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SEC4T (Weather Forecasting) , Topic :- Basics of Weather Forecasting (part-II)

CLASSIFICATION OF WEATHER FORECASTING

A daily weather forecast involves the work of thousands of observers and meteorologists all over the world. Modern computers make forecasts more accurate than ever, and weather satellites orbiting the earth take photographs clouds from space. Forecasters use the observations from ground and space, along with formulas and rules based on experience of what has happened in the past, and then make their forecast.

Meteorologists actually use a combination of several different methods to come up with their daily weather forecasts. They are

- a) Persistence Forecasting
- b) Synoptic Forecasting
- c) Statistical Forecasting
- d) Computer forecasting

a) Persistence Forecasting

The simplest method of forecasting the weather is persistence forecasting. It relies upon today's conditions to forecast the conditions tomorrow. This can be a valid way of forecasting the weather when it is in a steady state, such as during the summer season in the tropics. This method of forecasting strongly depends upon the presence of a stagnant weather pattern. It can be useful in both short range forecasts and long range forecasts. This assumes that what the weather is doing now is what it will continue to do. To find out what the weather is doing, meteorologists make weather observations.

b) Synoptic Forecasting

This method uses the basic rules for forecasting. Meteorologists take their observations, and apply those rules to make a short-term forecast.

c) Statistical Forecasting

Meteorologists ask themselves, what does it usually do this time of the year? Records of average temperatures, average rainfall and average snowfall over than years give forecasters an idea of what the weather is "supposed to be like" at a certain time of the year.

d) Computer forecasting

Forecasters take their observations and plug the numbers into complicated equations. Several ultra-high-speed computers run these various equations to make computer "models" which give a forecast for the next several days. Often, different equations produce different results, so meteorologists must always use the other forecasting methods along with this one.

Using all the above methods, forecasters come up with their "best guess" as to what weather conditions will be over the next few days.

