ANN based techniques for prediction of wind speed of 67 sites of India

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Authors:

Parul Arora

Prof. B.K Panigrahi

Mr. Hasmat Malik

Presented By:

Parul

Indian Institute of Technology, Delhi

CONTENTS

THE FORECASTING CHALLENGE

- Wind is typically created by small pressure gradients operating over large distances: hard to forecast accurately

- Turbulent & chaotic processes are also important & even harder to forecast

- Local topography can have a strong influence, but not captured in standard weather models

NEED OF WIND FORECASTING

- Plant power curves are highly non-linear, so small errors in wind = big errors in power.
- Need of both the grid operator and the wind energy generators.
- Helpful for unit commitment, economic dispatch and power system operations.
- For optimal performance of plants and to reduce downtime and unexpected losses.

TIME SCALE OF WIND FORECASTING(WF)

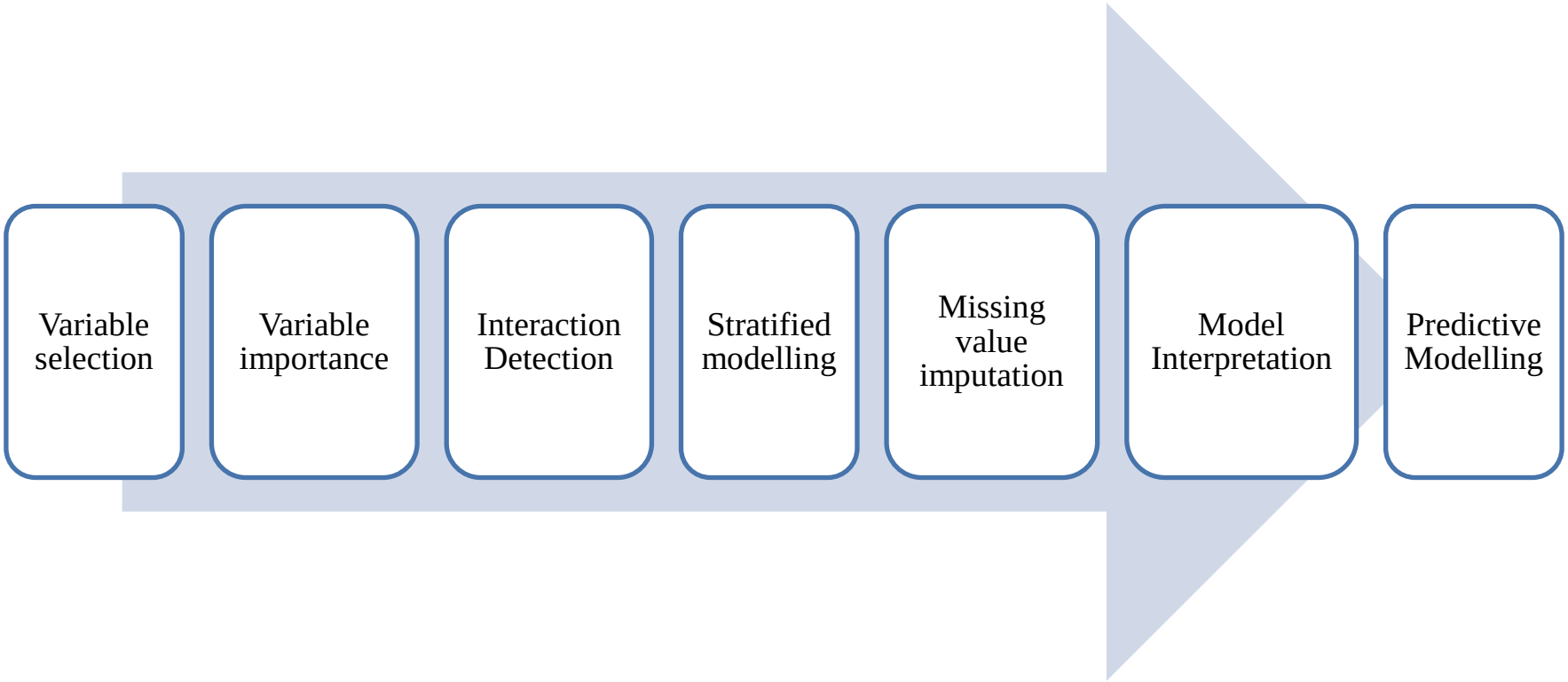
Time Horizon	Approximate Range	Applications
• Very Short Term	• Few seconds to 30 minutes ahead	• Electricity Market Clearing • Regulations Actions
• Short Term	• 30 minutes to 6 hours ahead	• Economic Load Dispatch Planning • Load Increment /Decrement Decisions
• Medium Term	• 6 hours to 1 day ahead	• Generator Online /Offline Decisions • Operational Security in Day ahead • Electricity Market
• Long Term	• 1 day to 1 week or more ahead	• Unit Commitment Decisions • Reserve Requirement Decisions • Maintenance Scheduling to obtain Optimal Operating Cost

