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Application of AI , IoT and ML in complex Engineering Projects

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Presentation outline

- ▶ 1. What is AI
- ▶ 2. What is IoT
- ▶ 3. What is ML
- ▶ 4. What are Complex Engineering Projects
- ▶ 5. Applications of AI, IoT and ML in Complex Engineering Problems.
- ▶ 6. Getting Ready for The Future
- ▶ 7. Conclusion



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What is artificial intelligence?



« The capacity given by humans to machines to memorize and learn from experience, to think and create, to speak, to judge and make decisions »



What is Artificial Intelligence ?



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THOUGHT	Systems that think like humans	Systems that think rationally
BEHAVIOUR	Systems that act like humans	Systems that act rationally
	HUMAN	COMPUTERS

3 Types of Artificial Intelligence



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Artificial Narrow Intelligence (ANI)



Stage-1

Machine Learning

- ▶ Specialises in one area and solves one problem



Siri



Alexa



Cortana

Artificial General Intelligence (AGI)



Stage-2

Machine Intelligence

- ▶ Refers to a computer that is as smart as a human across the board

Artificial Super Intelligence (ASI)



Stage-3

Machine Consciousness

- ▶ An intellect that is much smarter than the best human brains in practically every field



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The Internet of Things

From connecting devices to human value

01 Device connection

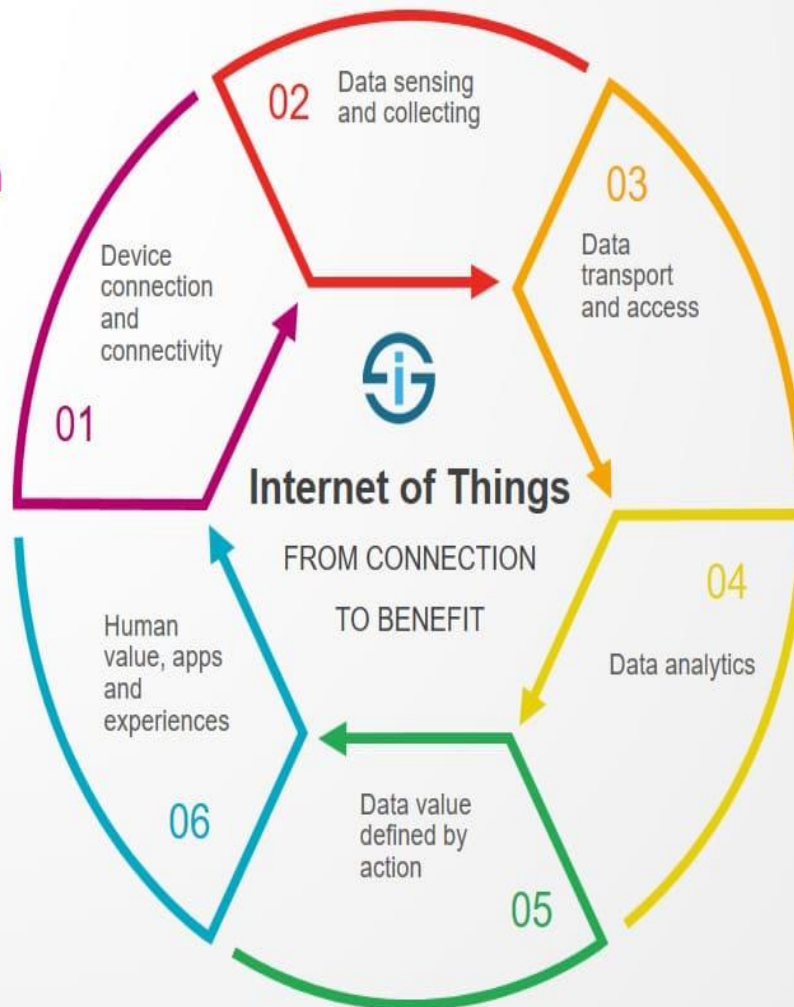
IoT devices
IoT connectivity
Embedded intelligence

