Introduction of Data Science

Principles, Standards and Best Practices

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https://github.com/chen115y/DataScienceTraining

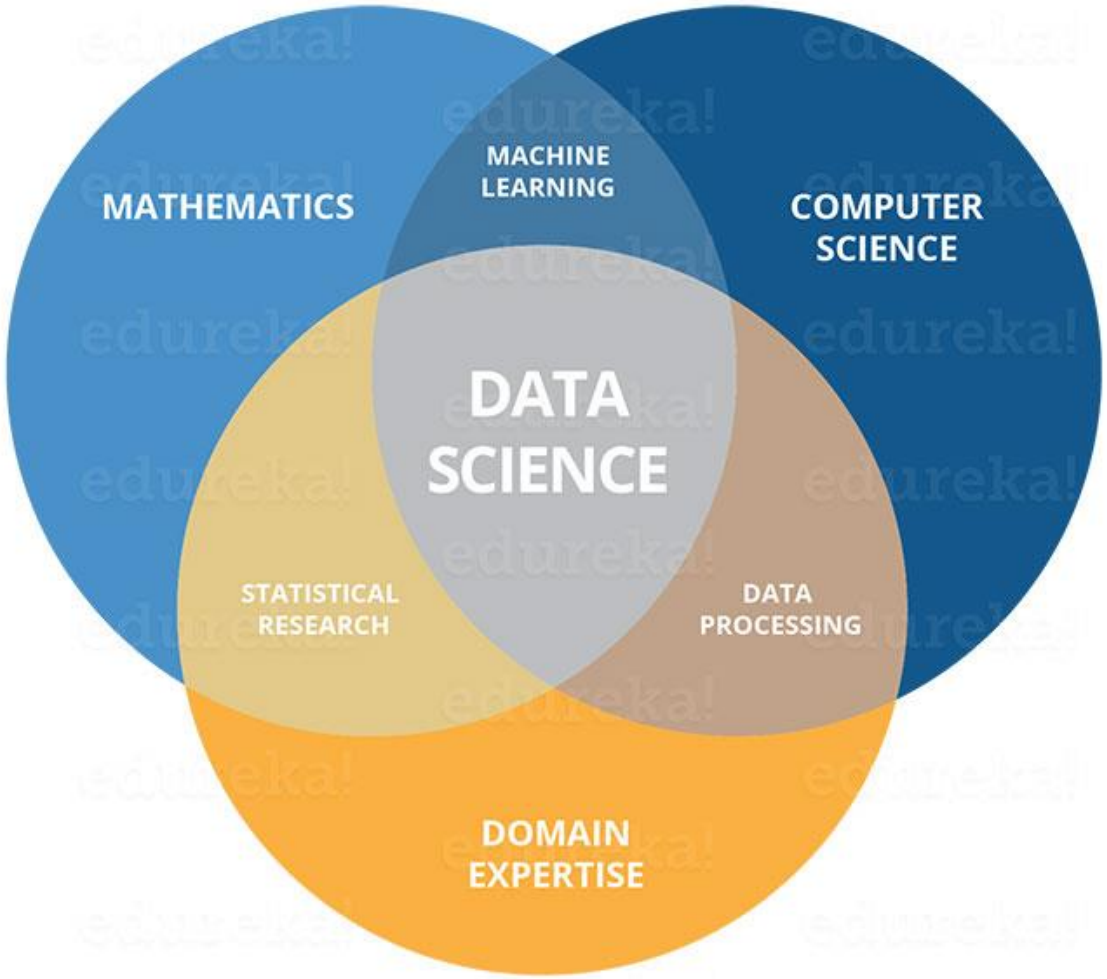
Agenda

- Data Science – Basic Introduction
- Data Science Life Cycle & Architecture
- Data Science – Principles, Standards and Best Practices
  - Data Science Experiments
  - Data Science Modeling & Evaluation
  - Data Science Productionalization
- Q & A

What is Data Science?

Data science comprises three distinct and overlapping areas:

- The skills of a ***statistician*** who knows how to model and summarize datasets (which are growing ever larger);
- The skills of a ***computer scientist*** who can design and use algorithms to efficiently store, process, and visualize this data; and
- The ***domain expertise***—what we might think of as "classical" training in a subject—necessary both to formulate the right questions and to put their answers in context.



Data Science is to use Data as base, Programming as legs, Machine learning as backbone and Business logics as heart.

Key Components of Data Science

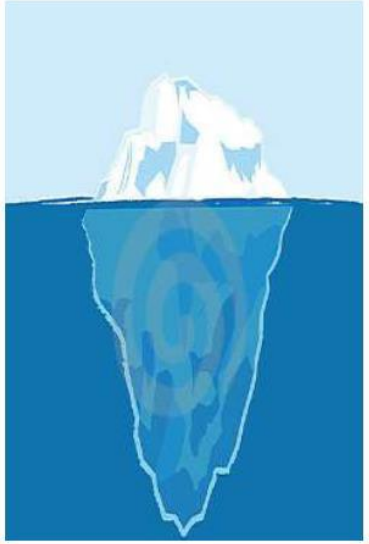
- Business Understanding ---------- Data Science Requirement Analysis
- Data Mining & Discovery
- Data Exploration
- Data Engineering
- Feature Engineering
- Visualization

