Enterprise architecture for artificial intelligence

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INTRODUCTION

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

Tips for reducing the friction of AI adoption in the enterprise using systems thinking and people-centered workflows for:
  o Discovery
  o Teams
  o Data
  o Building Solutions
  o Monitoring
DISCOVERY – Identify a Proper Business Case for AI

- **Challenge**: Defining a proper business case for using artificial intelligence.
- **Solution**: Identifying suitable use cases for AI. Develop Enterprise Standards for AI Projects. Intentional systems for discovering the best tools for addressing a real-world problem and then 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>
</tr>
</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>
</tr>
<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>
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</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 - AI Teams & Hidden Context

**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 Values 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 – documenting 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

 UNDERLYING STRUCTURES

 PEOPLE & POLITICS

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

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

 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 (our team: stakeholder/internal SME, prospective end-user, data scientist, engineering, IT)
Multidisciplinary vs. Interdisciplinary

- Stakeholder
- Data
- Engineering Project
- SME
- AI Solution

- Stakeholders
- Data
- SME
- Engineering
- AI Solution
<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</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 – System dashboards & triggers for concept & performance drift.

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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