


Enterprise architecture for artificial intelligence

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b|T
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INTRODUCTION

- § Background: Computer Science, Entrepreneur, 24yrs delivering enterprise software solutions
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- § Current Focus: Machine Learning @  time:study



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UNIVERSITY OF COLORADO HEALTH



COLUMBIA UNIVERSITY
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HOSPITAL



MedStar Washington
Hospital Center

WHAT TO EXPECT

Tips for reducing the friction of AI adoption in the enterprise using systems thinking and people-centered workflows for:

- Discovery
- Teams
- Data
- Building Solutions
- Monitoring



DISCOVERY – Identify a Proper Business Case for AI

- Challenge : Defining a proper business case for using artificial intelligence.
- Solution : Develop Enterprise Standards for AI Projects. Discover the best tools for addressing a real-world problem by mapping your intent (use case) to its impact on people and systems.
- Deep Dive / Case Study : Checklist of characteristics that govern successful AI project (ex: Validated Predictions to gain immediate feedback on predicting time)

Tip for getting started: Looking for small opportunities to build confidence with high value/low risk projects.

DISCOVERY – Make a Proper Business Case for AI

INSIGHTS	What is the problem? Who understands this problem-space well?
COMPLEXITY	Can you code the rules? Is this a simple problem to solve? How many factors are involved?
ACCURACY	What accuracy rate is required? How quickly does your process need to adjust & learn from mistakes?
SCALABILITY	Are/Can humans perform this in a series of repeatable steps? Are you able to scale their efforts?
DATA ASSETS	Do you have the “right” data to “learn from”? Is it balanced? How is data obtained, cleaned, shared?
RESOURCES	Do you have resources to build, monitor & maintain your proposed solution? What is the business impact?
RISK & IMPACT	What are the risks? How does this solution impact people and/or augment human decision making?

PEOPLE – Focus on Impact

- Challenge – Cultural challenges. AI projects differ from rule-based software development projects. Requires continuous human investment to avoid unintended and/or disastrous consequences.
- Solution - Prepare your workforce by enabling them to focus on the impact that the solution has on people. The technology is a tool for delivering impact.
- Deep Dive / Case Study – Focus on purpose to reduce blindspots

AI Solution = Human wisdom + Machine analysis

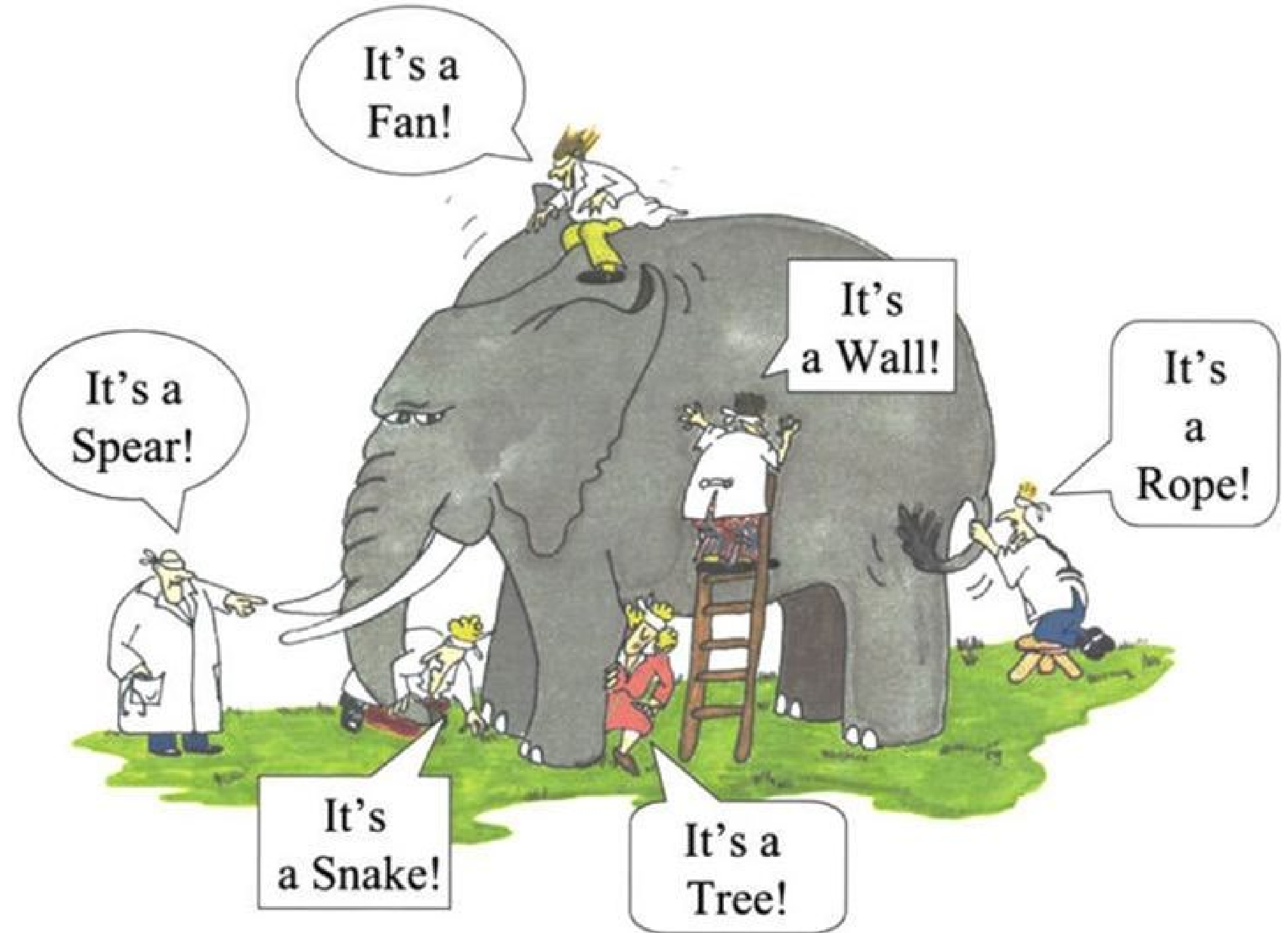
CULTURAL SHIFT – From “How?” to “Why?”

