INL/CON-23-75266-Revision-0

Big data in nuclear comes in the form of many structures, systems, components, data streams, data types, and more

November 2023

Cody McBroom Walker

Changing the World's Energy Future

INL is a U.S. Department of Energy National Laboratory operated by Battelle Energy Alliance, LLC

DISCLAIMER

This information was prepared as an account of work sponsored by an agency of the U.S. Government. Neither the U.S. Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness, of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S. Government or any agency thereof.

INL/CON-23-75266-Revision-0

Big data in nuclear comes in the form of many structures, systems, components, data streams, data types, and more

Cody McBroom Walker

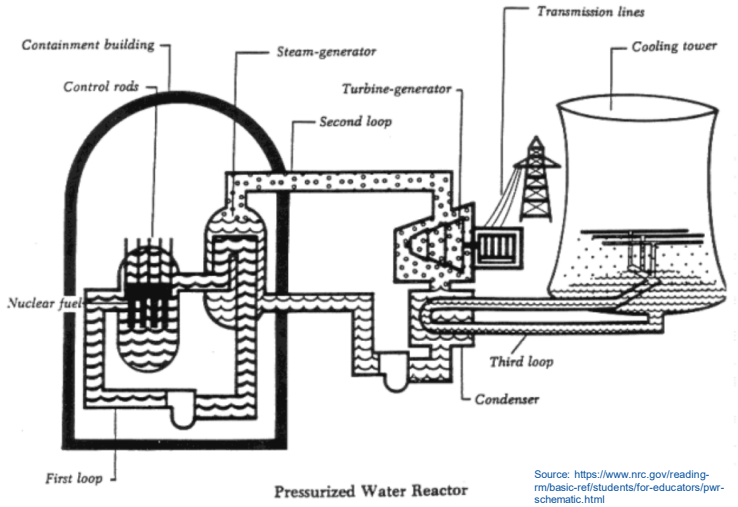
November 2023

Idaho National Laboratory
Idaho Falls, Idaho 83415

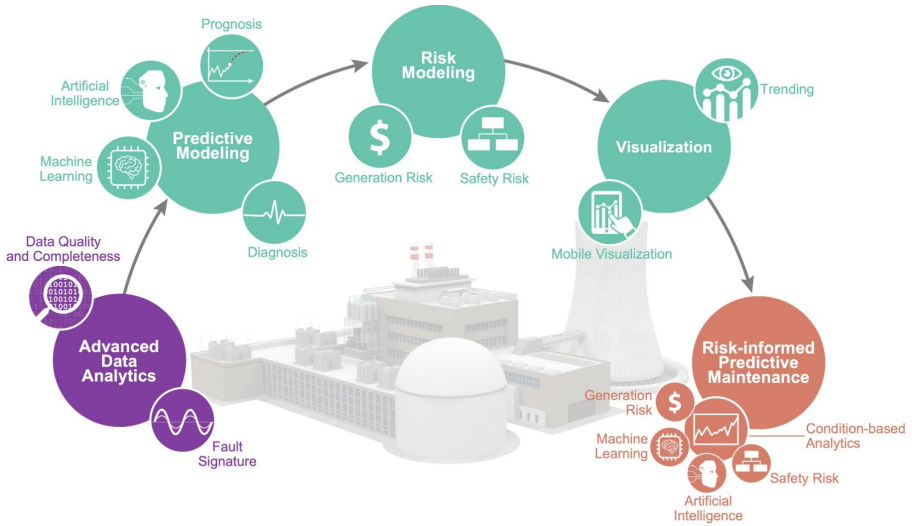
http://www.inl.gov

Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517

Big data in nuclear comes in the form of many structures, systems, components, data streams, data types, and more.



Source: https://www.nrc.gov/reading-rm/basic-ref/students/for-educators/pwr-schematic.html