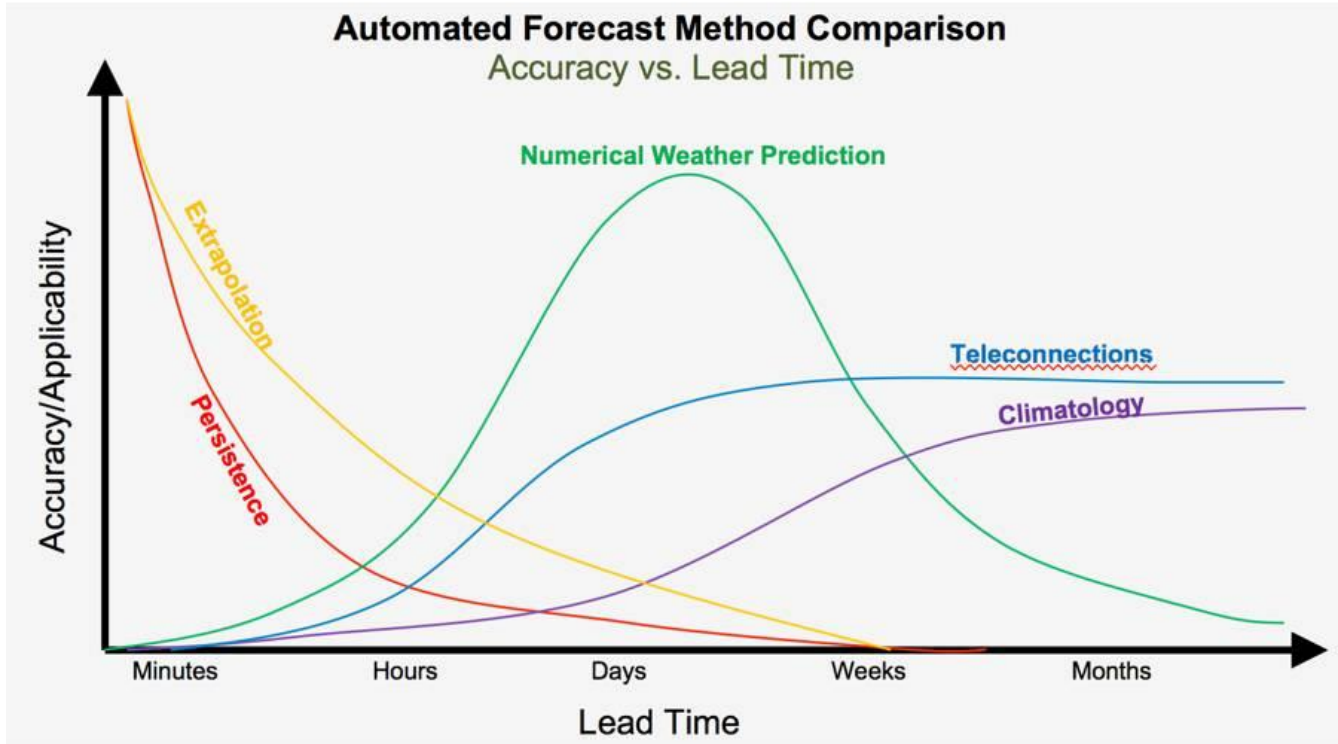


Fig- Comparison of Weather Forecasting Method

Weather forecasting now has a wide range of operational products that traditionally are classified under the following groups:

- (a) Very short-range forecast
- (b) Short-range forecast
- © Medium-range forecast
- (d) Long-range forecast