- **SKILLS**

- Engineering
- Data Science
- Design
- DevOps
- Security

- **MINDSET**

- Data Literate
- Value Transparency
- Systems Thinker
- Problem Solver
- Critical Thinker
- Curious
- Passion & Outcomes Oriented



DATA – from “Schemas” to “Stories”

- Challenge – Lack of appropriate data assets and data “wisdom”
- Solution - Using Data Iceberg to determine data acquisition needs and to evaluate the structures and behaviors that influence the data
- Deep Dive / Case Study – Creating more efficient data pipelines; document the data journey by expanding the data schema beyond “events & transactions”

bT DATA ICEBERG MODEL

DETERMINE THE UNDERLYING (I.E. NOT VISIBLE) STRUCTURES AND BEHAVIORS THAT INFLUENCE THE DATA.



EVENTS & TRANSACTIONS

- Data "Datasheet" & Dictionary
- Events & Transactions
- Historical Data (Patterns & Trends)



UNDERLYING STRUCTURES

- Data Authority: Owners & SMEs
- Data Lineage & Feedback Loops
- Data Collection Procedures
- Data Quality (Complete, Consistent, Accurate)



PEOPLE & POLITICS

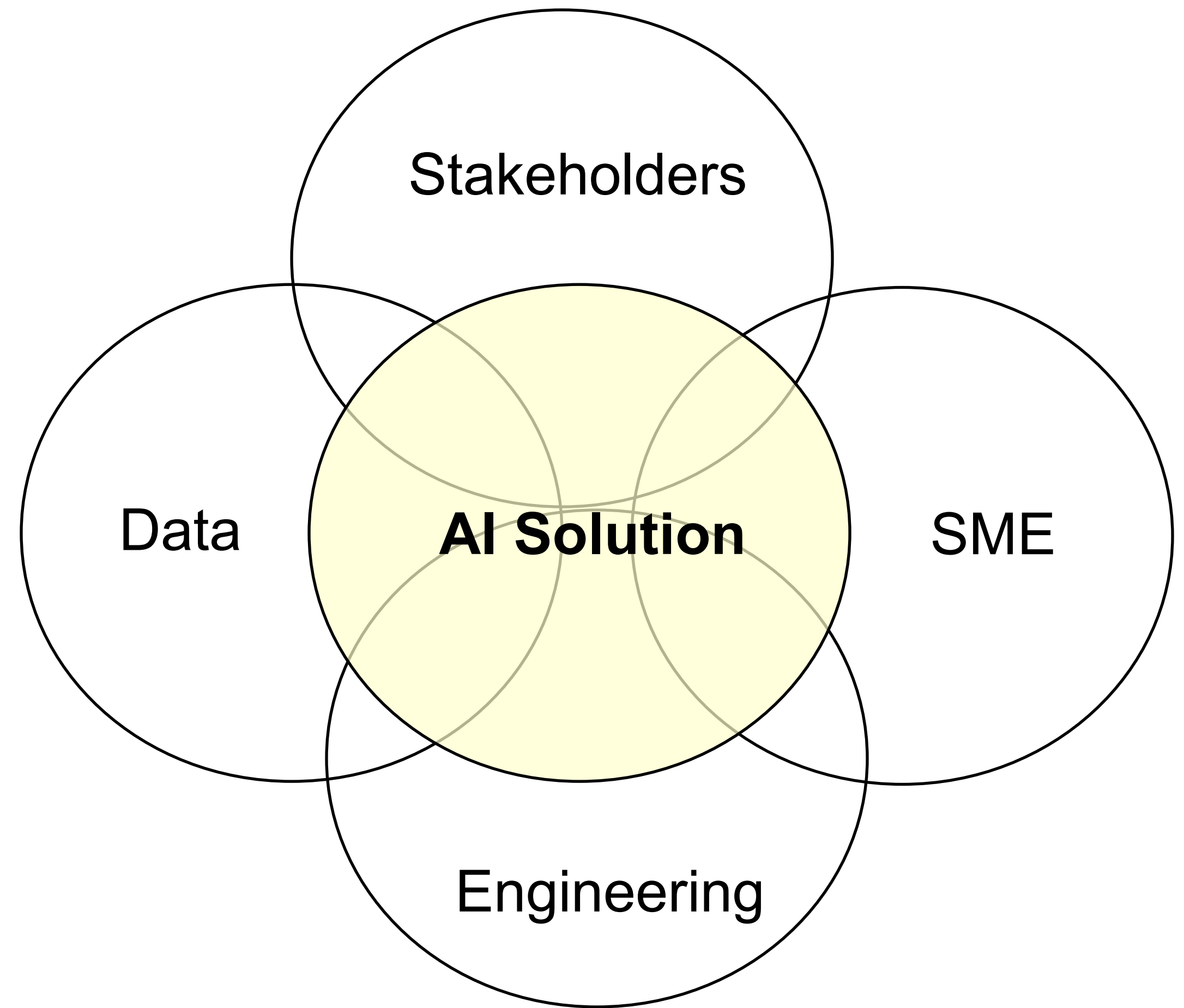
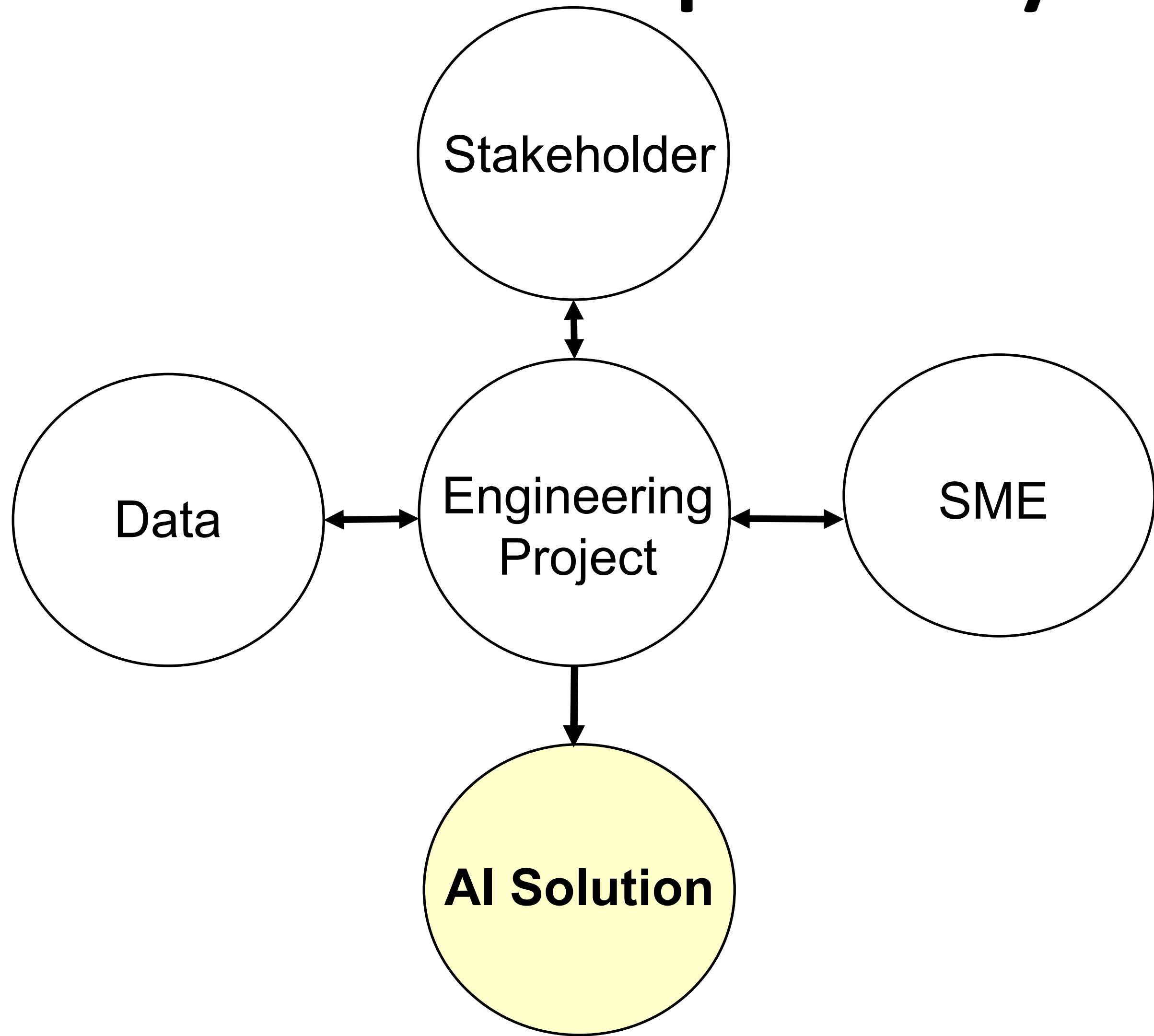
- Purpose for Data Collection & Active Use Case
- Data Governance & Data Access Rules
- Limitations of the Data
- Data Delays & Timeliness of Information