Data Science Experiments

- Modeling & Evaluation
- Software Implementation

Data Science Model Development

- Production Deployment & Monitoring -------- Data Science Productionalization



Machine Learning

Deployment

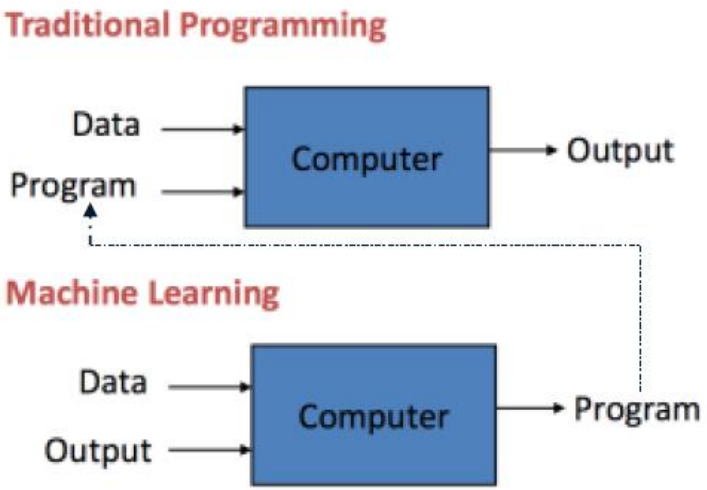
Application Development

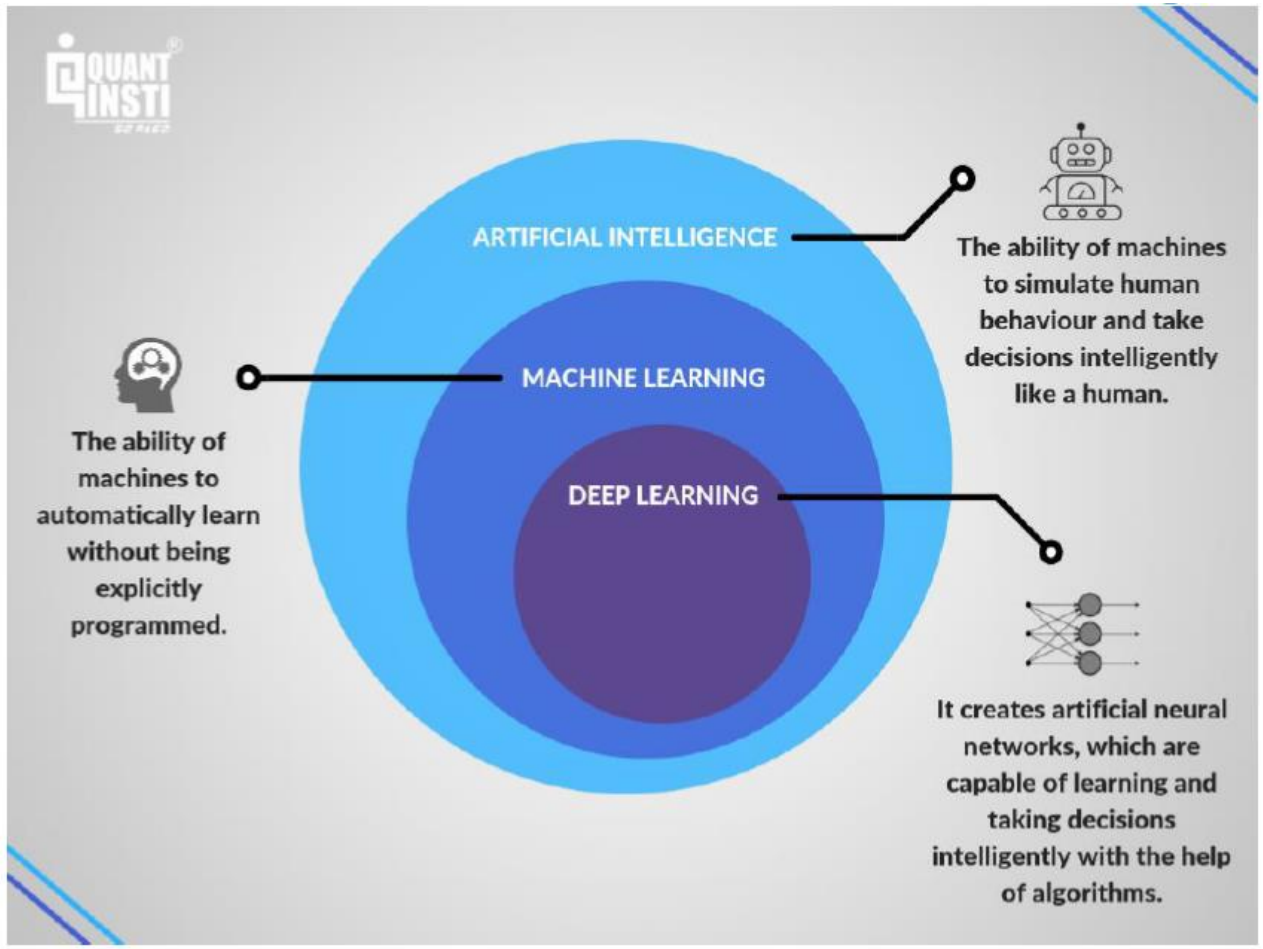
Big Data Processing

Data Storage

ETL

What is Machine Learning?

