Sneak Preview

Al for Energy Efficiency

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Contents & Agenda

- AI Current State
- Predictive Maintenance in Intelligent Buildings
- Al for Energy Efficiency
- Q&A



We're currently experiencing the third evolution of AI



Simple classification and regression technologies that revolutionized business and machine intelligence in the late-20th century are evolving towards deeper, unsupervised learning



Current wave of AI benefits from tech and big data

The third wave of AI innovation leverages inexpensive computing resources and vast data sets to expand and extend previous-generation technologies into more advanced AI



Intelligent Building Systems drive a range of values

Evolving Market Status

IoT technologies have created the opportunity for new services and products to be deployed in intelligent buildings, but ensuring that these solutions address customer needs while also opening new revenue streams for solution providers is a challenge that has not yet been properly addressed



Intelligent buildings will benefit from several advanced Al use cases

Energy management optimization, building asset optimization, and predictive maintenance are examples of application areas where appetite and return for new AI and ML solutions are likely to remain high



Many valuable AI use cases are driving workloads to the Edge

Across key verticals, strong areas of opportunity cluster around edge computing use cases that are best served through edge processing due to the mission- or time-critical nature of the applications



Predictive maintenance & asset management is a big

Opportunity Leveraging the value of asset health and systems knowledge is the next big step for mission critical equipment providers and their sub-system and component providers





Predictive Analytics for Mechanical Engineering: A Beginners Guide

🖄 Springer

SDG Goal No : 7 Clean and Affordable Energy Innovations in Sustainable Technologies and Computing

Makarand R. Velankar Parikshit N. Mahalle Gitanjali R. Shinde

Cognitive Computing for Machine Thinking

2 Springer

Al and Energy



AI, energy efficiency, and rebound effect

AI =>

- More efficiency (material, design, process, management,..)
- More abundance (cheep,more & new goods & service)

More elec likely:

✓ Past: Machine replaced human => More GDP, More elec ("rebound effect")

✓ (Direct burning of fuel at end use will decrease as substituted by elec)

Some Quotes

"Combined with the ability to estimate energy production, AI would raise (wind turbine) power output by around 5% and lower maintenance costs by 20%" -



"Two minutes after artificial intelligence took over control of the combustion unit, nitrogen oxide levels dropped by 20 percent" – Siemens

"Google's DeepMind is in discussions with the UK's National Grid to use artificial intelligence to help balance energy supply and demand in Britain"





"Smart algorithms were able to predict load on the data centers' cooling systems and control equipment more efficiently, resulting in a 40 per cent reduction in the amount of energy used for cooling" – Google 2017

Three broad categories of AI in energy and utilities include:



Energy Optimization

Three broad categories of AI in energy and utilities include:



- Data Analytics
- Predictive Maintenance
- Realtime Adjustment

Convergence





HOW CAN AI FACILITATE CLEAN ENERGY DEVELOPMENT as a paradigm shift? – Power Sector

- AI technologies develop smart entities that will produce more accurate predictions for complicated problems
- AI in Renewable Energy Management is a game changer
- Al can mitigate the unpredictability of renewable energy sources
- AI-based renewable energy production forecasting systems are steadily being perfected, facilitating their integration in power grids
- Al for Energy Forecasting to manage unreliability

HOW CAN AI FACILITATE CLEAN ENERGY DEVELOPMENT as a paradigm shift? – Power Sector

- Al for Energy Efficiency
- Al for accurate predictions of renewable energy
- Al applied to provide Communities with Solar Energy
- AI, has the potential to cut **energy waste**, lower **energy costs**, and **facilitate** and **accelerate** the **use** of clean renewable energy sources
- Utilities Leveraging AI to Harness the Power of Renewable Energy, management of electricity grids by improving the accessibility of renewable energy sources

Roadmap





AI & Electricity

<u>« Artificial Intelligence is the new Electricity », Andrew Ng</u>



Are blackouts a story of the past?

AI & Electricity







How AI can be of any help here ?



Machine Learning & power system

Mainly Today



Power System Community

AI Community

Artificial Intelligence & Power Grids



One small step for **Electricity**, one giant leap for **Sustainability**!

What is the technology roadmap to the future?

These five areas of engineering will play critical roles to reach net zero.



