VISVESVARAYA TECHNOLOGICAL UNIVERSITY

B.N.M. Institute of Technology

First Phase Presentation on:

Impact of temperature variations over the Bay of Bengal on the climate of Eastern coast of India

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Abstract of the project:

- Weather forecasting:
  - traditionally done by physical models of the atmosphere.
  - Unstable to perturbations
  - Inaccurate for large periods of time.
- Weather is a continuous, data-intensive, multidimensional and dynamic.
- These properties make weather prediction a big challenge.
- Machine Learning techniques are more robust to perturbations.
- Artificial Intelligence and Machine Learning has given rise to numerous weather prediction models.
- Potentially helpful to generate more accurate forecasts of weather for large periods of time.

Introduction:

- Artificial intelligence (AI)
  - creation of human-like intelligence.
  - learn, reason, plan, perceive, or process natural language.
  - machine learning.
  - instructions that allow model to learn from data without step-by-step instructions by the programmer.
- Data analytics
  - qualitative and quantitative techniques and processes
  - to enhance productivity and business gain.
  - Data is extracted and categorized to identify and analyze behavioral data and patterns.

- Weather - condition of air on earth at a given place and time.
- The application of science and technology are to predict the state of the atmosphere in future time.
- Extremely important considering its effects on human life and property.
- Today, weather forecasts are made by collecting quantitative data about the current state of the atmosphere using scientific understanding of atmospheric processes to project how the atmosphere will evolve.
- chaotic nature of the atmosphere implies the need of massive computational power required.

Literature survey

Base Papers:

- “ Machine Learning Applied to Weather Forecasting” *Stanford University*, (2016).[1] -Mark Holmstrom et al.
  - explores prediction of maximum temperature and the temperature for seven days, given weather data for the past two days, using linear regression model.
  - The linear regression model implemented in this paper is the base algorithm used in this project.
- “ Weather Prediction Based on Decision Tree Algorithm Using Data Mining Techniques’. *IJARCCE* (2016).[2] -Siddharth S. Bhatkande et al.
  - investigate forecasting maximum temperature, minimum temperature using Decision Tree algorithms on meteorological data collected between 2012 and 2015 from the different cities.

Reference papers:

"*Operational demand forecasting in district heating systems using ensembles of online machine learning algorithms*"[7] -C. Johansson et al. ● Heat demand forecasting is in one form or another an integrated part of most optimisation solutions for district heating and cooling	"A Semi- Supervised Technique for Weather Condition Prediction using DBSCAN and KNN"[5] - Aastha Sharma et al. ● semi-supervised weather prediction technique to validate the predictions done for certain atmospheric parameters taken for four years on a day wise basis in a certain city.
"A Deep Hybrid Model for Weather Forecasting"[3] - Aditya Grover et al. ● making predictions via a hybrid approach that combines discriminatively trained predictive models with a deep neural network that models the joint statistics of a set of weather-related variables.	" A machine learning approach to finding weather regimes and skillful predictor combinations for short-term storm forecasting"[4] -John K. Williams et al. ● random forest machine learning approach provides a tool for identifying a set of skillful predictors for thunderstorm initiation as well as providing a performance benchmark.

“A Service Oriented Architecture for Weather Forecasting Using Data Mining”[6] -Mrs. C. Beulah Christalin Latha et al. ● proposes a novel method to develop a service oriented architecture for a weather information system and forecast weather using data mining techniques.	“Wind Prediction: Physical model improvement through support vector regression”[8] -Daniel Bejarano et al. ● concentrates on wind speed prediction through the combination of support vector regression and the weather research and forecast model was explored.
“Rainfall prediction: A Deep Learning approach”[9] -Emilcy Hern´andez et al. ● introduces an architecture based on Deep Learning for the prediction of the accumulated daily precipitation for the next day. ● Includes an autoencoder for reducing and capturing non-linear relationships between attributes, and a multilayer perceptron for the prediction task.	“Weather Prediction through Machine Learning”[10] -Kiran Kumar. R et al. ● design an effective rainfall prediction agent model using support vector machine and multiple linear regressions.

Limitations of existing systems:

- Absence of any correlation between SST and land temperatures.
- The linear regression model:
  - high variance model
  - unstable without a large dataset
- The functional regression model:
  - high bias
  - requires a larger data set
  - two days of data is insufficient to capture any trends

Motivation:

- To be able to recognize pattern between sea and land weather.
- To consider a larger dataset.
- Improving weather forecasting process.
- Being able to provide warnings in time to save people as well as property.
- Damage control made easy.