02 Data sensing

Capture data
Sensors and tags
Storage

01 Communication

Focus on access
Networks, cloud, edge
Data transport



Data analytics

Big data analysis
AI and cognitive
Analysis at the edge

Data value

Analysis to action
APIs and processes
Actionable intelligence

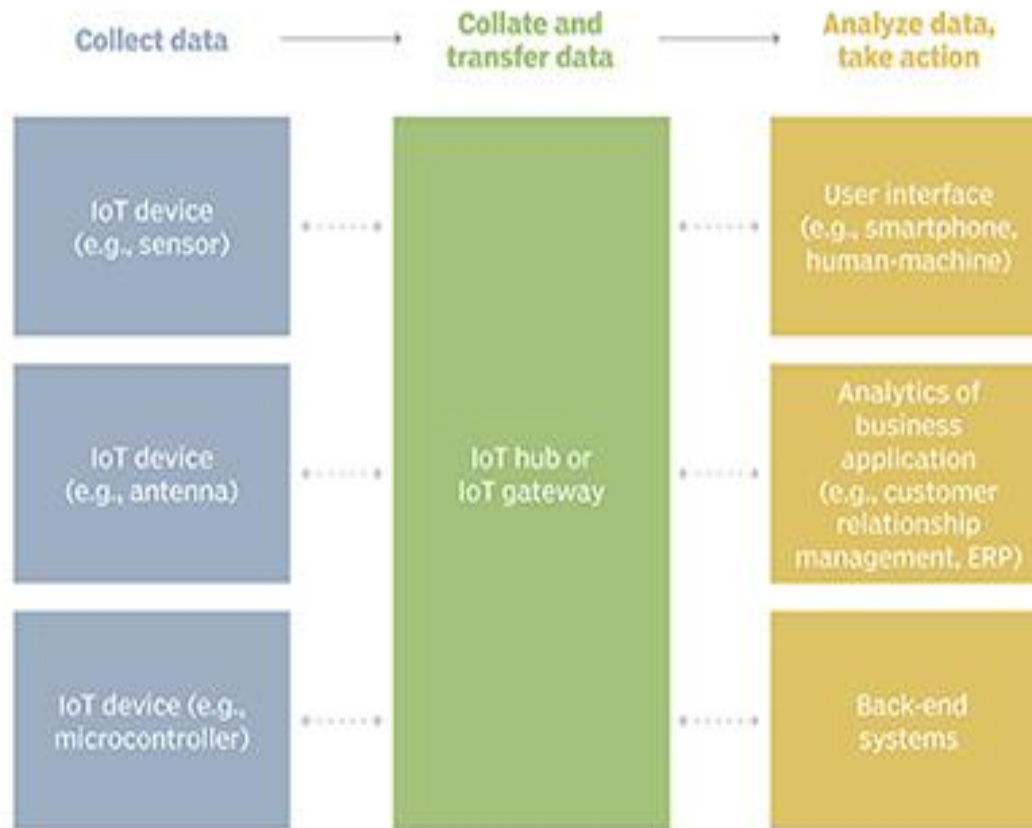
Human value

Smart applications
Stakeholder benefits
Tangible benefits



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Example of an IoT system





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What is Machine Learning?

Computational learning using algorithms to learn from and make predictions on data.

https://en.wikipedia.org/wiki/Machine_learning



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Human



I can learn everything automatically from experiences.
Can u learn?