Reference -Y.K.Wu ,J.S Hong, "A literature review of wind forecasting technology in the world",*proc.of IEEE Power Tech.,2007,pp.504-509.*

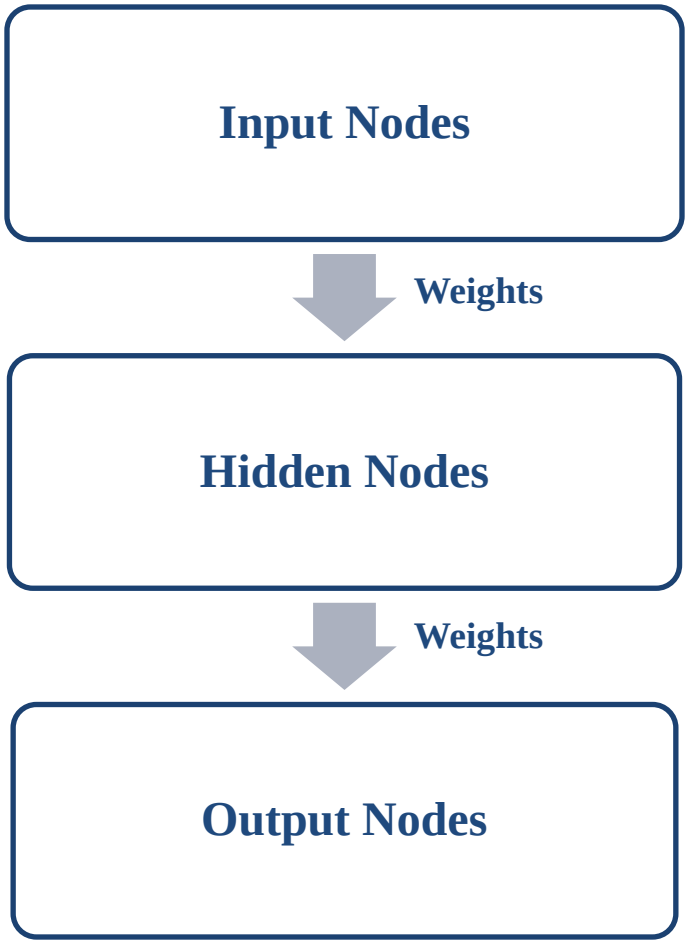
WIND FORECASTING(WF) METHODS

- **Persistence Method** –Wind speed /power at some future time will be same as it is when forecast is made.
- **Physical Method**-Lower atmosphere or weather forecast data like temperature ,pressure ,surface roughness and obstacles.
- **Statistical methods**-Aim at finding relationship of the on-line measured power data.
- **Artificial Intelligence Methods**-Many methods like ANN,ANFIS(Adaptive Neuro),fuzzy logic methods,SVM,neuro-fuzzy network ,MLP ,Decision tree and evolutionary optimization algorithms
- **Hybrid Method**-Many models like ARIMA-ANN ,ARIMA-SVM,NWP-ANN

PREDICTION USING ARTIFICIAL NEURAL NETWORKS



ARTIFICIAL NEURAL NETWORK METHODOLOGY



Input node get raw information and it is presented as activation values, where each node is given a number, the higher the number, the greater the activation

Based on the connection strengths (**weights**), inhibition or excitation, and transfer functions, the activation value is passed from node to node.

Each of the nodes sums the activation values it receives; it then modifies the value based on its transfer function. The activation flows through the network, through hidden layers, until it reaches the output nodes.