BUILDING – Full lifecycle, interdisciplinary team

- Challenge –lack of integrated and interdisciplinary development teams that work together toward a common goal, throughout the lifecycle of the project.
- Solution –AI Teams. How software workflows must be retooled for developing and maintaining artificially intelligent systems
- Deep Dive / Case Study – Reduce blind spots with integrated teams (our team: stakeholder/internal SME, prospective end-user, data scientist, engineering, IT)

Multidisciplinary vs. Interdisciplinary



ML ROADMAP	CLASSIFY	ACQUIRE	PREPARE	BUILD	VALIDATE	DEPLOY	MONITOR
GOAL	Identify hypothesis	Acquire data assets & establishing context	Improve data quality & identify bias	Develop an appropriate learning system	Identify & Reduce error	Present results	Monitor change
PRINCIPLE	Purposeful	Openness	Multi-dimensional	Patterns & Trends	Counter-intuitive	Emergence	Adaptability
TOOLS	Archetypes Ladder of Inference	Data Iceberg Model	Stocks and Flows	Modeling & Simulation	Feedback Loops	Highest Leverage	Behavior Over Time
METRICS	Questions That Data Can Answer	Data Boundaries	Transparent open datasets	Experiments & Algorithms	Model Scores & Results	Predictions	Performance & Impact
HUMAN INSIGHTS	Stakeholders, SME	Data Owners, SME	Data Managers	Engineers & Data Scientists	Engineers & Stakeholders, SME	IT, Engineers	Stakeholders, SME
TOOLS & ARCHITECTURE	Business Case	Data Lake	Data Warehouse	Safe Learning Space (Sandbox)	Cross Validation	Model as a Service	Dashboards & Audits

MONITORING – Continuous assessment & validation

- Challenge – Reactive environments that are unable to detect hidden issues such as concept/data drift over time.
- Solution – Concept drift detection. Importance of continuous assessment and validation for monitoring performance over time. Systems for monitoring outcomes, triggers for adaptation, and performance drift
- Deep Dive / Case Study – Using continuous assessment to identify & address unintended consequences

Visual performance dashboards can enable all team members to offer insights on performance drift and to provide hidden context

MONITORING – Performance Perspectives

DATA SCIENCE

- Drift detection & handling
- Identify impact of subtle and gradual changes (see “The Boiling Frog” syndrome)
- Continuous data profiling & data monitoring

OPERATIONAL / IT

- Detect and act upon abnormal changes in Training-Serving Pipeline
- Monitor process failures, input changes & tracks degradation over time

RESOURCE / COST

- Resource consumption
- Cost per Records/Second

SERVICE IMPACT

- Testing KPI for Accuracy & Changes Over Time
- Maintaining success benchmarks

INFORMATION

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