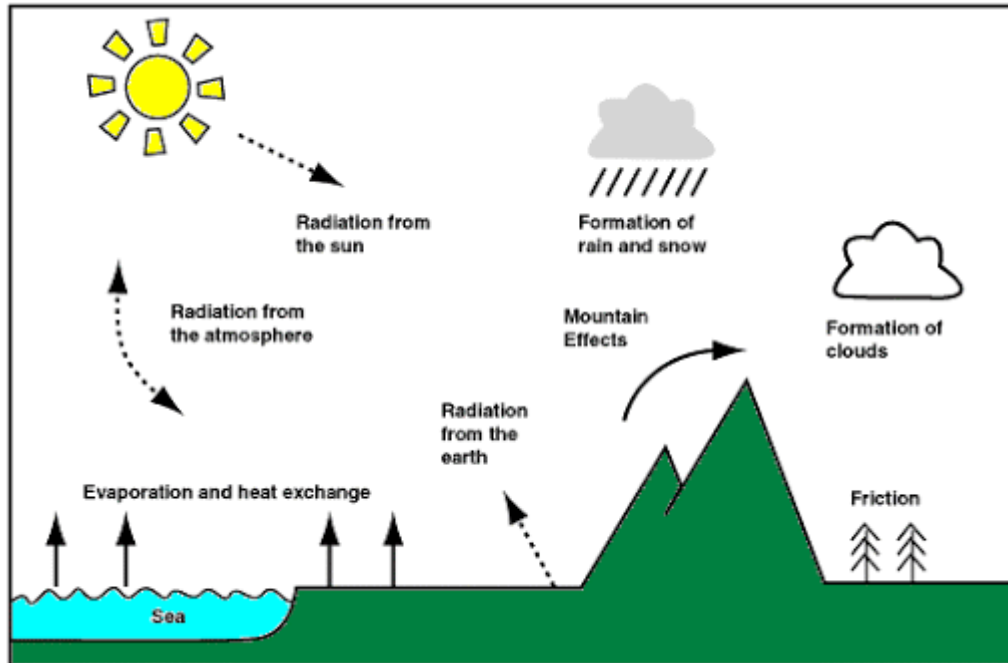


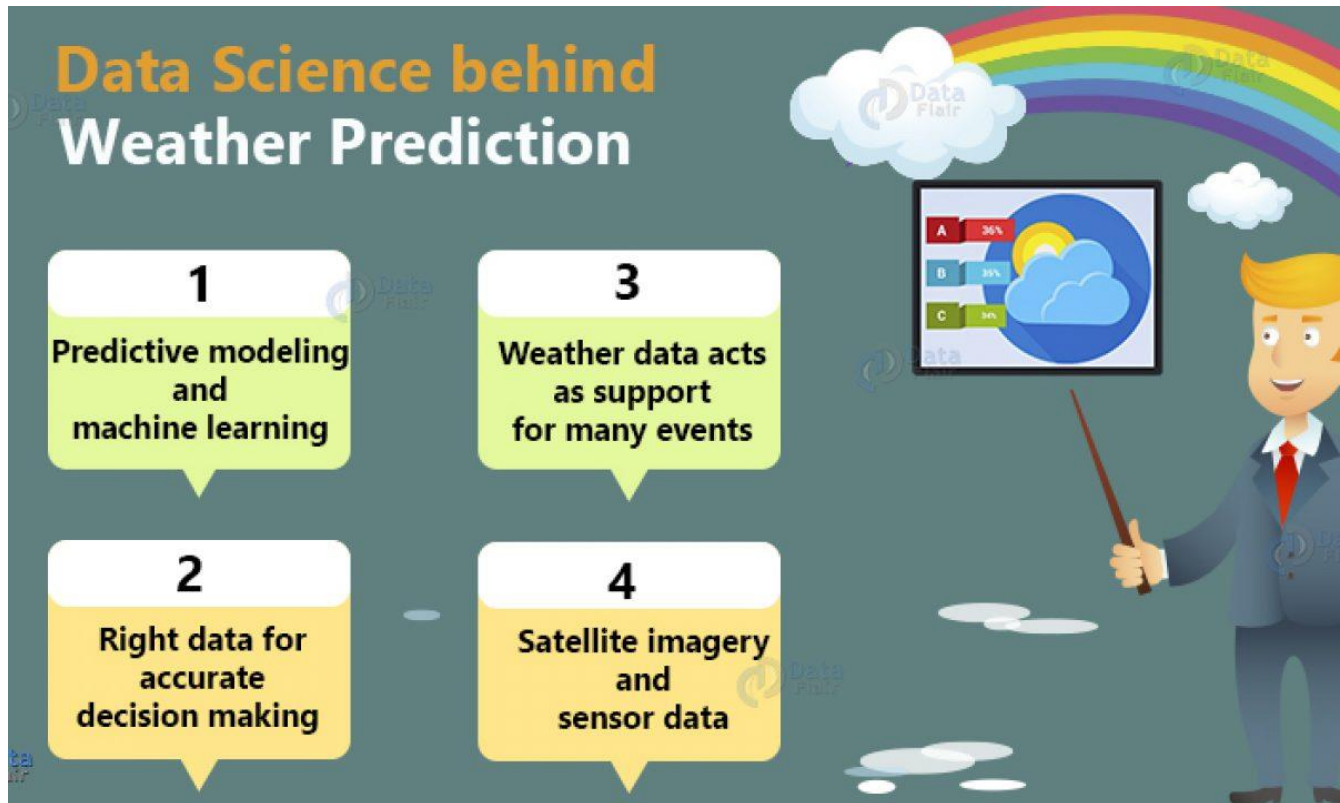
Fig- Types of Weather Forecasting

Each weather forecast can be defined on the basis of the following criteria:

- (a) Dominant technology
- (b) Temporal range of validity after emission
- (c) Characteristics of input and output time and space resolution
- (d) Broadcasting needs
- (e) Accuracy

IMPORTANCE OF WEATHER FORECASTING

Weather forecasting is used in many situations like severe weather alerts and advisories, predicting the behavior of the cloud for air transport, prediction of waterways in a sea, agricultural development and avoiding forest fire.



Severe weather alerts and advisories

A major part of modern weather forecasting is the severe weather alerts and advisories which are the national weather service's issue in anticipation of severe or hazardous weather are expected. This is done to protect life and property. Some of the most commonly known of severe weather advisories are the severe thunderstorm and tornado warning, as well as the severe thunderstorm and tornado watch. Other forms of these advisories include

winter weather, high wind, flood, tropical cyclone, and fog. Severe weather advisories and alerts are broadcast through the media, including radio, using emergency systems as the Emergency Alert System which breaks into regular programming.