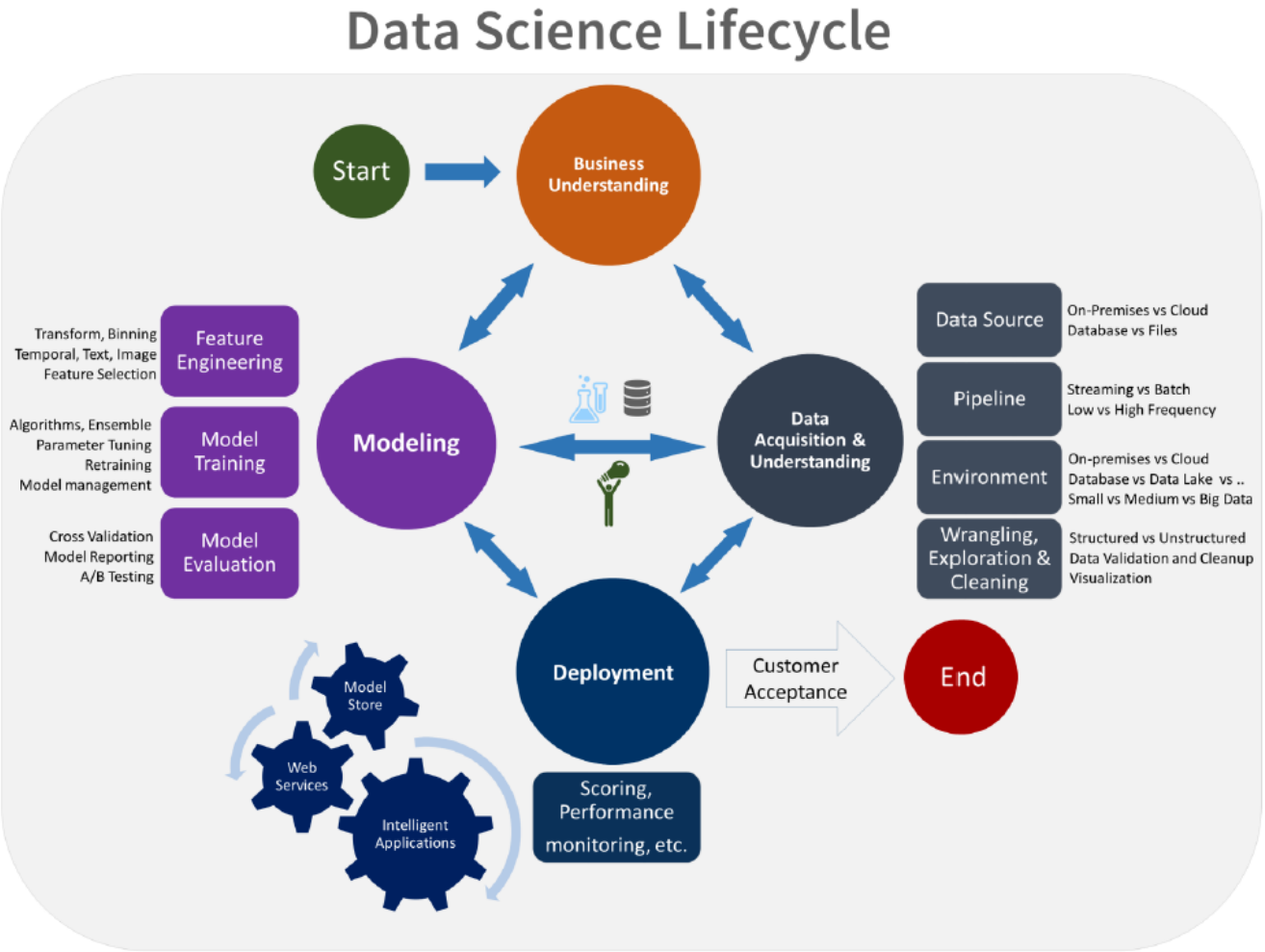




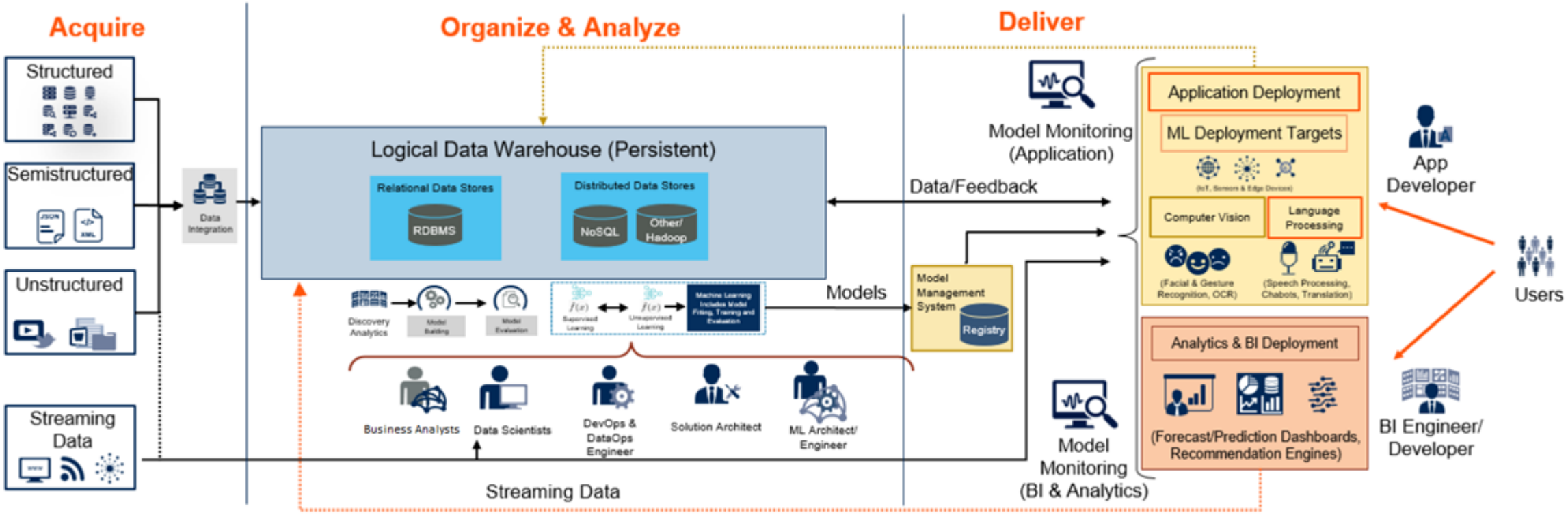
Why need Machine Learning or Use Cases for Machine Learning

- Problems for which existing solutions require **a lot of fine-tuning or long lists of rules**: one Machine Learning algorithm can often simplify code and perform better than the traditional approach.
  - For example, insurance under-writing processes
- Complex problems for which using **a traditional approach yields no good solution**: the best Machine Learning techniques can perhaps find a solution.
  - For example, image recognition