Problem statement:

- To analyse the related weather data under data mining techniques.
- To obtain correlation between sea surface temperature to corresponding coastal temperature.
- Implementing supervised machine learning algorithm on the available dataset.
- To forecast the weather conditions.

System requirements:

Hardware requirements:

- **System:**Intel core 7th Gen i7 Processor.
- **Hard Disk:** 150Gb Solid State Drive
- **RAM:** 8Gb recommended
- **Monitor:** 15 VGA Colour
- **GPU:** Nvidia GT 630M 1Gb VRAM

Software requirements:

- **O/S:** Windows 7 and above
- **Language:** python and MATLAB
- **Additional packages:** python scikit, python anaconda, tensorflow

Timeline:


PROJECT START
7 Feb
DATA EXTRACTION
23 Feb
DATA FILTERING AND CLEANING
7 Mar
SELECTING FEATURES FOR OUR MODEL
21 Mar
BUILDING LINEAR REGRESSION MODEL
12 Apr
TESTING
19 Apr
PROJECT END
30 Apr

Implementation Details:

Module-1 : Data Collection

Module-2 : Data Cleaning and Filtering

Module-3 : Feature Extraction

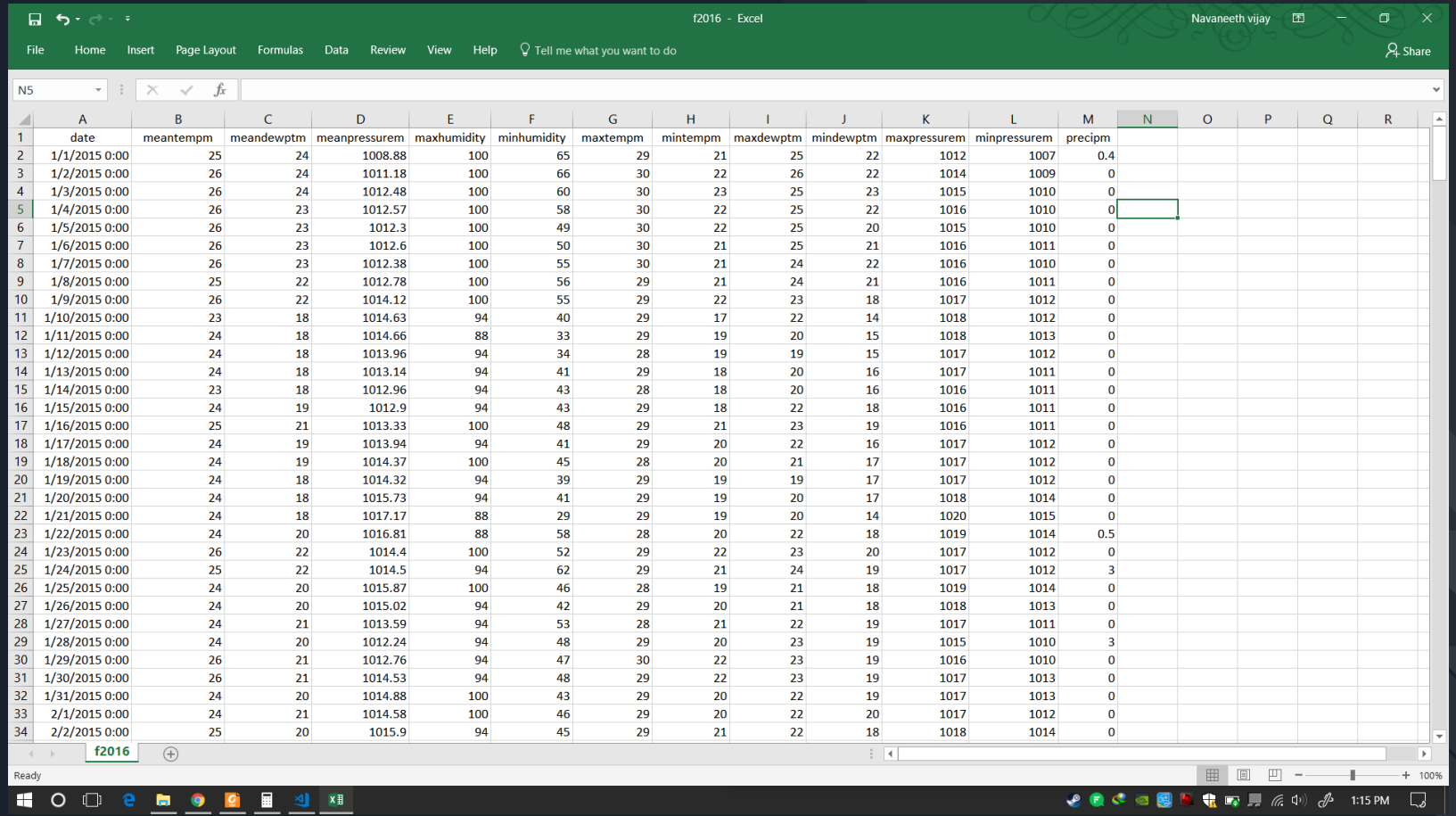
Module-4 : Implementing Regression model