Machine



Yes, I can also learn from past data with the help of Machine learning



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TYPES OF MACHINE LEARNING



Classical Machine Learning



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Task Driven



Supervised Learning

(Pre Categorized Data)
Predications & Predictive Models

Data Driven



Unsupervised Learning

(Unlabelled Data)
Pattern/ Structure Recognition

machine learning

unsupervised learning

supervised learning

reinforcement learning

Classification

(Divide the socks by Color)

Eg. Identity
Fraud Detection

Regression

(Divide the Ties by Length)

Eg. Market
Forecasting

Clustering

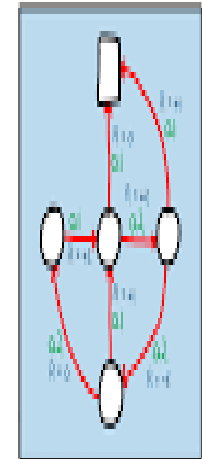
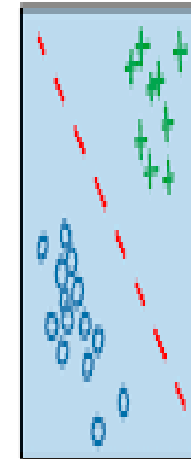
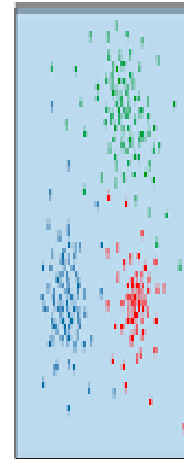
(Divide by Similarity)

Eg. Targeted
Marketing

Association

(Identify Sequences)

Eg. Customer
Recommendation





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Complex Problems

- Involve wide-ranging or conflicting technical, engineering and other issues
- Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
- Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach
- Involve infrequently encountered issues



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- Outside problems encompassed by standards and codes of practice for professional engineering
- Involve diverse groups of stakeholders with widely varying needs
- Have significant consequences in a range of contexts
- High level problems including many component parts or sub-problems



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COMPLEX ENGINEERING PROBLEM



Find the branch current I for the above circuit.



Complex Engineering Activities

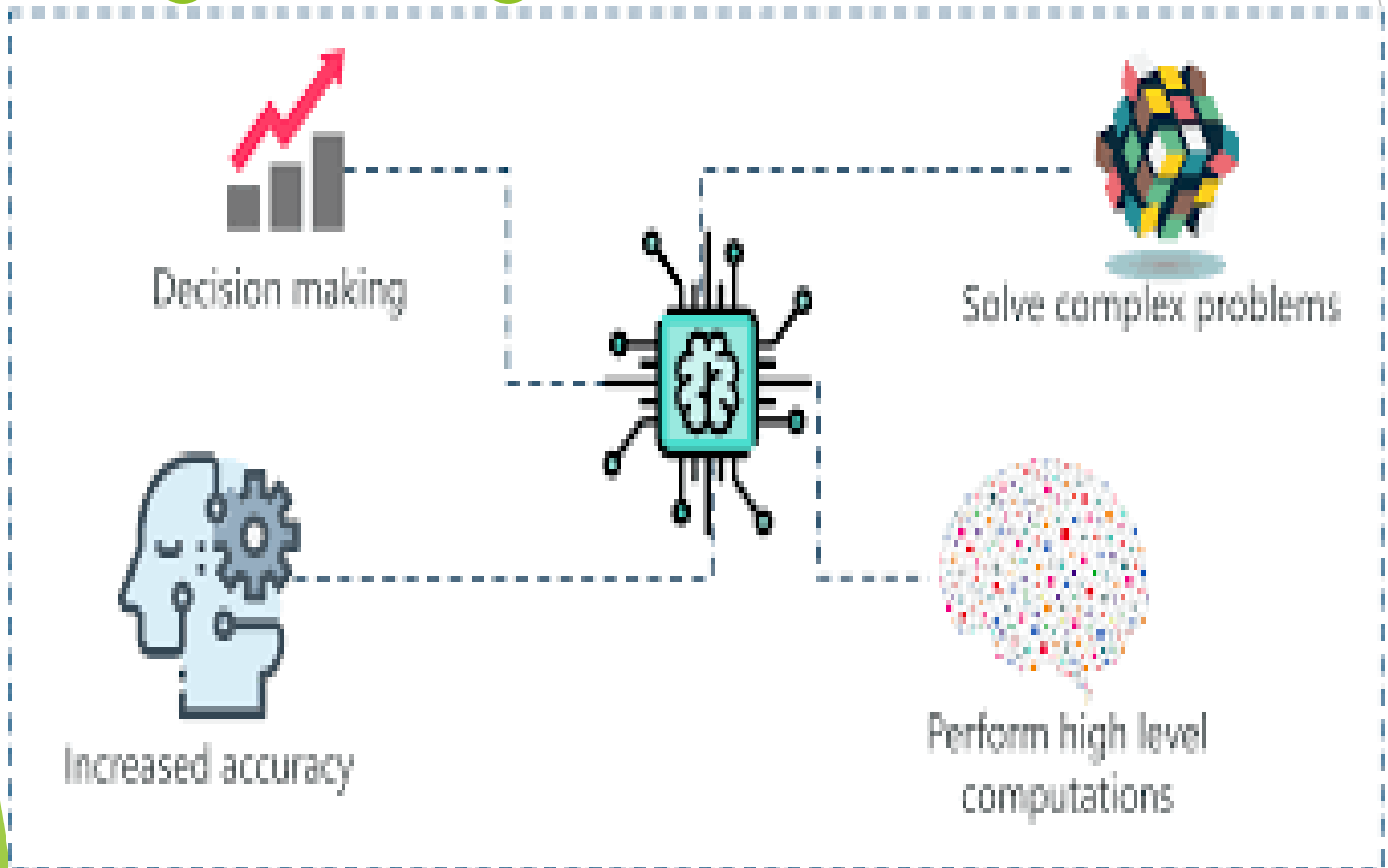
Complex activities means (engineering) activities or projects that have **some or all** of the following characteristics:

