LARGE SCALE WEATHER DATA INTEGRATION FOR RENEWABLE ENERGY PRODUCTION PREDICTIONS AND MAKING DATA-DRIVEN DECISIONS

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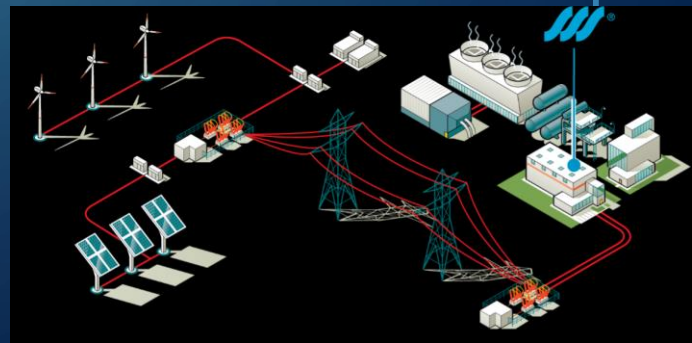
OUTLINE

- Big Data repository from multiple sources
- Deep Neural Network for predicting future power output

- Now we know what to do :
  - When to turn on the turbine
  - When to make maintenance or cleaning because a sand storm is coming
  - When shortage is expected (to rely on neighboring providers)

- Power grids are across countries
- Various power plants are connected to the grid : by coal, by natural gas, by wind, by solar (some need time to start)
- Problem with solar energy:
  - Not steady, many fluctuations
  - You cant store it, too expensive
- If only you could see into the future
  - You would organize a schedule



SOLAR PANELS

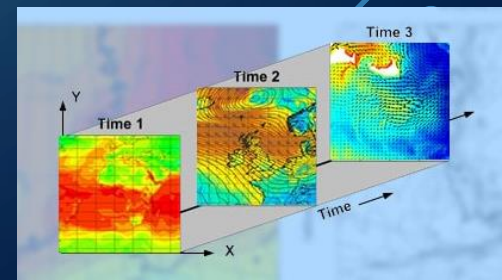
- Best place for solar panels (Ma'an, Aqaba)
- Rely on irradiance (w/m^2) (rays reaching ground)
- Effecting factors: cloud cover, dust, humidity, ….

SOLAR IRRADIANCE.

- Temperature: Daily temperature records.
- Cloud Cover: Information on cloud cover, cloud types, and cloud opacity.
- Wind Speed: Wind speed and direction data.
- Precipitation: Rainfall and snowfall data.
- Humidity: Relative humidity measurements.

STAGE 1 : BIG DATA INTEGRATION

- Important for AI
  - Garbage-in-garbage-out
- Many sources – different formats (Graph, Hierarchical, XML) easier for storage, retrieval, interchange