- Getting insights about complex problems and **large amounts of data**.
  - For example, text classification or sentiment analytics (NLP)

Data Science Life Cycle



Data Science Architecture



Data Science Team Members

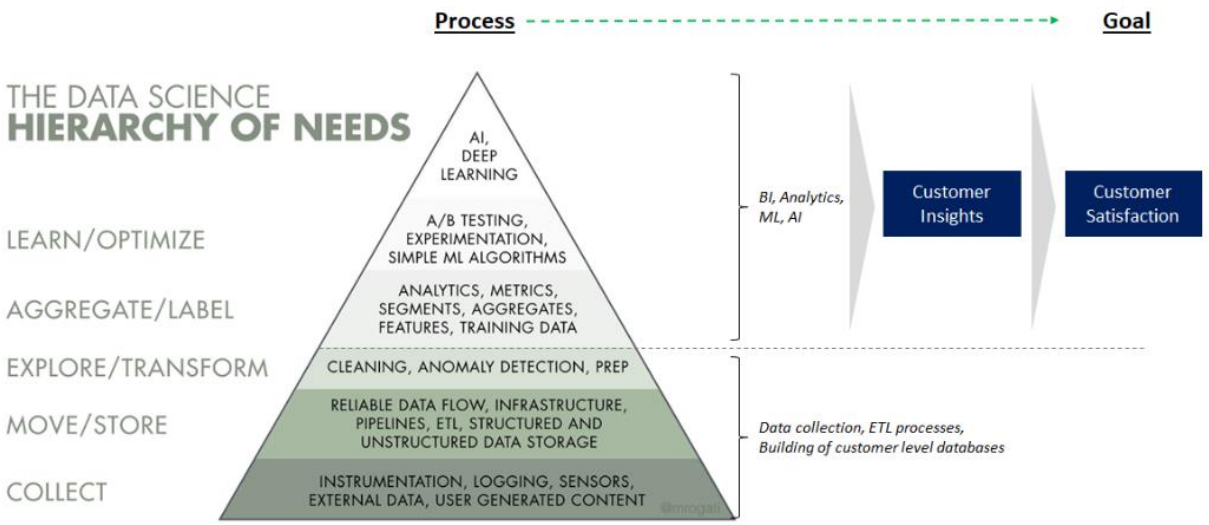
- **Product Sponsor or Owner**
- **Data Scientist and Data Analyst**
- **Machine Learning Architect and/or Engineer**
- **Data Architect and/or Engineer**
- **Business analyst**
- **Data Visualization Engineer**

Data Science – Principles, Standards and Best Practices

- Data Science Experiments
- Data Science Modeling & Evaluation
- Data Science Productionalization