EA1	Range of resources	Diverse resources (people, money, equipment, materials, information and technologies).
EA2	Level of interaction	Require resolution of significant problems arising from interactions between wide ranging or conflicting technical, engineering or other issues.
EA3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways
EA4	Consequences to society and the environment	Have significant consequences in a range of contexts , characterised by difficulty of prediction and mitigation.
EA5	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.



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APPLICATION OF AI,ML and IoT in Complex Engineering Problems





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IoT Applications for Smart Cities

Traffic
Management

Air Quality
Control

Public Safety
Solutions

Smart
Parking

Smart
Lighting

Smart Waste
Collection





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Applications of Machine Learning & AI in Mechanical Engineering

AI and ML are Revolutionizing Manufacturing



AI and ML are Increasing Accuracy

AI has helped reduce supply chain forecasting errors by 50%
(source: Mckinsey and Company)





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Three ways AI and ML are Transforming Mechanical Engineering



Predict Mechanical Failure

Predict failure probability of in-service equipment in factories

ML-based preventive maintenance reduces delays in airline industry



Detect Tumours:

3D MRI brain tumor segmentation detects tumours accurately



Reduce Test and Calibration Time:

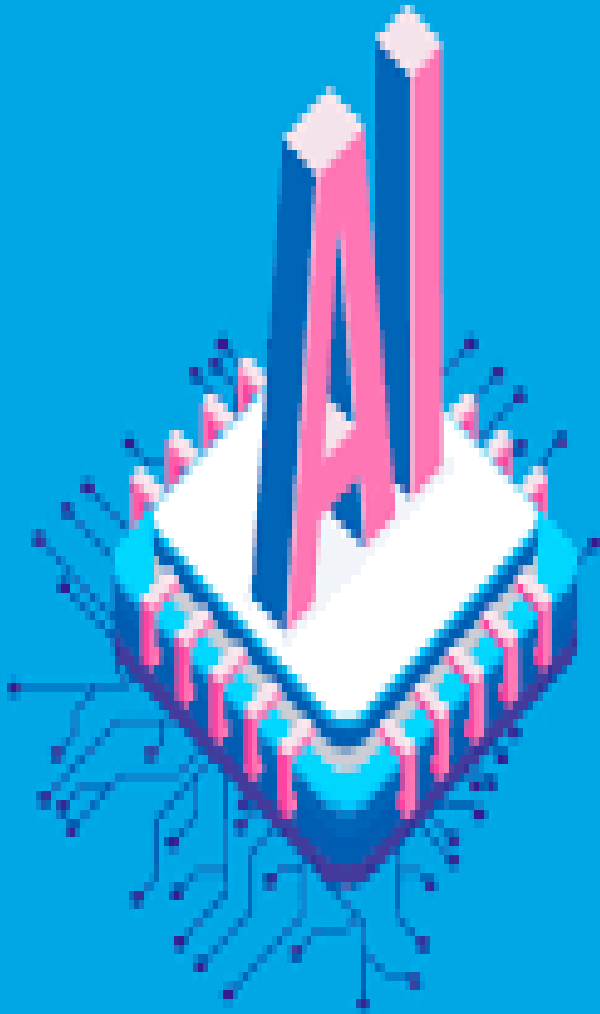
AI techniques can avoid unscheduled machine downtime and reduce test time



