Rainfall Prediction For Mehsana District

Institute of Engineering & Technology
Ahmedabad University

Presented By:
Mehul Katara(1421005)
Riddhi Patel(1421013)
Sahil Desai(1421014)
Saurabh Chauhan (1421015)
Guided By:
Prof. Sanjay Chaudhary

December 14, 2014

Introduction

- Rainfall Prediction is the application of science and technology to foretell the state of the atmosphere. It is important to exactly determine the rainfall for effective use of water resources, crop productivity and pre planning of water structures
- Rainfall is one of the most important hydrological parameter on which the economy of India depends.
- Monsoon prediction is clearly of great importance for India.

The need for Data Science and Analytics

- Data Analytics is the process of examining big data to uncover hidden patterns, unknown correlations and other useful information that can be used to make better decisions.
- Decipher the information that truly counts.
- Predicting the Rainfall become a crucial issue as many as disasters can be prevented if forecasting technology can be used efficiently.
- Inorder to protect our Nation against Flood/Drought Situations.

Challenges : Domain Specific and Technical

- Long-term rainfall prediction is a challenging task especially in the modern world.
- Different Methods are available for Rainfall Prediction.
- The accurate and timely prediction of rainfall is a challenging task.

Mathematical Model(Multi Linear Regression)

- There are two approaches for Rainfall prediction.They are
  - Empirical Approach
  - Dynamical Approach
- Multi linear regression is an approach for modeling the relationship between a scalar dependent variable y and one or more explanatory variables denoted X.
- Regression Formula
  $Y = a + b_1 * X_1 + b_2 * X_2 + b_3 * X_3 + .. + b_6 * X_6$
  where,
  Y=Rainfall Prediction
  X_1=Mean Temperature
  X_2=Mix Temperature
  X_3=Min. Temperature
  X_4=Mean Humidity
  X_5=Wind Speed(km/hr)
  X_6=Sea Level Pressure(hPa)

Mathematical Model(Multi Linear Regression) Conti.

a=Intercept
$b_1, b_2, b_3, \ldots, b_6$ are Coefficients of X_1, X_2, X_3 ,... and X_6 Respectively.

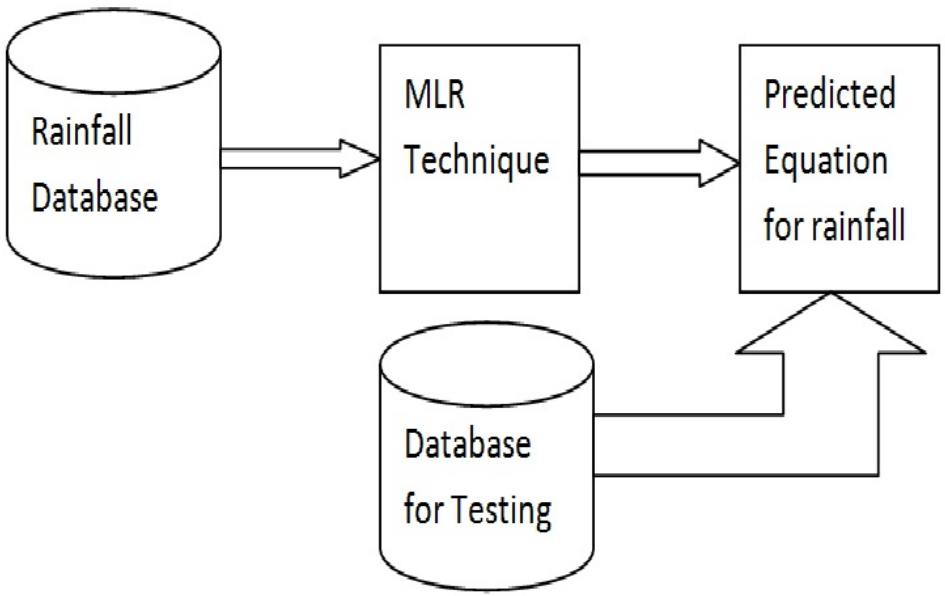
- Mean Square Error= MSE $= \frac{1}{n}\sum_{i=1}^{n}(\hat{Y}_i - Y_i)^2$
  where $\hat{Y}_i$ is a Predicted value of Rainfall and Y_i is actual value of Rainfall.

Mathematical Model(Moving Avg.)