Predicting the behaviour of the cloud for Air transport

The aviation industry is especially sensitive to the weather and accurate weather forecasting is essential. Fog or exceptionally low ceilings can prevent many aircraft from landing and taking off. Turbulence and icing are also significant in-flight hazards. Thunderstorms are a problem for all aircrafts because of severe turbulence due to their updrafts and outflow boundaries, icing due to the heavy precipitation, as well as large hail, strong winds, and lightning, all of which can cause severe damage to an aircraft in flight. Volcanic ash is also a significant problem for aviation, as aircraft can lose engine power within ash clouds.

Prediction of waterways in a sea

Commercial and recreational use of waterways can be limited significantly by wind direction, speed, wave periodicity, high tides and precipitation. These factors can each influence the safety of marine transit. Consequently, a variety of codes have been established to efficiently transmit detailed marine weather forecasts to vessel pilots via radio, for example marine forecast. Typical weather forecasts can be received at sea through the use of Radio fax.

Agricultural development

Weather plays an important role in agricultural production. It has a profound influence on the growth, development and yields of a crop, incidence of pests and diseases, water needs and fertilizer requirements in terms of differences in nutrient mobilization due to water stresses and timeliness and

effectiveness of prophylactic and cultural operations on crops. Weather aberrations may cause (i) physical damage to crops and (ii) soil erosion. The quality of the crop produced during movement from field to storage and transport to market depends on weather. Bad weather may affect the quality of the produce during transport and viability and vigor of seeds and planting material during storage.

Avoiding Forest fire

Weather forecasting of wind, precipitations and humidity is essential for preventing and controlling wildfires. Different indices, like the Forest fire weather index and the Haines Index, have been developed to predict the areas more at risk to experience fire from natural or human causes. Conditions for the development of harmful insects can also be predicted by weather forecasting.

Military applications

Military weather forecasters present weather conditions to the war fighter community. Military weather forecasters provide pre-flight and in-flight weather briefs to pilots and provide real time resource protection services for military installations. Naval forecasters cover the waters and ship weather forecasts. The Navy provides a special service to both themselves and the rest of the federal government by issuing forecasts for tropical cyclone across the Pacific and Indian Oceans through their Joint Typhoon Warning Centre.

Air Force

Air Force Weather provides weather forecasting for the Air Force and the Army. Air Force forecasters cover air operations in both wartime and peacetime operations and provide Army support. Military and civilian

forecasters actively cooperate in analyzing and creating weather forecast products.

DATA COLLECTION

Weather data for ten years (2001-2010) is collected from the Indian Meteorological department of Kanyakumari District, Tamilnadu. The chosen weather data is divided into two groups, the training group, corresponding to 75% of the data, and the test group corresponding to 25% of data. Weather forecasts today depend on collecting and analyzing data and measurements from around the world. Some of the misclassified data are taken from Weather.com and AccuWeather.com. It was supported the meteorologists in analyzing and predicting customized weather forecasts for a city or metropolitan area rather than providing general users with the ability to manipulate and interactively identify possible threats associated with impending weather hazards [HTTP2, HTTP3]. The data set contains fourteen attributes.

