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Using AI to support Requirements Definition at BorgWarner Power Drive Systems

Public





Using AI at BorgWarner

Introduction

- The use of Artificial Intelligence is introduced at BorgWarner to support the checking of requirements against quality criteria
- This paper introduces the state-of-the-art of AI, including machine learning and deep learning.

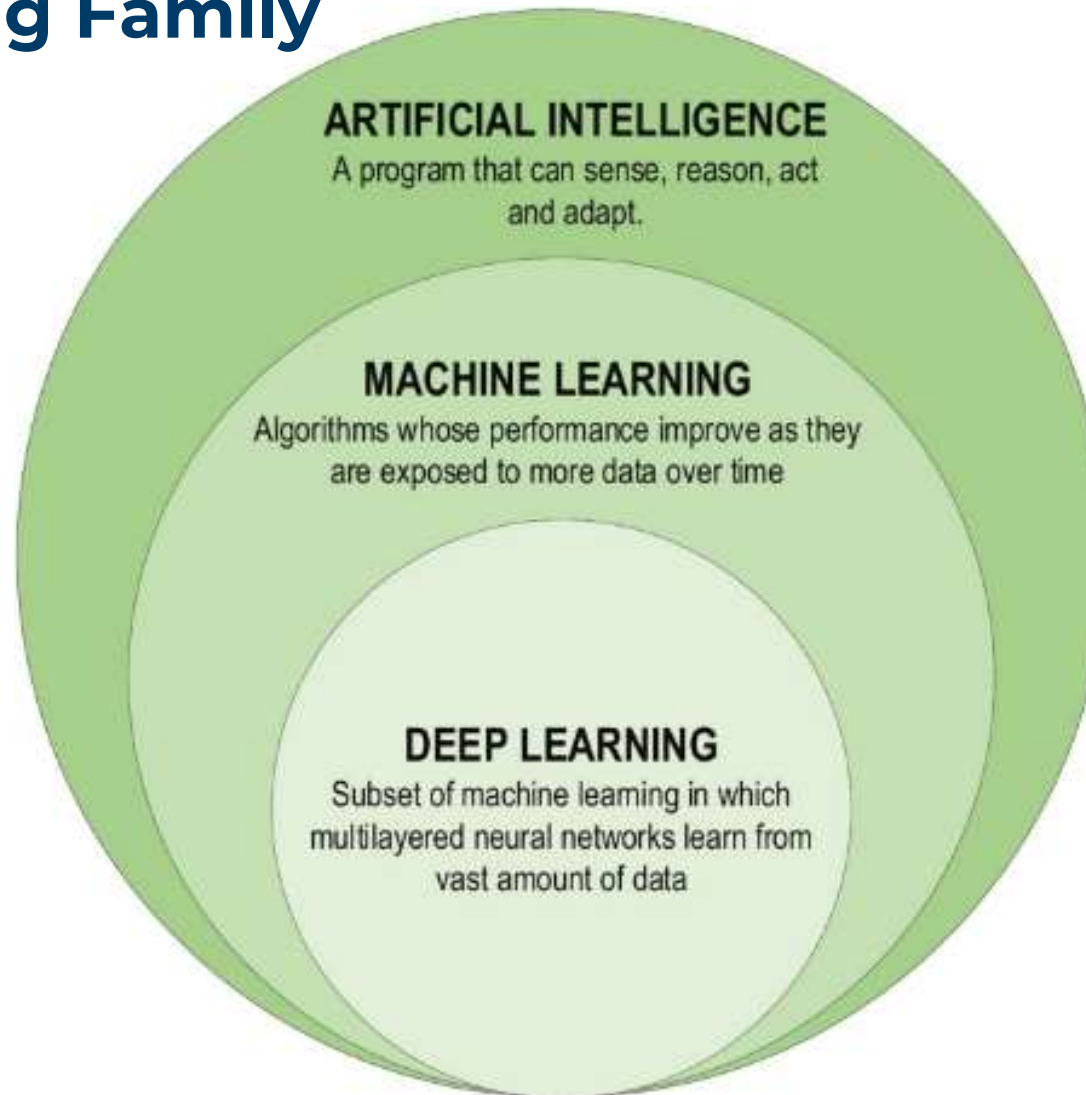


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A very short history of Artificial Intelligence

- The first computer was invented to quickly and reliably repeat simple operations.
- Colossus, the world's first digital, programmable, and electronic computer, had a single purpose: to help decipher the Lorenz-encrypted (Tunny) messages during World War II. (Tommy Flowers 1943)
- British mathematician Alan Turing envisioned a machine that could expand beyond its original programming.
- In the summer of 1956, a group of researchers gathered at Dartmouth College, New Hampshire, USA, for a workshop focused on investigating “thinking machines”