- In statistics, a moving average (rolling average or running average) is a calculation to analyze data points by creating a series of averages of different subsets of the full data set.
- A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles

Architecture of the Proposed System

Figure : Rainfall Prediction Model



Technology Stack for the Project

- S/W used:
  - R
- The model is built using R and requires 4 GB RAM and 2.4 GHz processor.

Brief about Data Sets

- Rainfall related data is collected from State Emergency Operation Centre,Revenue Department,Gandhinagar
- Data related to Min temp.,Max temp.,Mean temp.,Humidity and No of Rainy days are collected from www.indiastat.com(Through DAIICT IP Login) and www.TuTiempo.net

- Sample Data Set is shown Below.

A	B	C	D	E	F	G	H	I
Year	Mean T	Max T	Min T	Rainfall (mm)	Mean Humidity	No_rainyday	wind speed(km/hr)	Sea level Pressure(hPa)
1996	27.1	34.3	21	432	56.2	61	7.9	1006
1997	26.5	33	20.8	1361	60.9	80	7.6	1008
1998	27.3	34.4	21	941	57.3	65	7.3	1007
1999	26.9	34.3	20.5	371	55.5	50	6.8	1007
2000	27.6	35.1	20.3	289	48.3	38	7	1007
2001	27.1	34.4	20.5	626	50.2	66	7.8	1008
2003	27.2	34.4	21.2	822	48.1	63	8.4	1008
2004	27.3	34.6	21	565	54.1	6	8.6	1008
2006	27.4	34.3	21	1421	57.8	68	7.7	1008
2007	27.5	34.5	21.1	1119	56.3	67	7.9	1007
2008	26.6	33.9	20.7	619	56.9	62	6.8	1007
2009	28	35.3	21.8	459	52.1	42	10.4	1007
2010	27.8	35.1	21.9	783	52.1	87	12.8	1007
2011	28.9	35.3	21.3	863.03	51.4	69	8.2	1007
2012	27.9	35	20.6	578.81	51.8	61	8.4	1007
2013	27	34.1	20.6	1174.59	57.9	80	8.8	1007

Figure : Rainfall Data Set from 1996-2013

Results and Interpretation

	Coefficients
Intercept	-3.796e+05
Mean Temp	1.946e+02
Max Temp	4.057e+01
Min Temp	6.002e+01
Mean Humidity	6.300e+01
No of Rainy days	9.262e+00
Wind speed	-2.620e+01
Mean Sea Level	3.660e+02
Multiple R-squared	0.8765