Al's Contribution to Wind Power

- Al is primarily used in wind power forecast. Balance is preserved in power systems by nonstop changing generation capability and managing requests. Wind energy is a renewable energy source. Changing source of electrical energy since wind is variable.
- Short-term estimates are beneficial to the power system development for unit promise and notice, as well as in electricity trading in marketplaces where wind energy and stowing are exchanged or huddled.
- Wind farm maintenance, unit promise and thermal generator maintenance outages, grid maintenance, and energy storage operations all require medium-term forecasts and predictions.
- The creation of AI estimation methods should be an upcoming investigation focus. Updating the drill methods of individuals replicas could greatly enhance whose reliability. Furthermore, involvement information preparation ought to be investigated extensively aimed at various instances because this one has a significant impact on the predicting accuracy of the models. Additionally, as technological capabilities expand, novel AI models may be designed to provide superior overall results

Al's Contribution to Solar Power

- Because of its unique properties, such as faster velocity, lower processing time, reduced human influence, reliability, protection, and so on, Ai's position in the development and management of renewables is growing day by day.
- Because of its low carbon footprint and apparent mode, photovoltaic energy is regarded as among the most potentially sustainable power options. Photovoltaic systems, which transform florescent light into energy without such aid of a generator, are the most often utilized photovoltaics.
- For forecasting: Techniques based on data make estimates using statistics and machine learning algorithms to determine the connection among predicted results and based on past sources. The efficacy of information methods for predicting is strongly influenced by the excellence of the information as well as the analysis strategy. To increase estimate effectiveness, mixed methods combine several bases of information and statistical methodologies.
- A single-diode methodology and a double-diode methodology are the greatest often utilized photovoltaic approaches.

Al for Power Policy, Consumption, and Management



- Al approaches are rapidly becoming applied in grid electricity regulation and management. In comparison to additional methods, Ai does have the capacity to provide effective regulation of the distribution substation. Artificial intelligence will assist electricity firms to run additional efficiently by analyzing shapeless information about power production and use.
- AI developments for companies, like an expanded monitoring equipment range besides dispersed generation, will achieve an important part in electricity operations in the coming generation. Ai gadgets could automatically check net electricity use and requirement, and overall peak power could be decreased and regulated using Ai.
- AI could make daily load administration better and so additional automatic. Clients may now effectively achieve overall power reactions to need, avoid wastage or renewables, and redeem electricity thanks to Ai systems. The influence of Ai applications on statistics management must be exploited to improve predicting efficiency and correctness.

Al Developments



- AI was employed to enhance computational energy and generate massive amounts of information. The integration of big data and AI is a regular demand for an intelligence instrument to successfully manage and evaluate a huge amount of information produced by energy networks. Big data and AI apparatuses intended outcomes and judgment, examinations, and predictive maintenance.
- A power system is a hybrid of various forms of energy with IoT architecture, and AI could evaluate a massive amount of data to enhance the effectiveness and reliability of such novel news providers. IoT refers to the expanded utilization of equipment and things with sensing devices and Internet access. An intelligent grid's electricity oscillations are controlled by AI.
- Ai methods are employed to improve smart grids, intelligent load characteristics, load control, divisional load shifting, detecting power outages in the intelligent grid atmosphere, and preventing cybercrime.

Possibilities for Further Investigation

- AI is widely used in renewable energy studies for efficiency, planning, control, estimates, regulation, and transmission. Al algorithms for studies on renewable energy seem to be sophisticated and costly.
- Such approaches, in essence, must be simpler and more expensive. Several suggestions includes - It is necessary to develop Ai network services that could appropriately detect electricity effectiveness and funds for clients and companies in the coming years. Through dispersed power bases and dispersed generation, Ai would incorporate renewable electricity into the grid and enable considerable discretion.

Conclusion

- Al is widely used in practically all renewables' studies (like PV, winds, and combination) for planning, construction, administration, prediction, regulation, and transmission.
- It is necessary to develop Ai software packages that could appropriately recognize electricity effectiveness and investments for individuals and trades in the coming years.
- The connection and optimization of renewables with electricity networks utilizing Ai technology can improve flexibility, dependability, electricity constancy, profitability, bur-den scheduling, and so on. Ai has the potential to change numerous power industries and boost development in the next years.



Thank You! Questions?

Any Doubt ?

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Thank You !!!

