Moving AI solutions from concept into production

Follow a proven path to the development and deployment of artificial intelligence applications that solve business problems.

ABSTRACT

In this white paper, we walk through five steps on the path to a successful artificial intelligence project, from developing a clearly defined use case to scaling a solution in a production environment. In addition, we explore a case study highlighting the experiences of a global enterprise that worked with the Dell Technologies HPC & AI Innovation Lab to develop a proof of concept for an AI solution that stops credit card fraud in real time.

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A STRATEGIC APPROACH TO AI PROJECTS

The process of developing and deploying artificial intelligence applications brings unique challenges. Complexity runs through the entire project, from defining use cases and preparing data to training algorithms, developing software code for last mile execution and scaling the solution in a production environment.

These are all familiar challenges to the data scientists, computer scientists and subject matter experts at Dell Technologies. The HPC & AI Innovation Lab team regularly works with enterprises, universities and public entities on the development of artificial intelligence algorithms and the high performance computing systems that run them.

As part of its mission, the team works proactively to share its learnings and best practices with the global user community. One of these overarching lessons is that organizations on the path to AI need to think strategically, across the entire lifecycle of the project, and then move down the development and deployment path in a stepwise manner.

With that thought in mind, we suggest these five steps toward a successful AI project:

1. Clearly define the use case
2. Clean, tag, transform and catalog data
3. Understand your data science skillset and needs plus train your model
4. Use DevOps for the last mile
5. Scale to production

In this white paper, we walk through each of these steps, and then explore the case study an AI project launched by a global enterprise. This organization worked with the HPC & AI Innovation Lab to develop a proof of concept that proved the business value of an ambitious effort to use AI to fight credit card fraud in real time.

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**BUSINESS USE CASE**

<table>
<thead>
<tr>
<th>Goal</th>
<th>KPIs</th>
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<td>Collection</td>
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**APP DEV**

Team leader
Dev platform
On/off-prem

**DATA**

Sources
Type
Location
Transformation
Access
Age

**DATA SCIENCE**

Team leader
Framework
Workbench
Location

*Figure 1.* rDE deployed as data proxy for Cassandra databases – conceptual architecture
FIVE STEPS TO A SUCCESSFUL AI PROJECT

STEP 1. CLEARLY DEFINE THE USE CASE

While any AI project should begin with a clearly defined use case, this isn’t always the reality on the ground. Some organizations begin their paths to AI focused on developing systems that will allow them to capitalize on the massive amounts of data they are collecting — for example, data from the Internet of Things — without having a clear understanding of the business problem they are trying to solve. The outcomes of such projects can be less than optimal.

A better approach is to begin with an AI use case that focuses on a specific business problem that needs to be solved and considers the strategic impact of the project. This first step of the project takes an end-to-end view, from considering the feasibility of implementation to identifying the key performance indicators (KPIs) that will be used to measure return on investment and project success.

A few examples:

• A manufacturer might use AI and computer vision capabilities to detect anomalies and defects in parts coming into a factory, such as parts that don’t meet tolerance requirements. The business value here is to reduce the number of defective products coming off the manufacturing line and the associated warranty repair costs.

• A telecommunication company might use AI to analyze massive amounts of data to predict and prevent hardware and network problems. AI systems can be trained to monitor the state of equipment, detect patterns and anomalies that are indicative of emerging issues, and predict the likelihood of failures. The operations team can then work proactively to address equipment issues before services and customers are impacted. This proactive work can help service providers meet SLAs, maintain customer satisfaction and build brand loyalty.

• A healthcare provider might use AI in a natural language processing (NLP) application to automate burdensome manual processes, such as the transcription of spoken or written notes from clinical staff members. Or a provider might use NLP for “text mining,” or searching through documents to find information related to patients and their care, the content of clinical studies and more. The payoff here can be cost savings that come with automated processes as well as improved patient care.

These are all examples of clearly defined AI use cases that generate business value.

About the lab

The Dell Technologies HPC & AI Innovation Lab in Austin, Texas, encompasses a 13,000-square-foot data center devoted to high-performance computing and artificial intelligence. It houses thousands of servers, a TOP500 cluster, and a wide range of storage and network systems. This lab is staffed by a dedicated group of computer scientists, engineers and subject matter experts who actively partner and collaborate with Dell Technologies customers and other members of the HPC community. The Lab provides early access to new technologies, integrates and tunes clusters, benchmarks applications, develops best practices, and publishes their results.
STEP 2. CLEAN, TAG, TRANSFORM AND CATALOG DATA
For organizations developing AI-driven applications, data is a complex issue. You can have a petabyte of data, but if you don’t know what that petabyte consists of, and if you don’t clean, tag, transform and catalog that data, you can’t put it to use in an AI-driven application. Step 2 makes this data AI-ready.

In this step, you identify what type of data you are going to use and where that data is located. You also determine how you are going to clean, tag, transform and catalog that data to get it into a form that can be used by a machine learning algorithm.

Data management is another key consideration. To be successful with AI, you need to have a strategy for managing data across the end-to-end data pipeline. This strategy addresses critical questions about your data pipeline. For example:

• What is the operational model and process for extracting value from your data?
• What happens to data once it comes into your enterprise? How do you ingest it? How do you process it? How do you transform it?
• How do you get data ready for analytics and model training, whether it’s machine learning or deep learning?

The questions don’t stop there. Once you have your dataset ready for analysis, you need to determine how you are going to get your data into your software tools and put it to work. For example, is that analysis going to be done in Apache Spark or in a NoSQL database? Do you want to run a machine learning algorithm? Do you want to run a neural network, and then put that output into some form of data analytics?