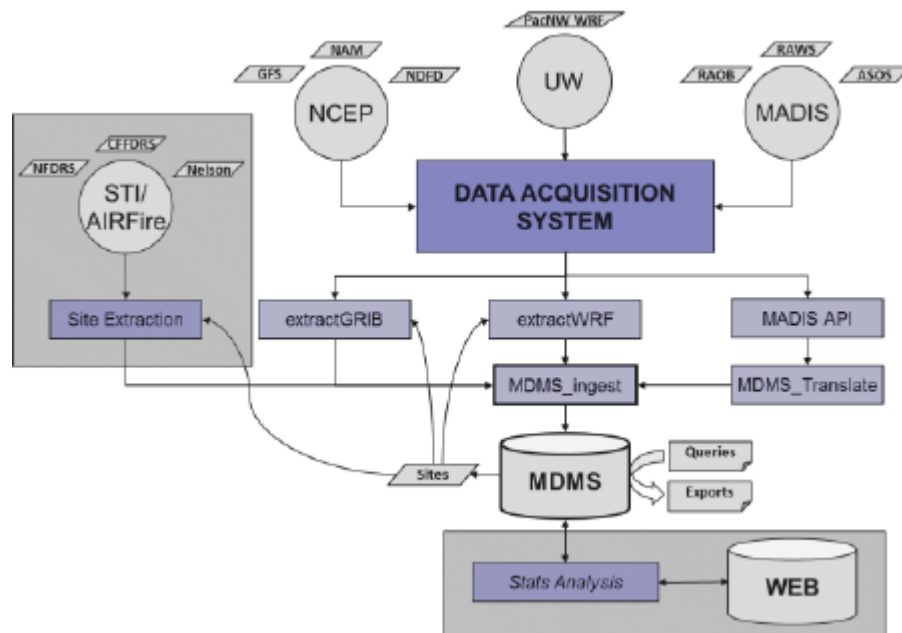


Fig- Flow Chart of Data Collection of Weather Forecasting

They are -

1. Bar Temperature
2. Bar reading
3. Station level pressure
4. Mean-sea level pressure
5. Dry bulb temperature
6. Wet bulb temperature
7. Maximum temperature
8. Minimum temperature
9. Vapor pressure
10. Relative humidity
11. Precipitation
12. Cloudiness
13. Wind speed
14. Wind direction

OBJECTIVES AND SCOPE

The objectives of this research study are

(a) To examine the applicability of Neural Network approach by developing effective and efficient predictive models for weather analysis for Kanyakumari District, TamilNadu, India.

(b) To develop an efficient, reliable and effective weather forecasting system based on Back Propagation Neural Network, Radial Basis Function Neural Network, Generalized Regression Neural Network and Fuzzy ARTMAP Neural Network.

(C) To compare and evaluate the performance of above models and the programming was carried out using MATLAB as a tool.

The scope of this research work is to evaluate the performance of the above Neural Network models with chosen dataset.

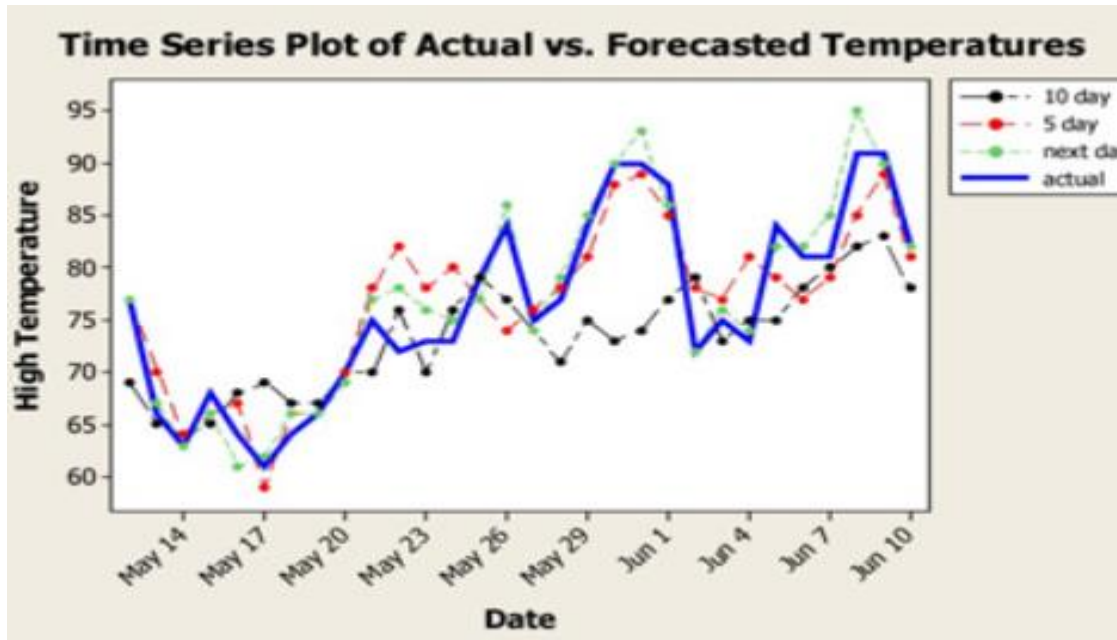


Fig- Weather Forecasting using Time Series

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