Data Science Experiments

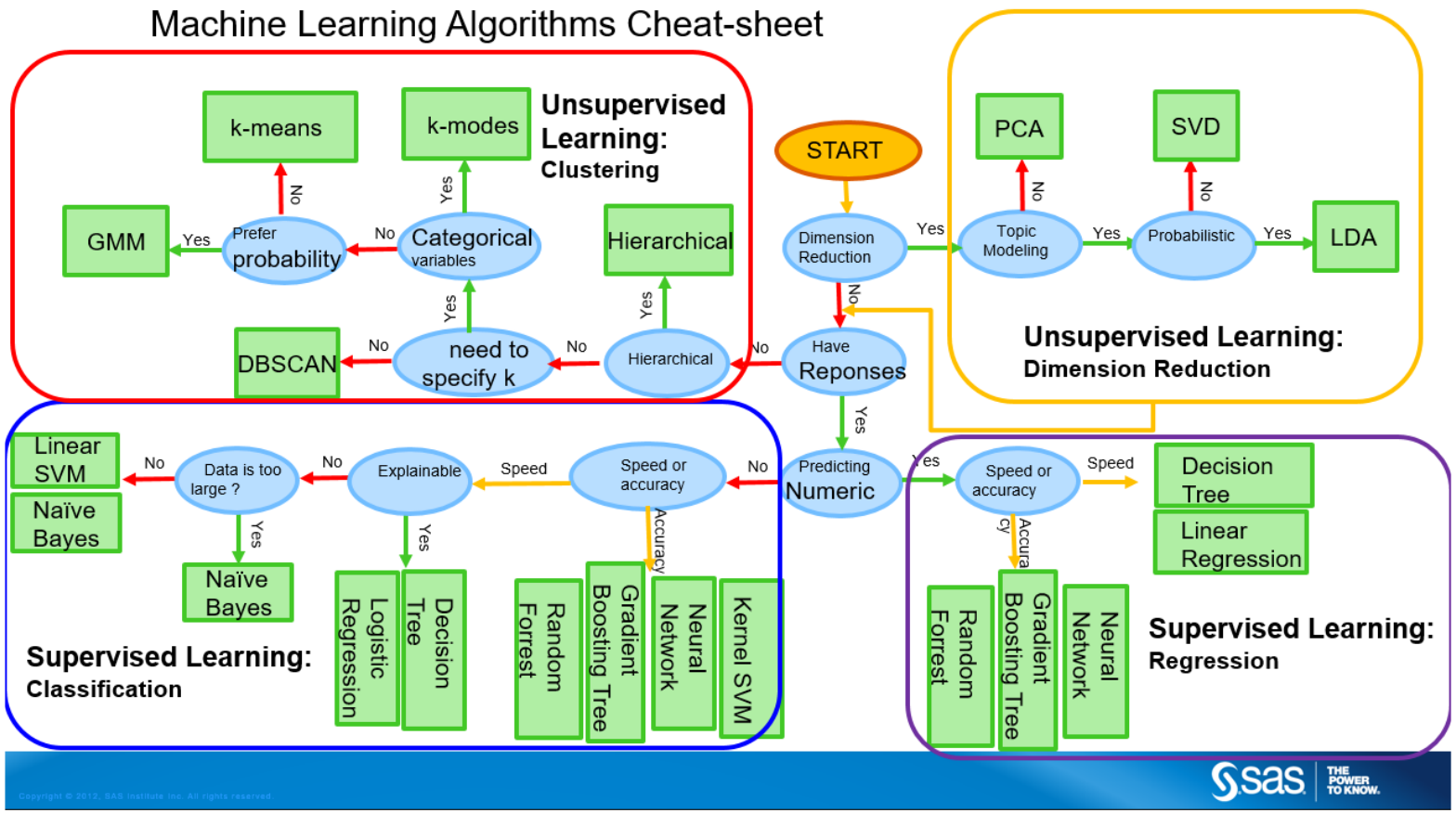
- **Principles**
  - **Understand the Data Science Hierarchy of Needs**
  - **Iterate fast:** Quickly setup a baseline approach and improve it with advanced technologies if needed and move on with this iteratively.
  - **Data is no magic bullet:** Understanding the limitations of data and how machine learning algorithms work is important to know which models are worth building.
  - **Models must be carefully evaluated b**
    implementation stage.
- **Best Practices**
  - **Use Jupyter Notebook with some tem**
  - **Use Notebook extensions to help proc**



