



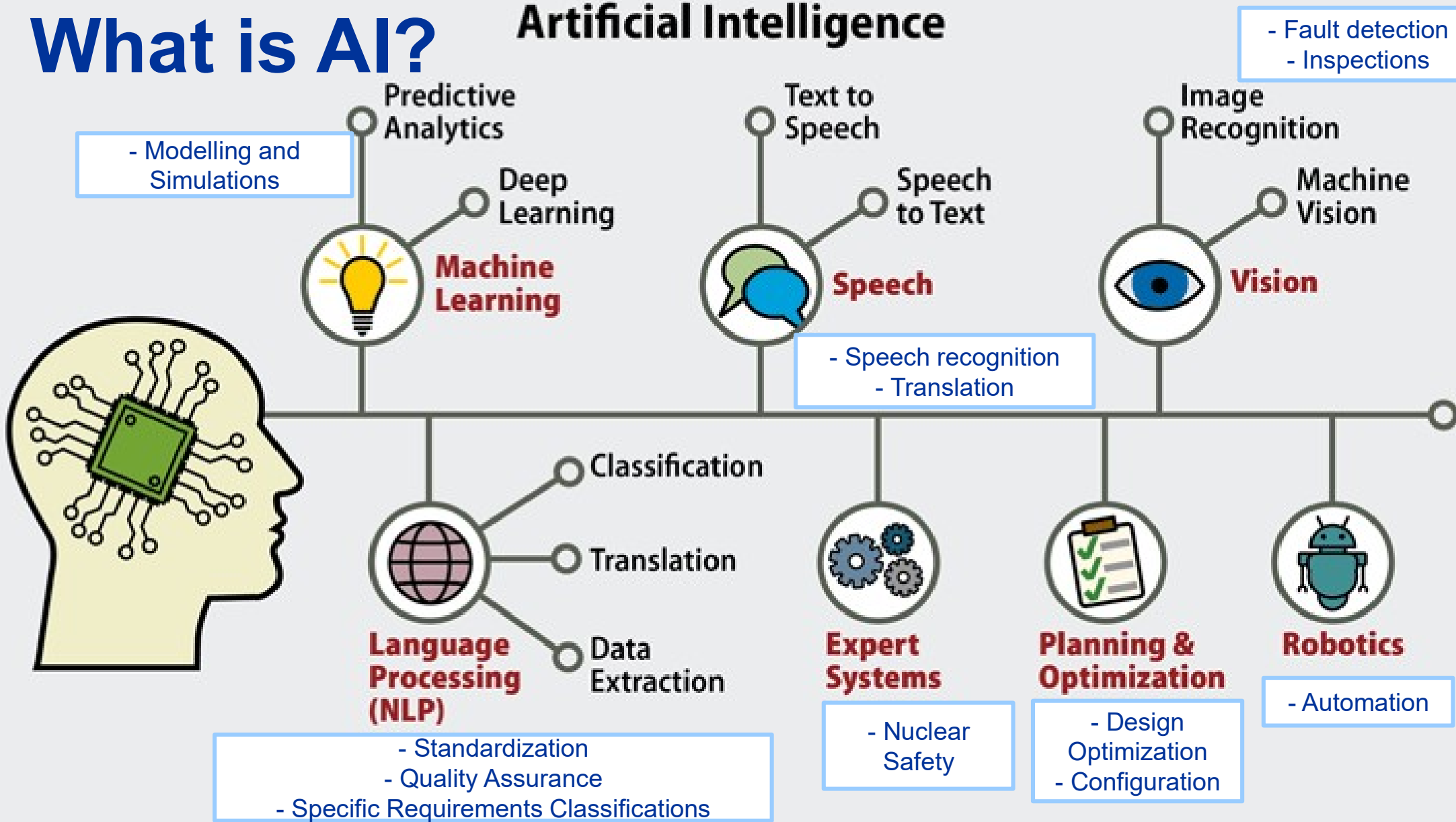
AI for Nuclear Energy

Ms Aline DES CLOIZEAUX
Director, Division of Nuclear Power,
Department of Nuclear Energy, IAEA
A.des-Cloizeaux@iaea.org

Session T1 – “Am I a Robot? – How Artificial Intelligence and Machine Learning are Impacting the NRC and Nuclear Industry”

What is AI?