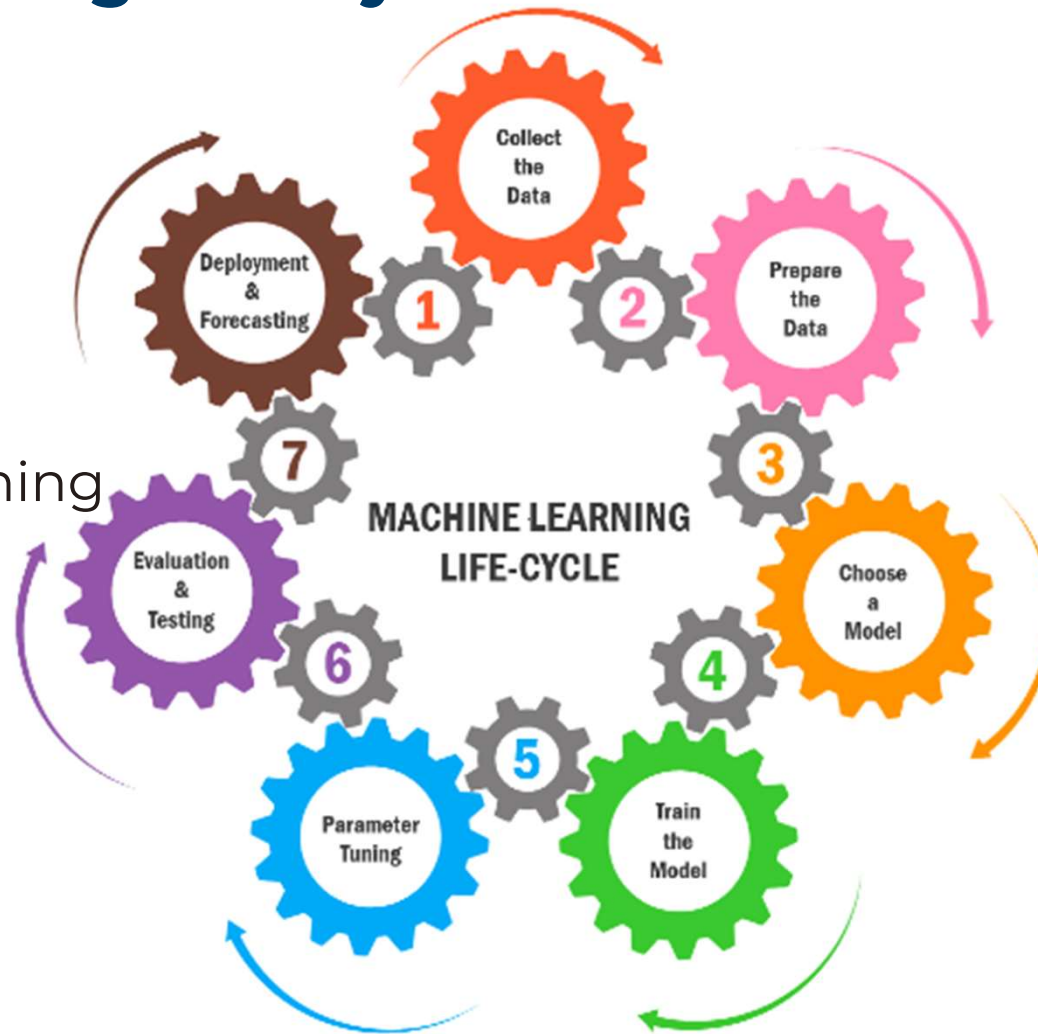
Deep Learning Family





Machine Learning Life-cycle

1. Collect Data
2. Prepare Data
3. Choose Model
4. Train Model
5. Parameter tuning
6. Evaluation
7. Deployment

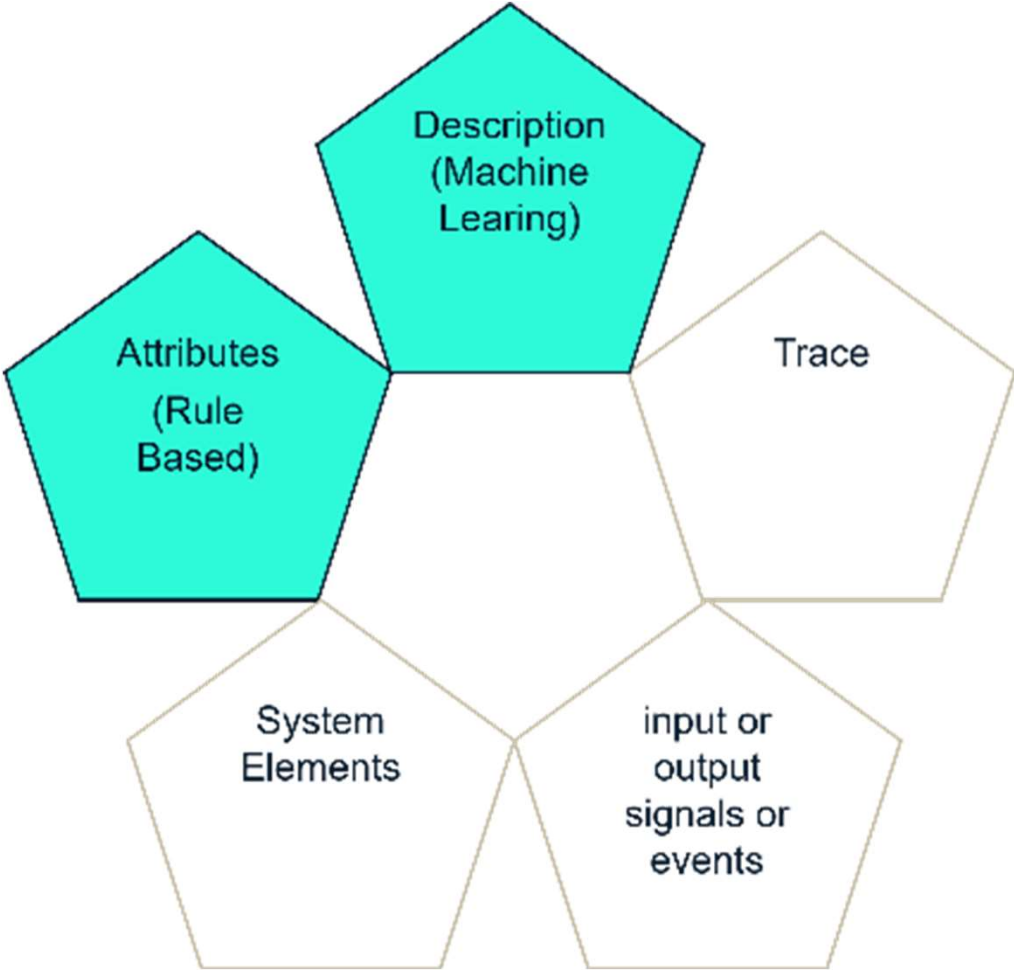




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We consider that there are 5 parts to a requirement:

- 1. The description in the form of text or diagram,
- 2. Attributes,
- 3. Trace information
- 4. System elements e.g. a switch
- 5. Input or output signals or events, e.g. measured temperature.



Evaluation and Deployment



IMS Corporate Integrated Management System /QHSE Platform

Back

SYS.2 SYS.3 SYS.4 SYS.5 SWE.1 SWE.5 SWE.6 SUP.1 SUP.8 SUP.9 SUP.10 MAN.3

System Requirements Analysis : P456_AUDI Customer Name : AUDI
Jira Project Name : P456 AUDI TSG+ (AL) SYSTEM Polarian Project Name : PDS_AUDI_P452_TSGEN
BP1 BP2 BP3 BP4 BP5 BP6 BP7 BP8

Specify system requirements
Total Polarian BW WorkItems : 1037 Total Polarian Cus WorkItems : 14101 NPLF: L Refresh

Key Findings

S.No.	Criteria	Number of Findings	Finding List
1	Are all stakeholder requirements uniquely identified?	No Findings	
2	Do all stakeholder requirements have a related System Requirement?	155	Polarion Links
3	System Requirements to not Contradict each other	No Findings	
4	Did too many system requirements come out of a single stakeholder requirement?	45	Polarion Links
5	Has the System requirements description been filled out with any information?	1	Polarion Links
6	Are Functional requirements included into the project?	No Findings	
7	The following Functional requirements are inadequate(ML)	473	View
8	The following Functional requirements are Adequate(ML)	519	View
9	Are Non-Functional requirements included into the project?	No Findings	
10	The following non-Functional requirements are inadequate(ML)	34	Polarion Links
11	The following non-Functional requirements are Adequate(ML)	8	Polarion Links
12	The following non-Functional requirements need manual check (ML)	2	Polarion Links

Selecting functional requirements categorized as 'inadequate'



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Conclusions

1. The early signs are promising.
2. It was important to manage expectations.
3. The performance enhancements are a support to humans performing tasks, rather than humans being relieved of all effort.
4. Initial results show that the AI model is not 100% accurate, but provides a very effective support in helping engineers to make the best use of their time.
5. There is a slight, as yet unsubstantiated, doubt that people might stop using their initiative and abdicate responsibility to the machine.
6. The Deep Learning is not yet introduced at BorgWarner.



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Next Steps

1. The understanding of the organisation is improved, and we are investing realistic amounts of time and effort in the initial steps.
2. The use of the AI is currently being tested on real projects to check and improve the machine-based results compared to historic human results.
3. The next steps are to use this technology in real current projects.