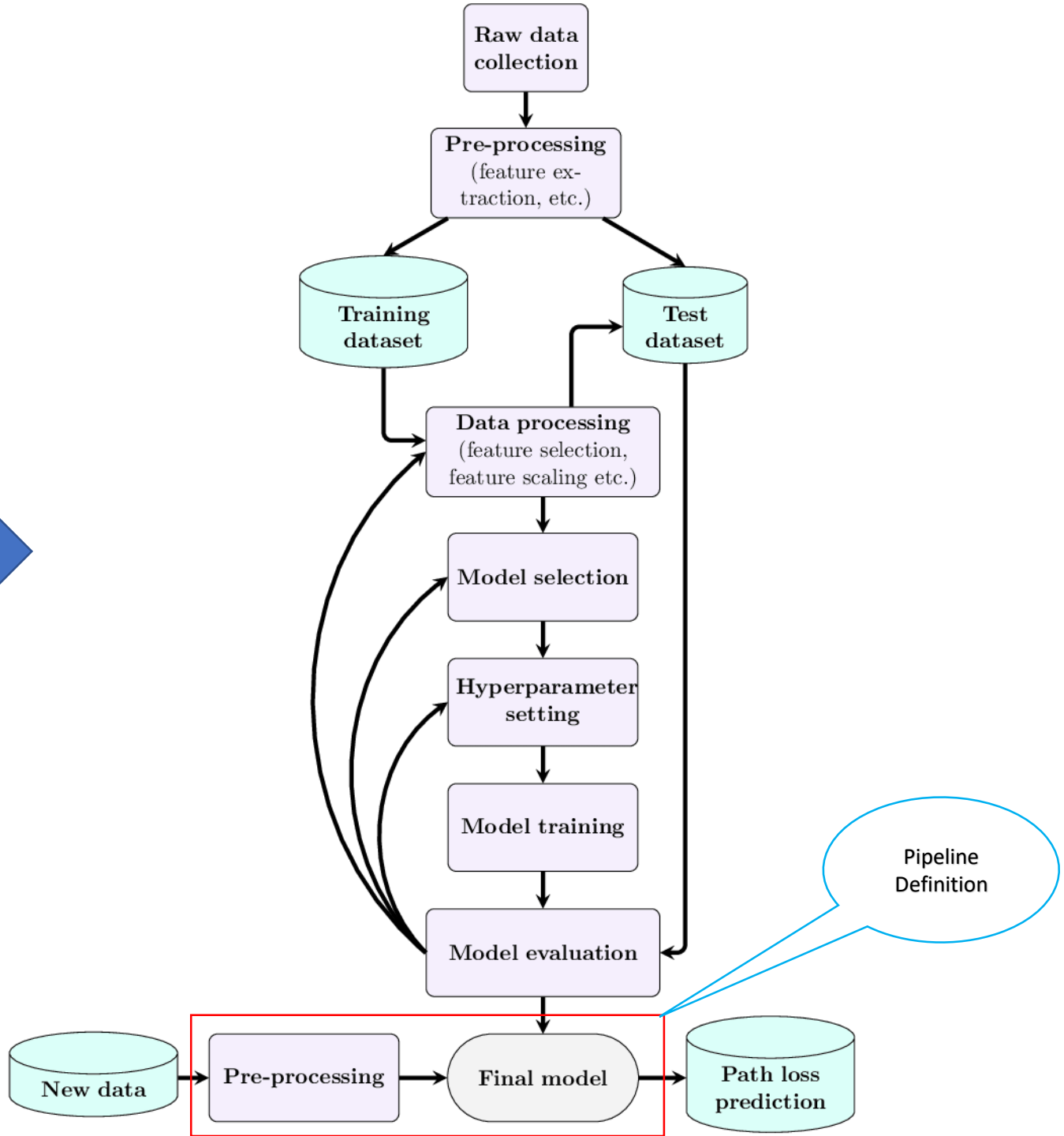
Data Science Modeling & Evaluation

- **Principles**
  - **Build models that answer the right questions**
  - **Analyze the best models and their errors**
- **Best Practices**
  - **Use machine learning model selection guidance or cheat sheets**
  - **Be conservative when choosing modeling technology**
  - **Better evaluation using cross-validation**
  - **Use auto-search methods for fine-tune model hyperparameters.**
- **Standards:**
  - **Data science modeling work flow standards**
  - **Data science model evaluation standards**
  - **Python data science libraries and frameworks**

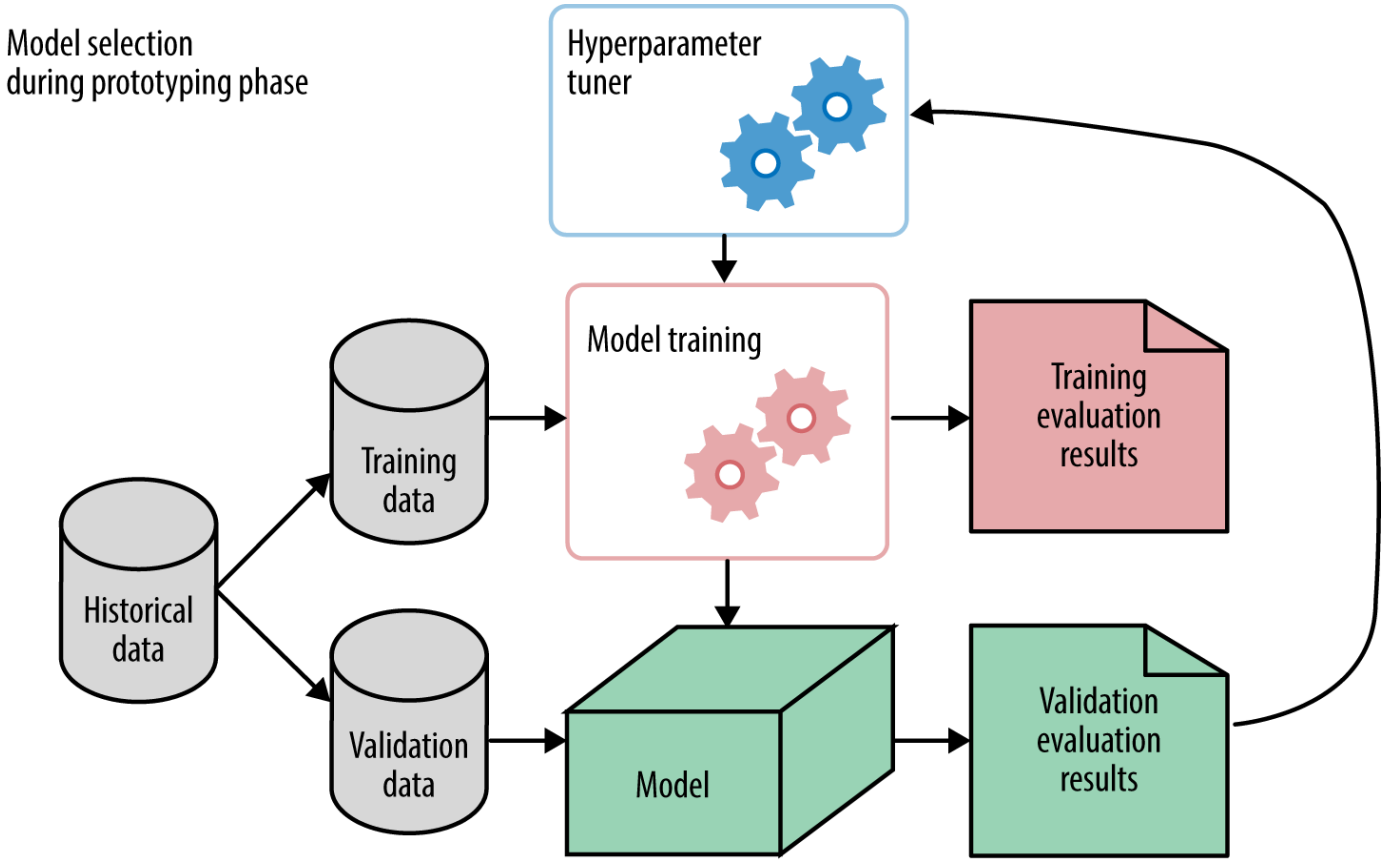
A Simple Machine Learning Model Selection Guidance