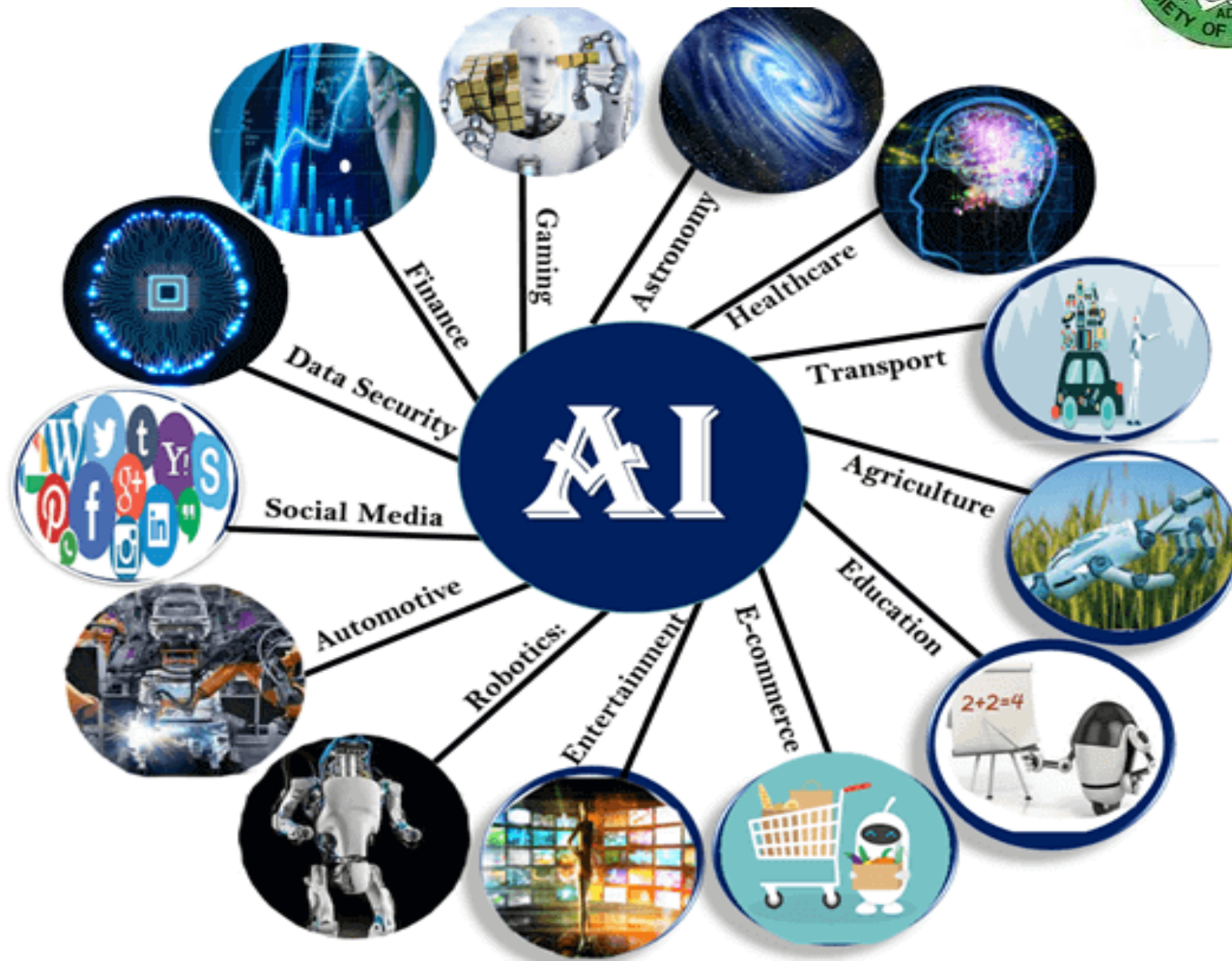


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Applications



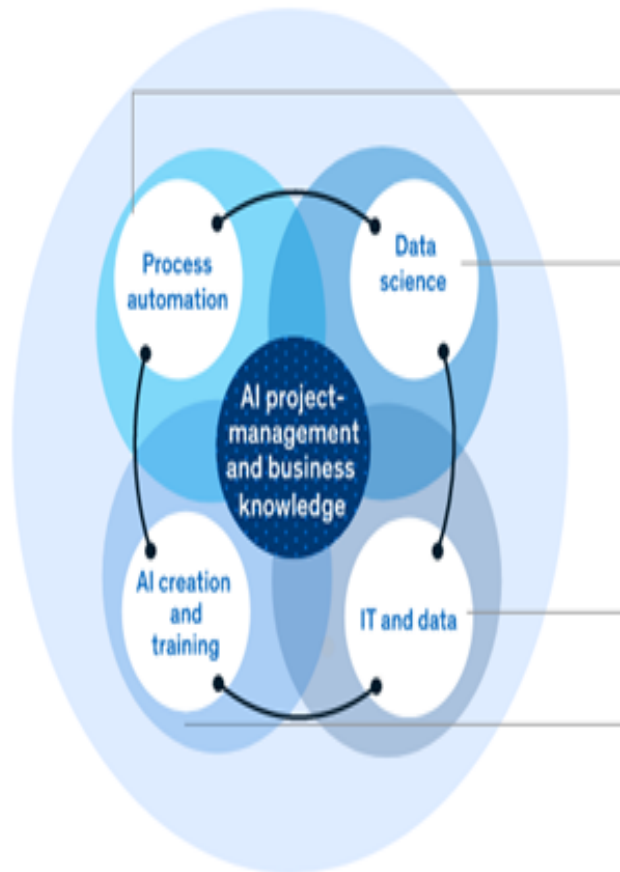
- ▶ Deep Learning Applications
- ▶ Predictive Analytics
- ▶ Translation
- ▶ Classification and Clustering
- ▶ Information Extraction
- ▶ Speech to Text
- ▶ Text to Speech
- ▶ Image Recognition
- ▶ Machine Vision
- ▶ Planning, Scheduling and Optimization
- ▶ Robotics
- ▶ Expert Systems





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- Existing skills
- Development needs



PROCESS & AUTOMATION ENGINEERS:

- Process data and automation know-how

DATA SCIENTISTS:

- Advanced analytics know-how

IT & DATA ENGINEERS:

- IT infrastructure know-how

AI CREATION EXPERTS/TRANSLATORS:

- Methods and delivery know-how
- Capability/training know-how



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Thank you For listening