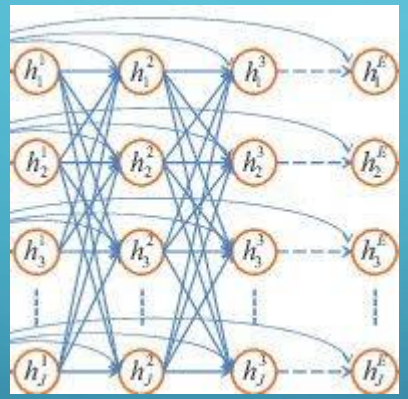


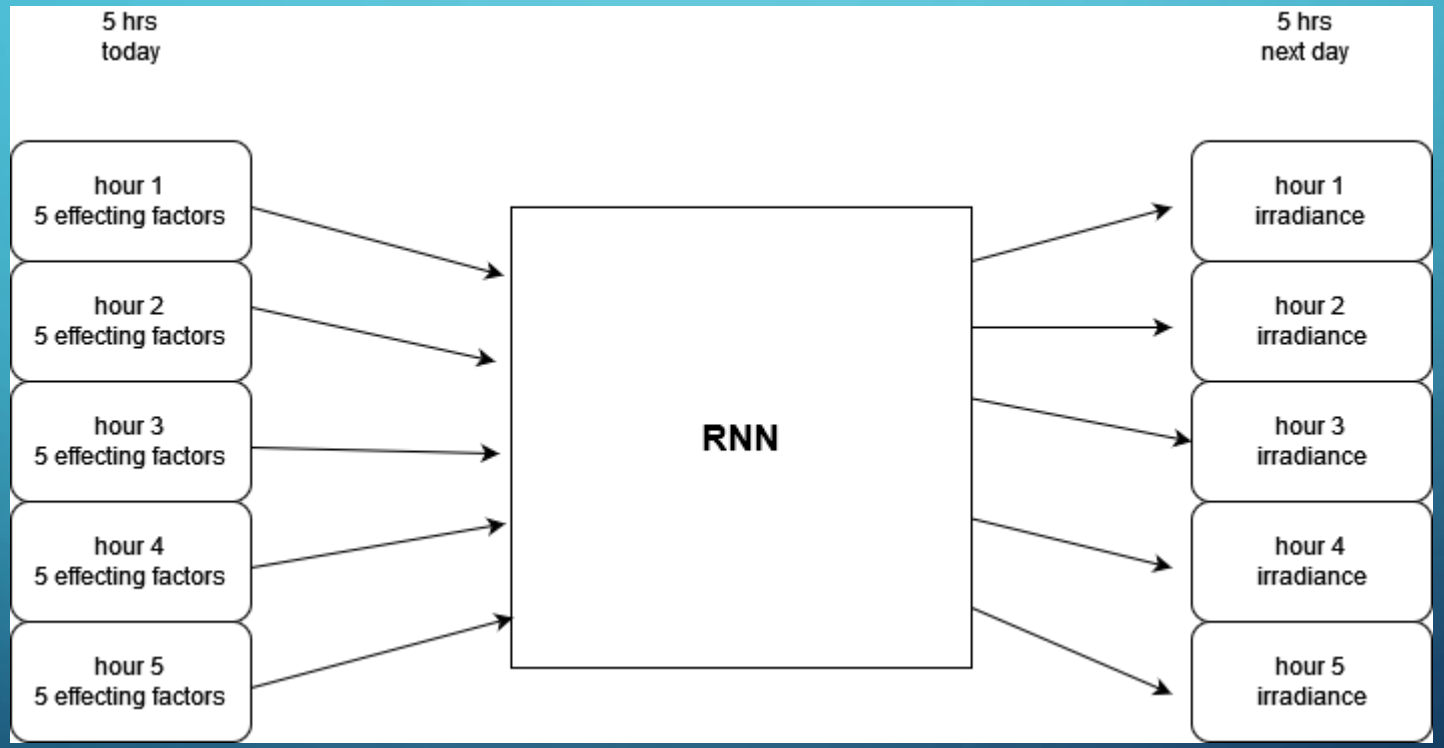
STAGE 2 : PREDICTION

- Need quality input
- Need as much historical data as possible

DEEP NEURAL NETWORK

- Recurrent Neural Networks (RNN) : considering it a time series problem




5 hrs
today
hour 1
5 effecting factors
hour 2
5 effecting factors
hour 3
5 effecting factors
hour 4
5 effecting factors
hour 5
5 effecting factors
RNN
5 hrs
next day
hour 1
irradiance
hour 2
irradiance
hour 3
irradiance
hour 4
irradiance
hour 5
irradiance

- The energy produced by a solar cell can be calculated using the following formula:

$E = A \times G \times \eta \times t$

Where:

- EE represents the energy produced in watt-hours (Wh) or joules (J).
- AA is the area of the solar cell in square meters (m^2).
- GG is the solar irradiance in watts per square meter (W/m^2).
- ηη is the efficiency of the solar cell, expressed as a decimal (e.g., 0.15 for 15% efficiency).
- tt is the time duration in hours for which the solar cell is exposed to the irradiance.

THANK YOU