Data Science Modeling Work Flow Standards

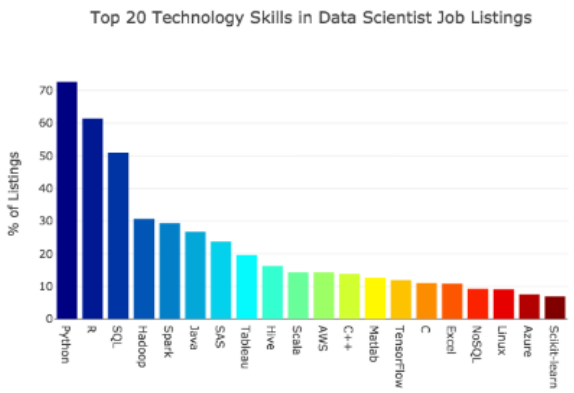


Model Evaluation Standards

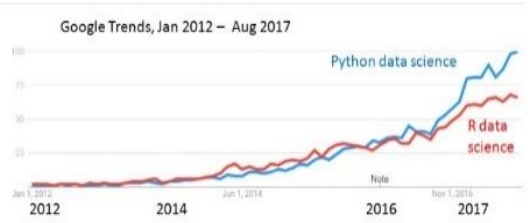


Python for Data Science

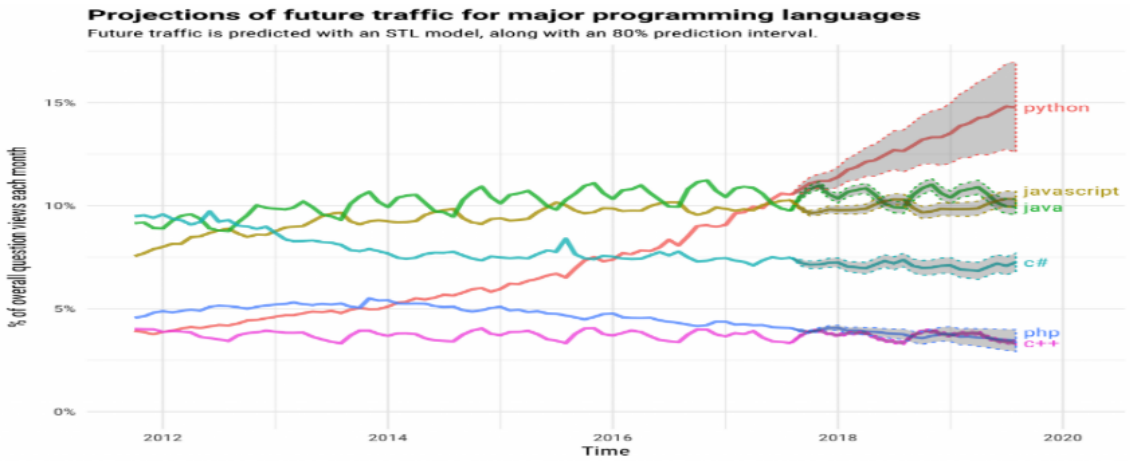
- Functional Scripting & Object-Oriented Programming
- General Purpose including Software Development, Data Science & Data Engineering
- Huge Open Source Libraries/Packages & Community
- Readability & Maintainability
- Less code base complexity
- Support by most all vendors