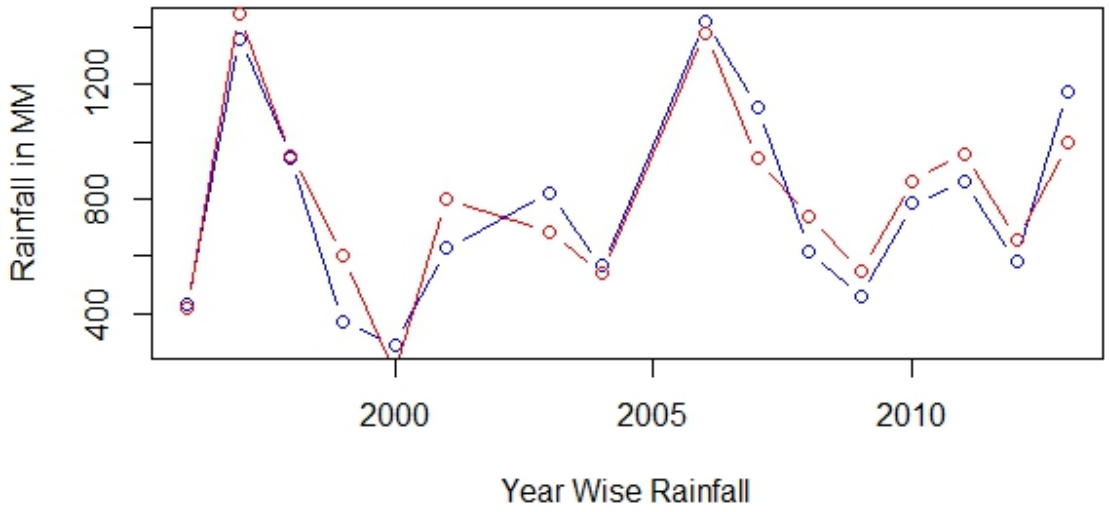


Figure : Year-wise Rainfall Prediction from 1996-2013

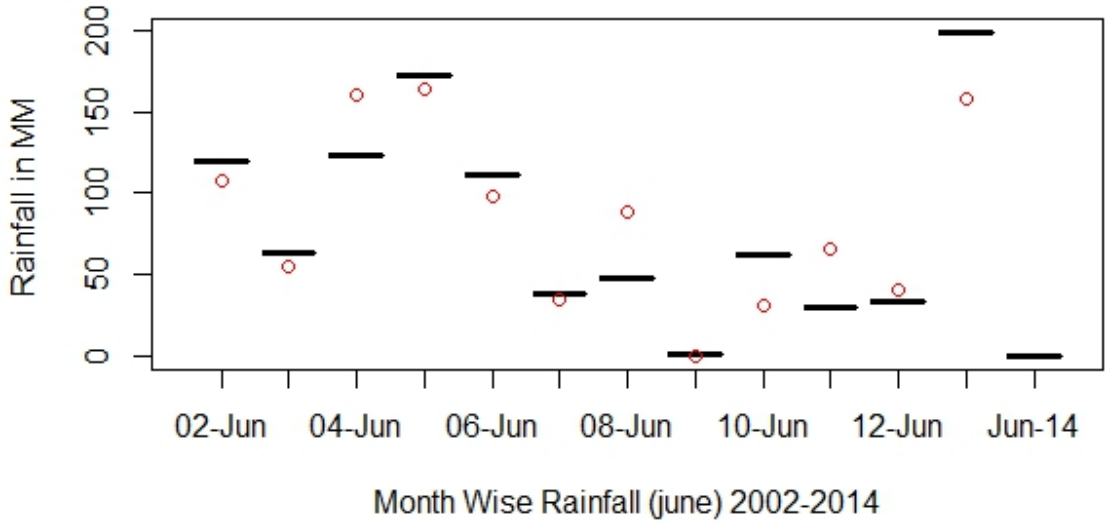


Figure : Rainfall Prediction for June from 2002-2014

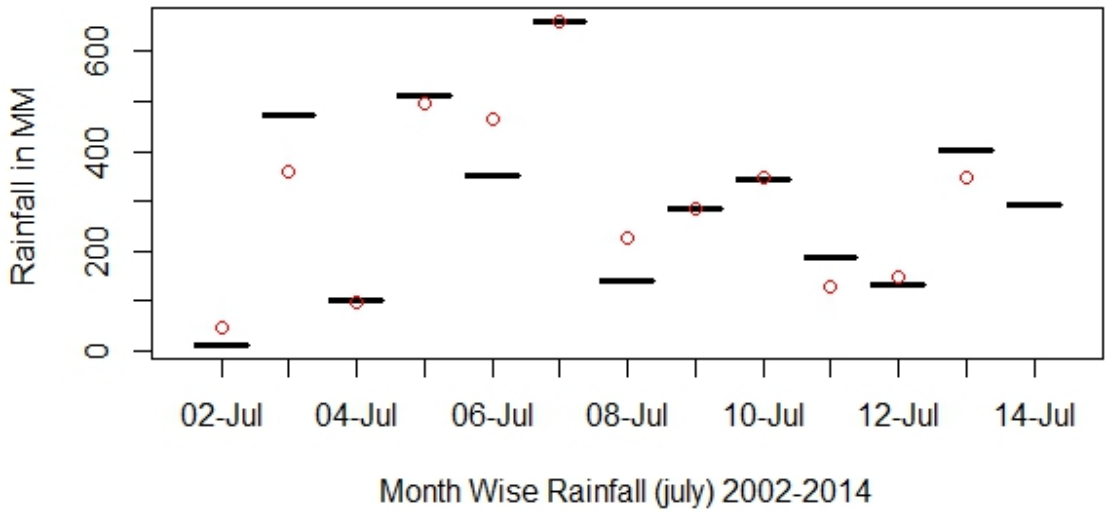


Figure : Rainfall Prediction for July from 2002-2014

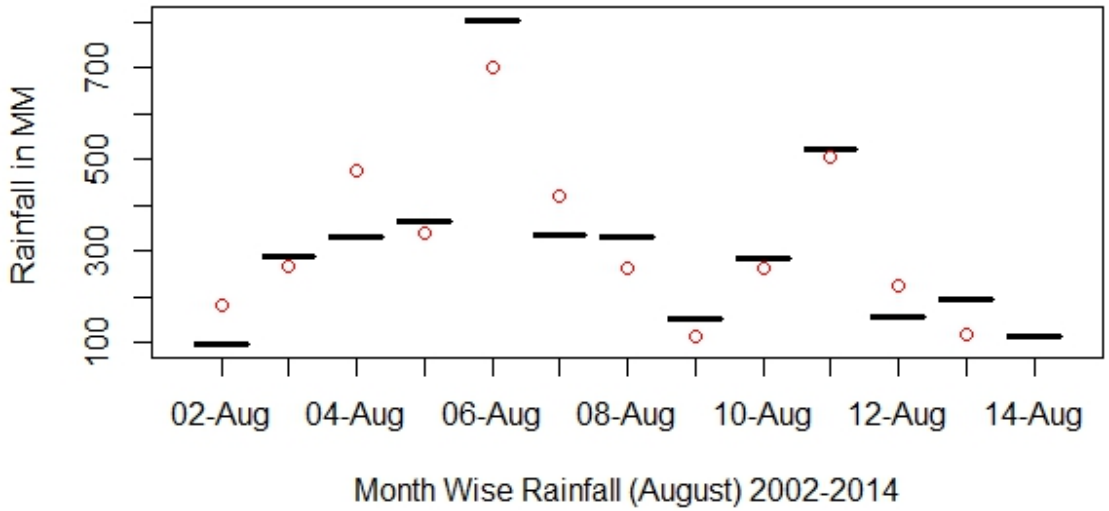


Figure : Rainfall Prediction for August from 2002-2014

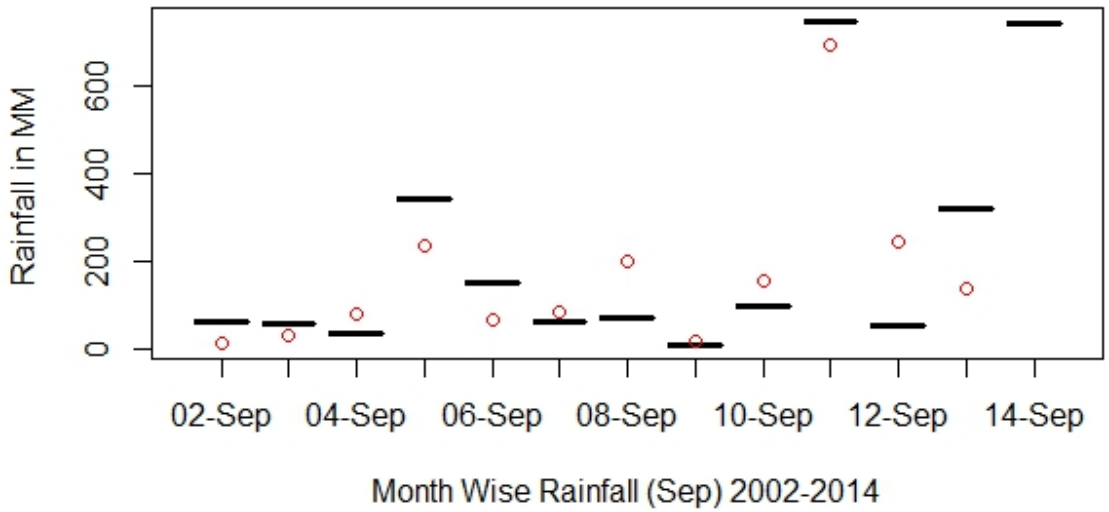


Figure : Rainfall Prediction for Sept. from 2002-2014

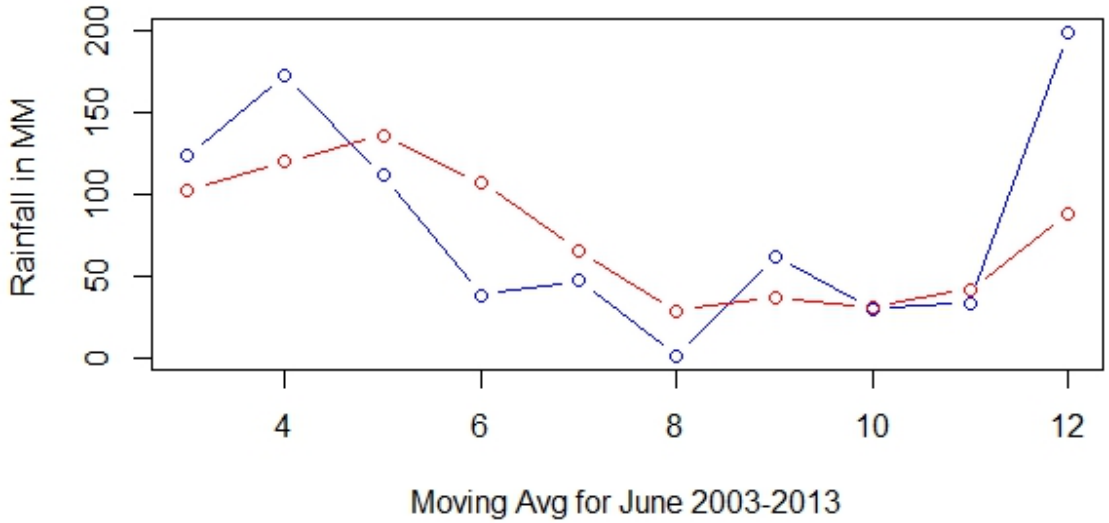


