \qquad \qquad y$
 $\text{monthly} \rightarrow \text{daily}$