Medium

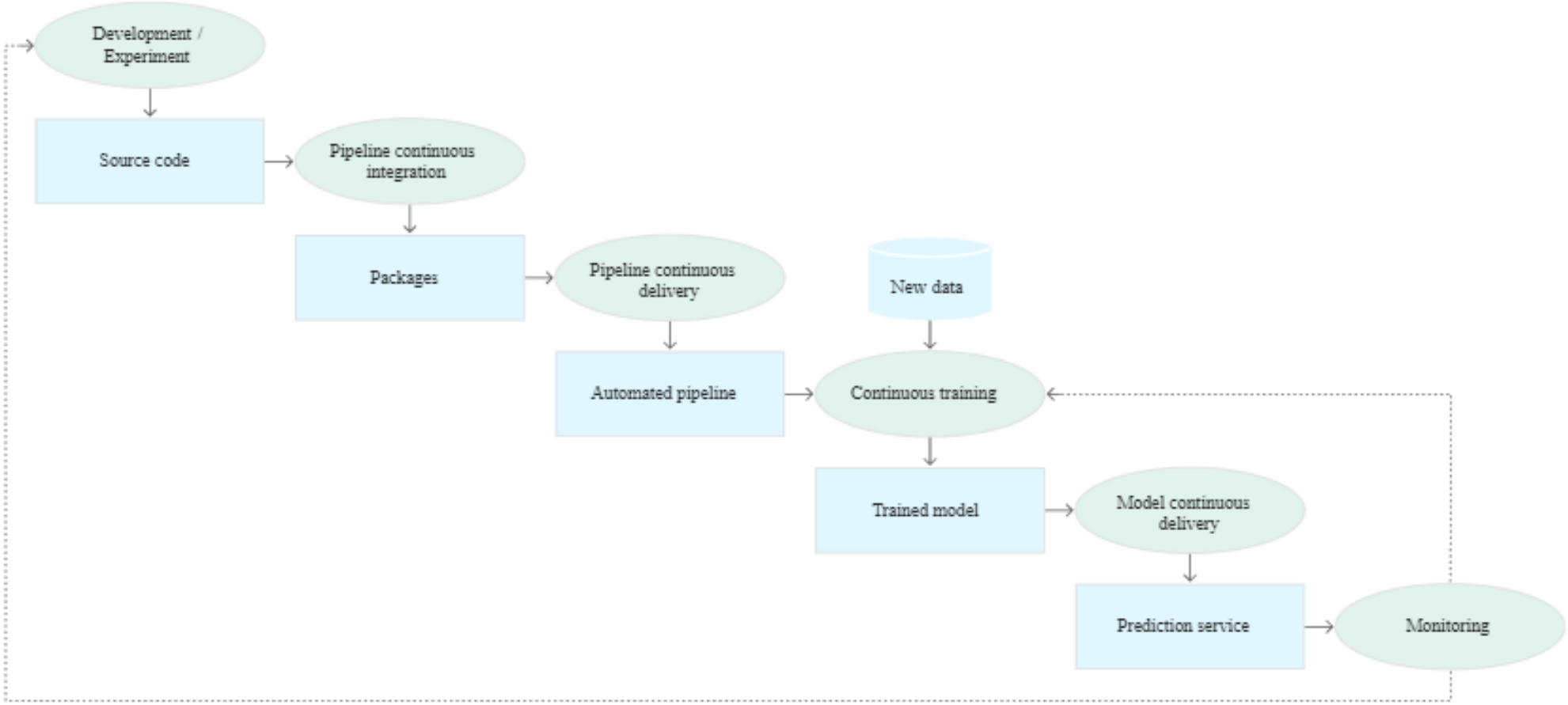


KDnuggets



Stack Overflow Blog

Data Science Productionalization – CI/CD Pipeline Best Practices



- https://cloud.google.com/solutions/machine-learning/mlops-continuous-delivery-and-automation-pipelines-in-machine-learning

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Data Science & AI Services in Cloud

Business Use-case	AI — Solutions	amazon web services	Google	IBM Watson	Microsoft
Insights	Machine Learning Platform	Amazon SageMaker	AI Platform and Cloud AutoML	Watson Studio	Azure Machine Learning Service
User Experience	Conversational Platforms	Amazon Lex	Dialogflow	Watson Assistant	Microsoft Bot Framework + Azure Bot Service
	Text Summarization/Analytics	Amazon Comprehend + Amazon Textract	Cloud Natural Language (NL) API + AutoML Natural Language + Document Understanding AI	Watson (NLU + Discovery + Knowledge Studio)	Azure Cognitive Services —Language
	Image Classification	Amazon Rekognition Image	Vision API and AutoML Vision	Watson Visual Recognition	Azure Cognitive Services — Computer Vision
	Streaming Video Processing	Amazon Rekognition Video and Amazon Kinesis Video Streams	Cloud Video Intelligence + AutoML Video	Watson Media	Azure Media Services — Video Indexer
Process Automation	IoT Platform	AWS IoT	Cloud IoT Core	Watson IoT	Azure IoT Central
	Contact Center	Amazon Connect	Contact Center AI	Customer Care Voice Agent	Dynamics 365 Virtual Agent for Customer Service