Enterprise architecture for artificial intelligence

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INTRODUCTION

§ Background: Computer Science, Entrepreneur, 24yrs delivering enterprise software solutions

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§ Current Focus: Machine Learning @

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

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

• MINDSET
  o Data Literate
  o Value Transparency
  o Systems Thinker
  o Problem Solver
  o Critical Thinker
  o Curious
  o 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”
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

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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

Data → Engineering Project → SME → AI Solution

Stakeholder

AI Solution

Stakeholders

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

<table>
<thead>
<tr>
<th>DATA SCIENCE</th>
<th>OPERATIONAL / IT</th>
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<tbody>
<tr>
<td>• Drift detection &amp; handling</td>
<td>• Detect and act upon abnormal changes in Training-Serving Pipeline</td>
</tr>
<tr>
<td>• Identify impact of subtle and gradual changes (see “The Boiling Frog” syndrome)</td>
<td>• Monitor process failures, input changes &amp; tracks degradation over time</td>
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<tr>
<td>• Continuous data profiling &amp; data monitoring</td>
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<tr>
<th>RESOURCE / COST</th>
<th>SERVICE IMPACT</th>
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<tr>
<td>• Resource consumption</td>
<td>• Testing KPI for Accuracy &amp; Changes Over Time</td>
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<tr>
<td>• Cost per Records/Second</td>
<td>• Maintaining success benchmarks</td>
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INFORMATION

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