Module-5 : Final model

Module 1:
Data Collection

Data collection:

step 1: Initialize base url, api key, target date, feature name list.
step 2: open a csv file in write mode
set the fieldnames to feature list values
step 3: for each in range(days)
send a request to the base url defined
convert the api response to json format
write the json data to the opened csv file
increment the target date to next day
end for
step 4: end



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	date	meantempm	meandewptm	meanpressurem	maxhumidity	minhumidity	maxtempm	mintempm	maxdewptm	mindewptm	maxpressurem	minpressurem	precipm					
2	1/1/2015 0:00	25	24	1008.88	100	65	29	21	25	22	1012	1007	0.4					
3	1/2/2015 0:00	26	24	1011.18	100	66	30	22	26	22	1014	1009	0					
4	1/3/2015 0:00	26	24	1012.48	100	60	30	23	25	23	1015	1010	0					
5	1/4/2015 0:00	26	23	1012.57	100	58	30	22	25	22	1016	1010	0					
6	1/5/2015 0:00	26	23	1012.3	100	49	30	22	25	20	1015	1010	0					
7	1/6/2015 0:00	26	23	1012.6	100	50	30	21	25	21	1016	1011	0					
8	1/7/2015 0:00	26	23	1012.38	100	55	30	21	24	22	1016	1010	0					
9	1/8/2015 0:00	25	22	1012.78	100	56	29	21	24	21	1016	1011	0					
10	1/9/2015 0:00	26	22	1014.12	100	55	29	22	23	18	1017	1012	0					
11	1/10/2015 0:00	23	18	1014.63	94	40	29	17	22	14	1018	1012	0					
12	1/11/2015 0:00	24	18	1014.66	88	33	29	19	20	15	1018	1013	0					
13	1/12/2015 0:00	24	18	1013.96	94	34	28	19	19	15	1017	1012	0					
14	1/13/2015 0:00	24	18	1013.14	94	41	29	18	20	16	1017	1011	0					
15	1/14/2015 0:00	23	18	1012.96	94	43	28	18	20	16	1016	1011	0					
16	1/15/2015 0:00	24	19	1012.9	94	43	29	18	22	18	1016	1011	0					
17	1/16/2015 0:00	25	21	1013.33	100	48	29	21	23	19	1016	1011	0					
18	1/17/2015 0:00	24	19	1013.94	94	41	29	20	22	16	1017	1012	0					
19	1/18/2015 0:00	24	19	1014.37	100	45	28	20	21	17	1017	1012	0					
20	1/19/2015 0:00	24	18	1014.32	94	39	29	19	19	17	1017	1012	0					
21	1/20/2015 0:00	24	18	1015.73	94	41	29	19	20	17	1018	1014	0					
22	1/21/2015 0:00	24	18	1017.17	88	29	29	19	20	14	1020	1015	0					
23	1/22/2015 0:00	24	20	1016.81	88	58	28	20	22	18	1019	1014	0.5					
24	1/23/2015 0:00	26	22	1014.4	100	52	29	22	23	20	1017	1012	0					
25	1/24/2015 0:00	25	22	1014.5	94	62	29	21	24	19	1017	1012	3					
26	1/25/2015 0:00	24	20	1015.87	100	46	28	19	21	18	1019	1014	0					
27	1/26/2015 0:00	24	20	1015.02	94	42	29	20	21	18	1018	1013	0					
28	1/27/2015 0:00	24	21	1013.59	94	53	28	21	22	19	1017	1011	0					
29	1/28/2015 0:00	24	20	1012.24	94	48	29	20	23	19	1015	1010	3					
30	1/29/2015 0:00	26	21	1012.76	94	47	30	22	23	19	1016	1010	0					
31	1/30/2015 0:00	26	21	1014.53	94	48	29	22	23	19	1017	1013	0					
32	1/31/2015 0:00	24	20	1014.88	100	43	29	20	22	19	1017	1013	0					
33	2/1/2015 0:00	24	21	1014.58	100	46	29	20	22	20	1017	1012	0					
34	2/2/2015 0:00	25	20	1015.9	94	45	29	21	22	18	1018	1014	0					

Modules to complete:

Module – 2, Module – 3,
Module – 4, Module - 5

Thank You!

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