Artificial Intelligence



AI for Nuclear



State-of-the-art



Automation

Increase reliability and reduce time of common operations



Optimization

Increase efficiency and design of complex operations



Analytics

Increase the quality of current models and understanding of the used systems



Prediction/ Prognostics

Better inform maintenance activities



Insights

Extract lessons from experiments and operating experience

Deployment Challenges



- Interpretability, confidence, and robustness measures of performance for AI
- Development of AI technologies for safety critical applications could present a challenge to regulators, as many traditional V&V approaches might not be easily applicable
 - Limited transparency of AI/ML
- Demonstration of compliance with standards
 - High level regulatory safety assessment principles and guidance may need to be developed
- Security poses unique challenges through data management and threats of adversarial attacks
- Development of standards is important for the adoption of new technologies

What Next?

Technology Development

- Development of anomaly detection from plant monitoring data
- Core monitoring techniques and experimental validation
- Neural networks to be further leveraged to guide the optimization (e.g. of fuel loading)

Technology Deployment

- Industry has the technological means to start practical adoption of machine learning
- Automated analysis of non-destructive evaluation examination
- Condition monitoring and automation of predictive maintenance procedures

Technology Enabling

- Development of legal regulation for AI application in the design engineering process
- Development of common requirements database
- Development of the requirements that are accessible and understandable to AI (optimization, simplification, specification, etc.)
- Development of design algorithms that are accessible and understandable to AI

IAEA activities



TM: AI for Nuclear



- Technical Meeting on Artificial Intelligence for Nuclear Technology and Applications: **25-29 October 2021**
- 2 plenary topics and 12 Working Groups.
- All [meeting material](#) is freely available and a [networking site](#) is established to enhance coordination

Plenary



ENABLING
INFRASTRUCTURE



ADVANCED
MODELLING AND
SIMULATION
METHODOLOGIES

Ethics

Food and
Agriculture

Human Health

Nuclear Data

Nuclear
Fusion

Nuclear
Physics

Nuclear Power

Nuclear
Security

Radiation
Protection

Radioisotopes
and Radiation
Technology

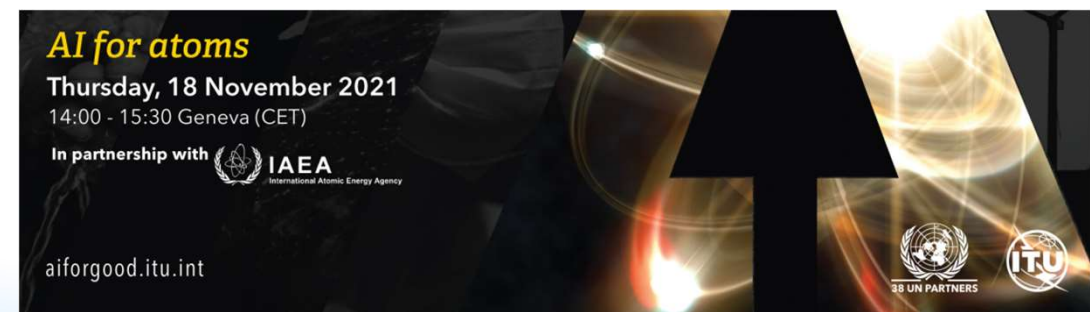
Safeguards
Verification

Water and
Environment

...In collaboration with ITU



- Under the umbrella of AI for good Summit
- **AI for Nuclear Energy Webinar**, ~1200 registrations
 - How do we use digital twins for nuclear plan monitoring?
 - AI for operation and maintenance of nuclear reactors
 - Development of international standards on AI for nuclear energy
 - AI applications for nuclear energy
- One of the most successful event of the summit
- Another webinar on **AI for Atoms**
 - Healthcare, Food and Agriculture, Nuclear Science, Fusion, Ethics



Publications



ITU Publications

International Telecommunication Union

United Nations Activities on Artificial Intelligence (AI) 2021



- Chapter on IAEA activities

International Atomic Energy Agency.....	10
1. Description of Activities on AI	10
2. Related Sustainable Development Goals	19
3. Relevant Links	19



**Artificial
Intelligence
for Nuclear
Technology
and
Applications**

- Under Preparation***
- ***To be published by the end of 2022***
 - ***Output of the IAEA Technical Meeting***

Thank you!