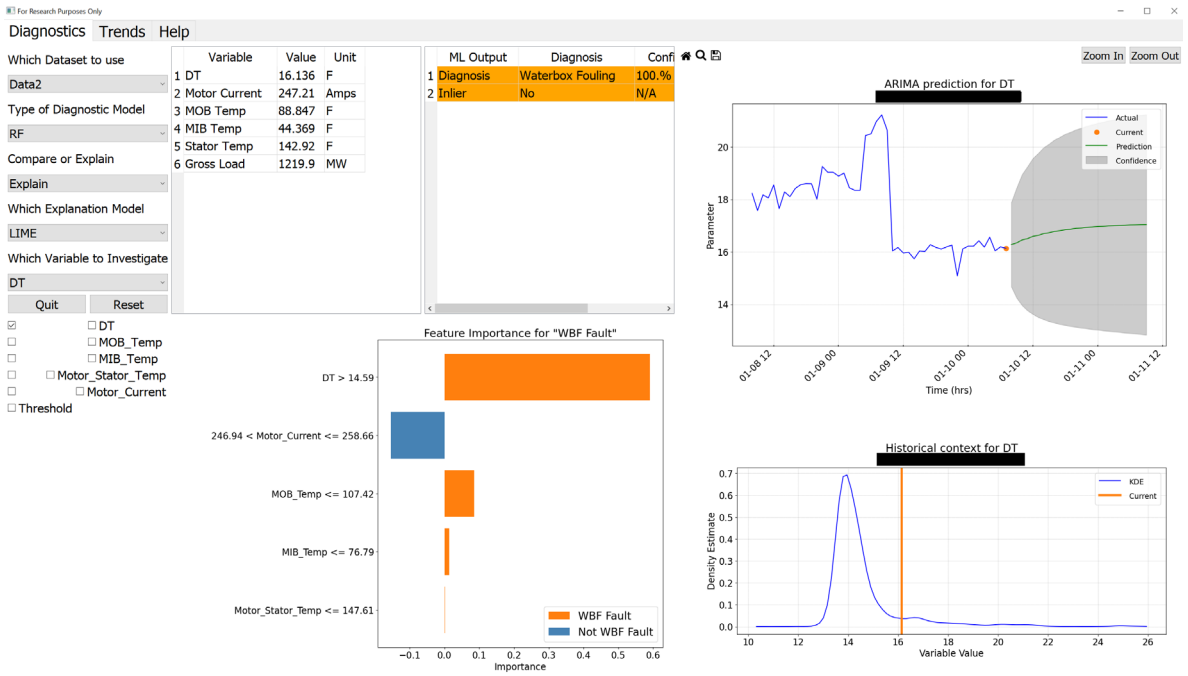


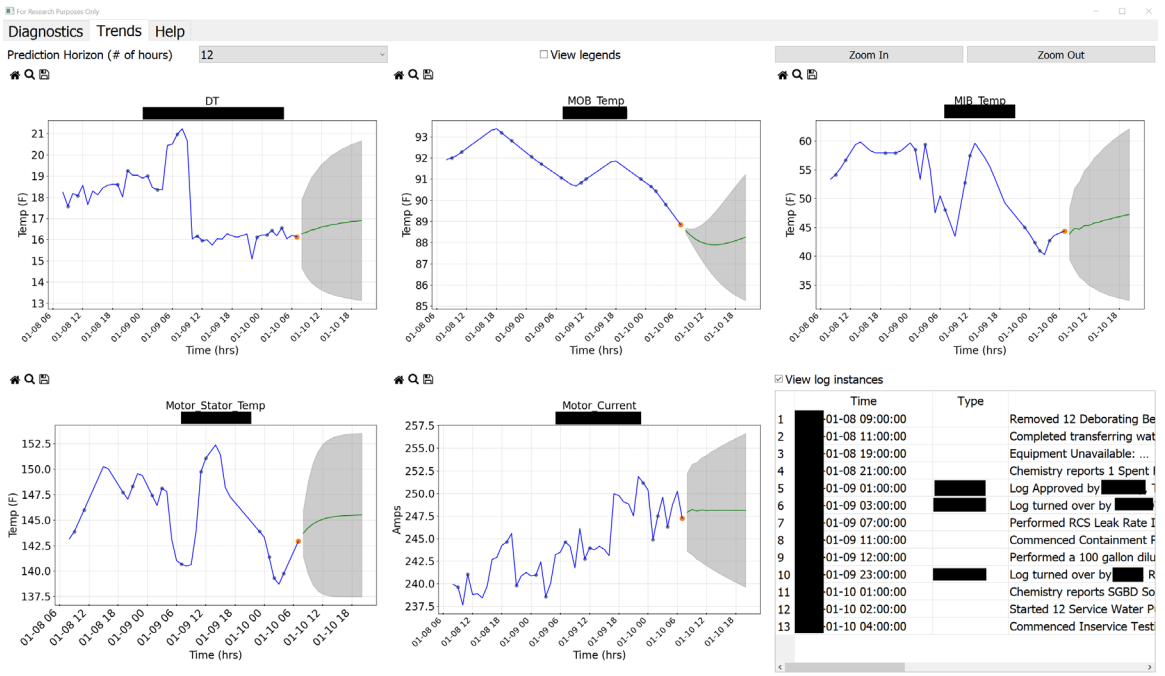
Source: Walker, Cody, et. al. Explainable Artificial Intelligence Technology for Predictive Maintenance. August 2023. INL/RPT-23-74159

- Reactor, steam generators, turbines, circulating water system
- Safety versus non-safety
- Motors, pumps, valves, actuators
- Temperature, pressure, motor current
- Manually sampled data, in situ measurements, converting analog-to-digital
- Maintenance logs, expert/tribal knowledge
- Electricity prices, cost of repairs.

Extracting salient information from many data streams with differing formats, frequencies, and data quality can be a challenge.

Once we have the model output, we still need to effectively transmit this information to the human-in-the-loop for action.





- Explainability metrics capture how the model came to its conclusion.
- User should be able to dig deeper into either the model or the data itself.

- Having access to the data alongside the work orders or operator logs can provide much-needed context to data changes.

Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.