Through the process of answering questions like these, you map out the steps in your data pipeline at a very granular level. The result is a clear view of your data management strategy. At this point, you can turn your attention to your data science needs.

STEP 3. UNDERSTAND YOUR DATA SCIENCE SKILLSET AND NEEDS PLUS TRAIN YOUR MODEL
The next step on the path to AI is to determine your data science needs and train your AI model, using your targeted dataset. The key is to ensure that you have the right data science resources in place — in terms of both people and software tools.

Questions to explore here include:

• Do we have the data science expertise that we need?
• Do we have a data science workbench, governance process and toolset that will allow our data science team to collaborate?
• What frameworks and libraries are we going to use to train our model?
• How are we going to build our data workflows?
• How are we going to compare the accuracy of different models that we train?

This step also covers considerations about security, governance and the reproducibility of your training. For example, you need to determine how you are going to keep track of who touched your model and what they did to it.

Here’s another important caveat for this step. It’s not enough to hire data scientists. You also need to ensure that you have the right data science tools in place to allow your professionals to be successful.
STEP 4. USE DEV-OPS FOR THE LAST MILE
Once you have trained your model, the next big step is to put that model into some type of software or application, so you can actually use it.

In this step, you determine how you are going to get your model into code, the tools your software developers require to integrate the model with your application, and how your Dev-Ops team will interact with your data science team. This “last-mile” execution positions your organization for a successful launch of a proof of concept and an eventual production application.

STEP 5. SCALE TO PRODUCTION
Once you get your model into code, you have all of the pieces in place for a proof of concept to demonstrate the business value that your solution will deliver. A successful PoC will typically be followed by the rollout of a production application.

Key questions to address at this step include:

• What is the status of your PoC? Did you uncover any challenges?
• How is your PoC data different from your production data?
• What steps do you need to take to put your model into a production environment?

At this step, it’s also a good time to think about the entire lifecycle of your model. How you are going to operationalize this within your four walls? How often do you want to retrain the model? Are you going to use new data or old data to retrain the model? The answers to questions like these will help ensure that your AI initiative is successful on an ongoing basis.

A CUSTOMER CASE STUDY

USE CASE
A team from a global payments processing firm worked with the Dell Technologies HPC & AI Innovation Lab to develop a proof of concept for an AI use case focused on stopping fraudulent credit card transactions in real time. This team wanted to use the proof of concept (PoC) to demonstrate the value of the AI application to executive management, and then scale to production. The team members believed that an AI-driven application that reduced fraudulent transactions would deliver $4 million to $6 million in ROI the first year, and more than $20 million over three years.

DATA
For the fraud-detection application, the team wanted to use time-series data that is generated in the course of credit card transactions. This data ranges from the days and times that transactions are made to cardholders’ spending patterns and geographies. They wanted to use this time-series data to build a profile of cardholders, and then use AI to detect any potentially fraudulent transactions that fell outside of a user’s profile. The goal was to have an AI system that identifies fraudulent transactions within 2 milliseconds, and then cancels those transactions before they take place.

For the training effort, the team members began with a clean historical dataset of cardholder transactions. To protect the identities of the cardholders whose information was in the dataset, the team worked with the data scientists in the HPC & AI Innovation Lab to anonymize the data. In addition, they used machine learning algorithms to catalog and tag data related to known fraudulent transactions. For example, the project categorized all fraudulent transactions over $500.
DATA SCIENCE
The team members from the global payment processor worked with the data scientists in the HPC & AI Innovation Lab to train a deep-learning neural network that could detect different patterns, user behaviors and other characteristics that could be indicative of fraudulent behavior. They choose to develop an accelerated neural network, rather than a machine learning model, because of the size of the dataset. This network would need to ingest time-series data for potentially millions of transactions.

Based on the amount of data that would be used to train the model, the IT professionals in the Dell Technologies HPC & AI Innovation Lab chose Dell EMC PowerEdge C4140 servers. This flexible, dense 1U rack server is optimized for accelerators and designed for some of today's most-demanding workloads, including HPC, data visualization and rendering applications.

In round numbers, the model-training effort started out with 500 gigabytes of data, grew to a terabyte and then expanded to 3 terabytes. With this huge dataset, the project team trained a highly accurate model.

DEV-OPS
As a payment processor, the company needed to comply with Payment Card Industry (PCI) rules and regulations, including data security standards. To maintain PCI compliance, the company is required to use specific software for cardholder transactions. This meant that the company's Dev-Ops team had to write the software code to build the fraud-detection model into the transactional software. This is the "last-mile execution."

SCALE
The data scientists in the HPC & AI Innovation Lab worked with the payment processor's team to scale the fraud-detection model, using anonymized data, to prove that they could actually detect a fraudulent transaction within 2 milliseconds. Once that milestone was passed, the IT professionals in the lab determined the number of servers and accelerators the payment processor would need to get the performance required for ongoing model training and inferencing workloads.

KEY TAKEAWAYS
A successful artificial intelligence initiative requires a strategy for moving an AI vision from conception to production. This process begins with a clearly defined use case that solves a business problem. From there, a project proceeds in a stepwise manner, addressing data considerations, data science needs, Dev-Ops software development and, ultimately, a proof of concept that scales to a production system.

TO LEARN MORE
To explore HPC solutions for powering AI-driven applications, visit Dell EMC Ready Solutions for AI and the Dell Technologies HPC & AI Innovation Lab.

To learn more, visit DellTechnologies.com/AI.