Figure : Rainfall Prediction using Moving Avg. for June from 2002-2014

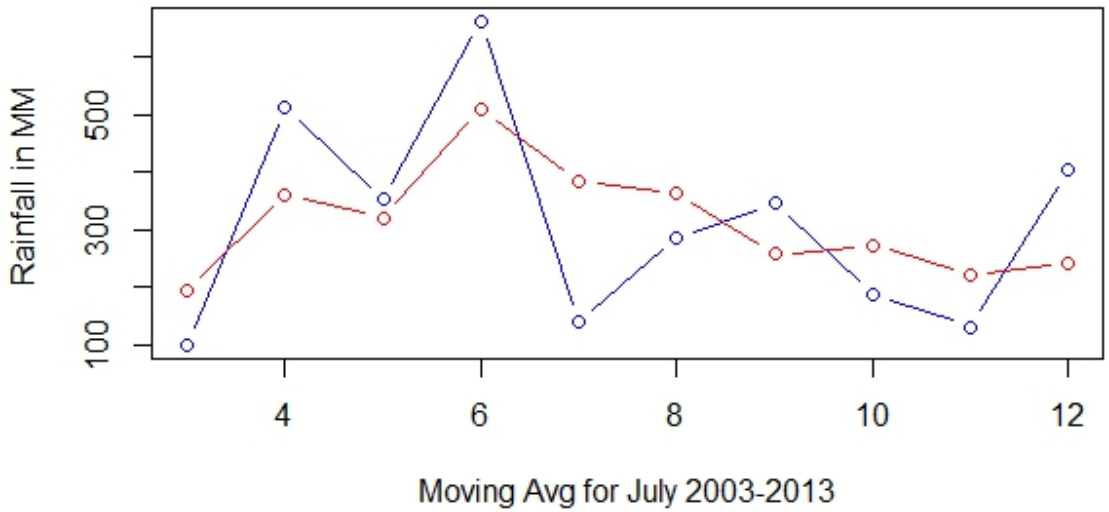


Figure : Rainfall Prediction using Moving Avg. for July from 2002-2014

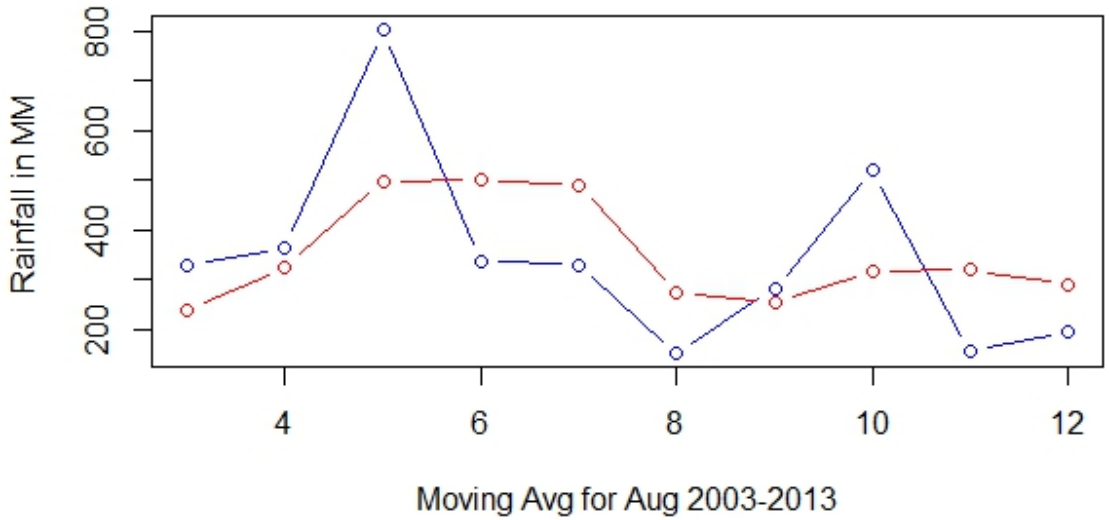


Figure : Rainfall Prediction using Moving Avg. for Aug from 2002-2014

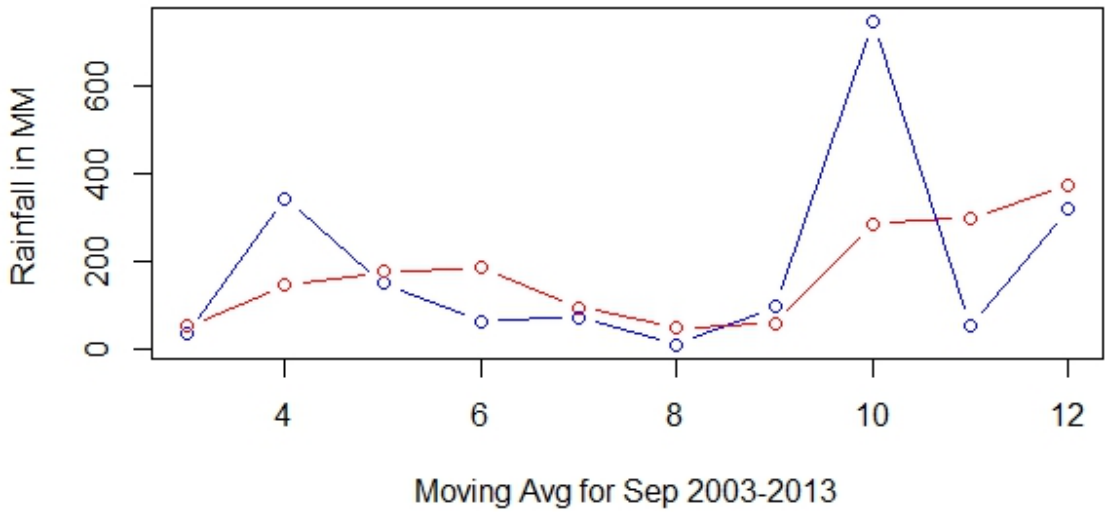


Figure : Rainfall Prediction using Moving Avg. for Sept. from 2002-2014

Conclusion And Future Direction

- The values of rainfall are calculated using the data collected over 17 Years.
- The Predictors selected are Mean Humidity, Minimum Temperature, Maximum Temperature,Mean Temperature,Sea Level Pressure(hPa),Wind Speed(km/hr) and No of rainy Days.
- In this project we are dealing with structured data but in future we may try to work with unstructured data.
- From technology point of view , We may apply different machine learning technique and try to come up with the best technique suitable for the forecast.

References

- M. Kannan (2010) International Journal of Engineering and Technology, Vol.2 (6),2010, 397-401.
- N. Sen, Forecast models for Indian South-West Monsoons Season Rainfall, in Current Science, vol. 84, No. 10, May 2003, pp.1290-1291.
- Gadgil, S et al (2002) On Forecasting the Indian summer Monsoon: the Intriguing Season of 2002.
- Rajeevan, M (2001) Prediction of Indian summer monsoon: Status, problems and prospects, Current Science, 81, 1451-1457.
- http://www.ijcse.com/docs/INDJCSE14-05-02-081.pdf
- http://www.iucaa.ernet.in/ nspp/ieee.pdf