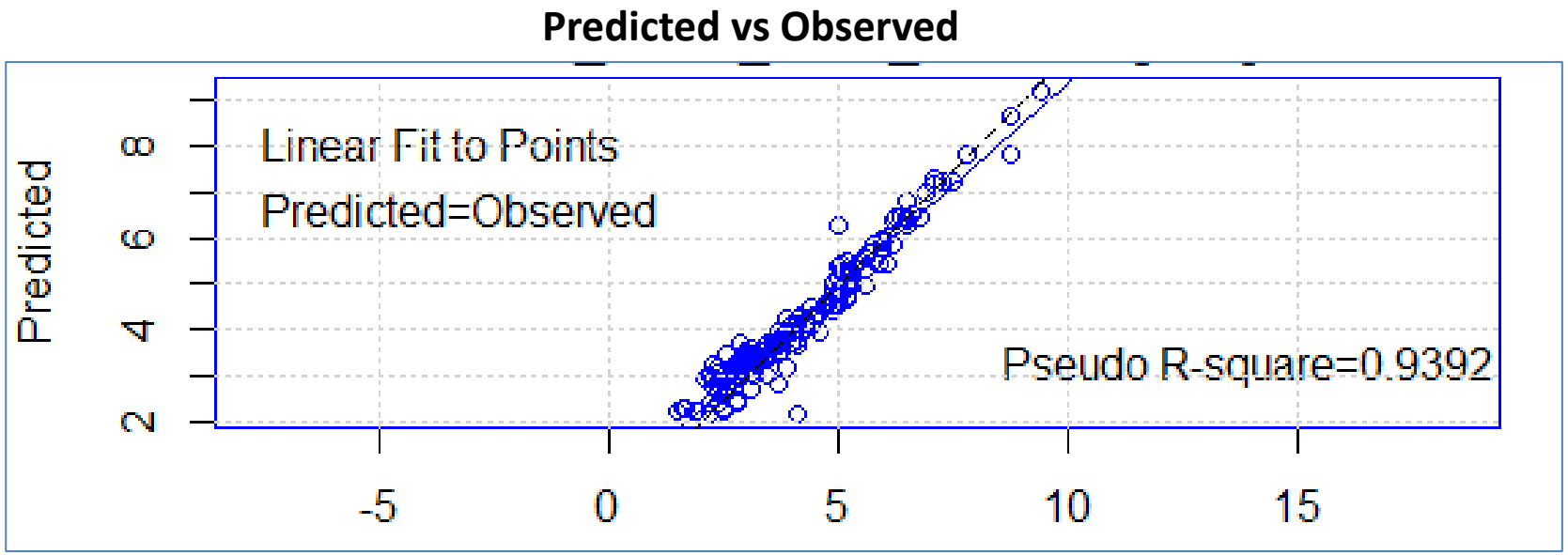
The output nodes then reflect the input in a meaningful way to the outside world. The difference between predicted value and actual value (error) will be propagated backward by apportioning them to each node's weights according to the amount of this error the node is responsible for

TRAINING MULTI LAYER PERCEPTRON

A 19-10-1 network with 230 weights.

Inputs: Latitude, Longitude, Air.temperature, Relative.humidity, Daily.solar.radiation...horizontal, Atmospheric.pressure, Earth.temperature, Heating.degree.days, Cooling.degree.days, Elevation, Heating.design.temperature, Cooling.design.temperature, Earth.temperature.amplitude, Frost.days.at.site, Monthly.Wind.power.density, Power.Law.Index..PLI., Energy.Pattern.Factor, Air.Density, Standard.Deviation.

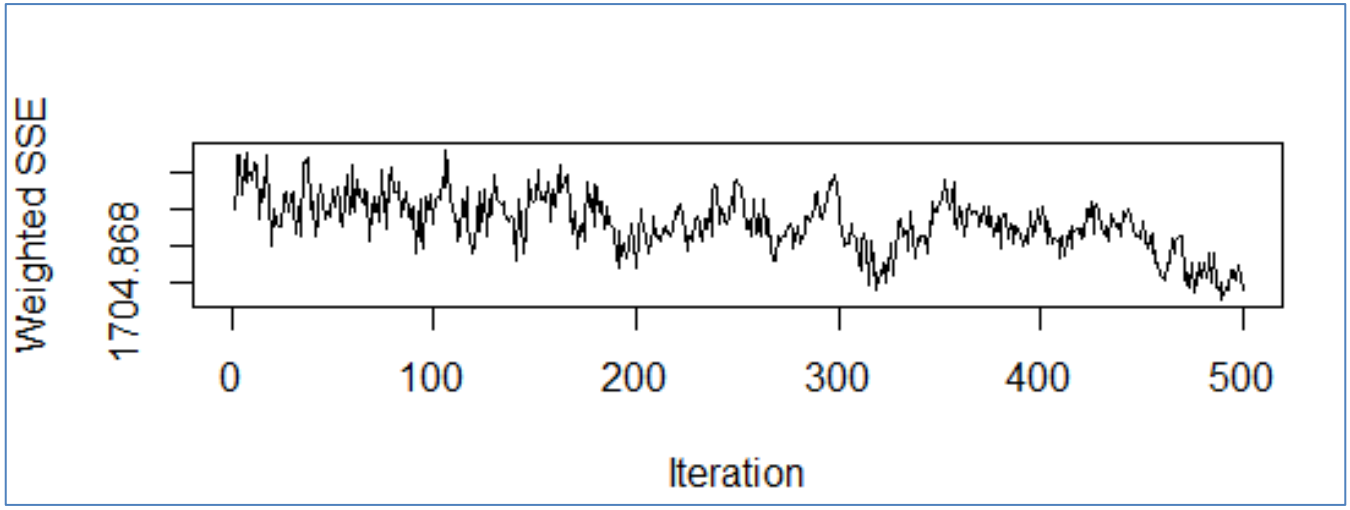
Output : Monthly mean wind speed



TRAINING RADIAL BASIS FUNCTION

Network Name- RSNNS
Source Files:
No of units- 32
No of connections- 240
No of unit types- 0
No of site types-0
Learning function- Radial Basis Learning
Update Function- Topological Order

Predicted vs Observed



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5	Ministry of Non-Conventional Energy Sources (www.mnes)


THANK YOU FOR LISTENING
ANY QUESTIONS?