Enabling Citizen AI with the Power Platform and Azure

A general technology trend is the growing popularity of Citizen AI roles. Such roles are business practitioners looking to improve business processes through the application of ML and AI technologies. A significant contributor to this trend is the growing maturity and availability of low code tools to develop machine learning models.

With a well-known high failure rate to such initiatives, the ability to rapidly prototype and validate an AI application in a real-world setting becomes a key enabler to a "fail fast" approach. At a very high level there are 2 key technology requirements to develop an end-to-end prototype:

1) **An ML toolkit for all skill levels – support for no code to fully coded ML development:** This enables business users and domain experts to rapidly source and prep data, build and deploy a model leveraging the flexibility of a low code GUI and the power of advanced Automated ML capabilities for ML algorithm development.
2) **A low code Application development toolkit:** This enables business users and domain experts to build custom applications and automation workflows that help end consumers and business processes to apply and interact with an ML model to modernize processes and drive transformative outcomes.

One without the other means a business user can rapidly prototype a model but requires a skilled developer to build a custom front end and process workflow to interact with the model in real world scenarios, or vice versa.

Potential use cases

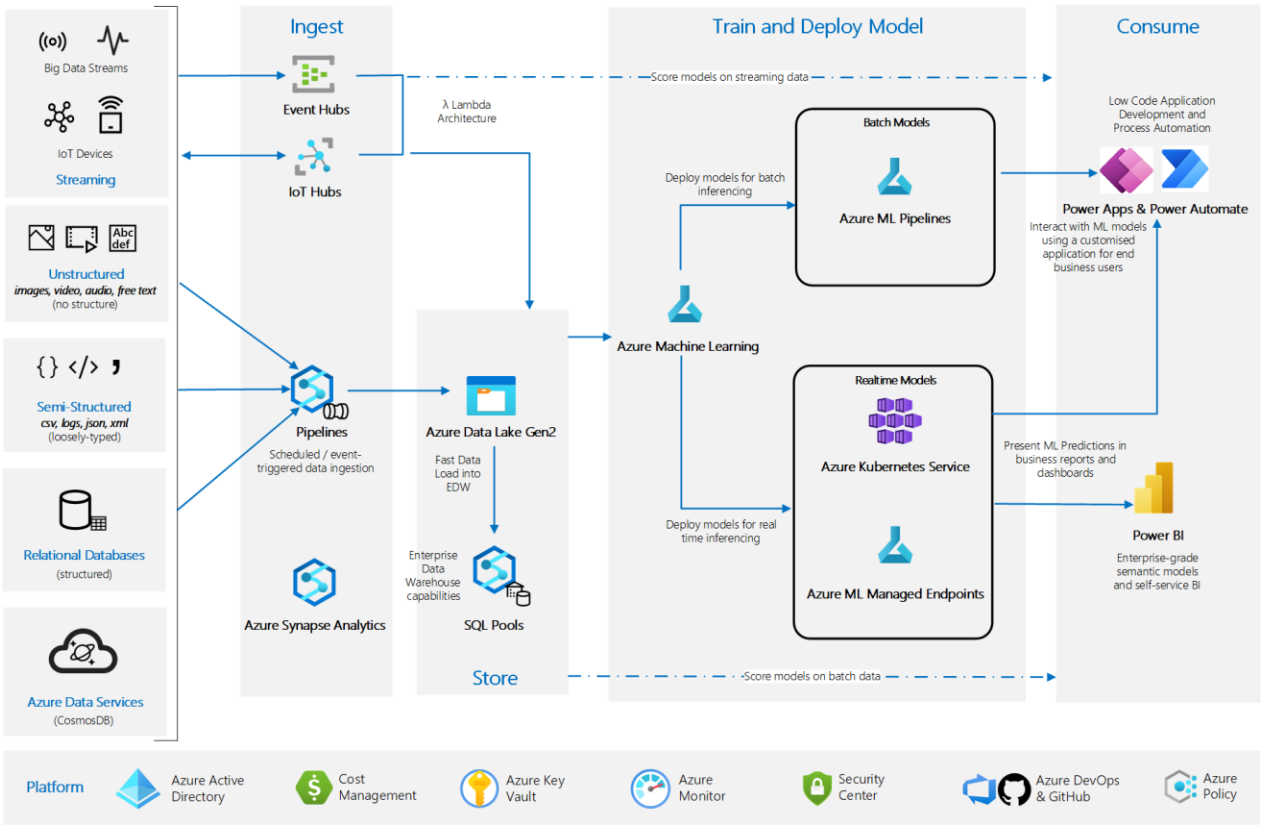
Combining a low code ML toolkit with a low code application development toolkit unlocks the ability to rapidly prototype the impact of an ML model on a business process without requiring significant investment in integration with the existing application supporting the process. This can also then be easily extended to a production grade scenario as required. For example:

- Manufacturing Ops: Supported by legacy applications often using outdated deterministic predictions that could benefit from the improved accuracy enabled by a Machine Learning model. Proving this would require both a model and development effort to integrate with ageing legacy systems on prem.
- Call Center Ops: Where a model that is automatically retrained when data has drifted could result in a significant uplift in churn prediction or risk profiling accuracy, but validation requires integration with existing CRM and ticket management systems which could prove expensive.

Architecture

The architecture below extends on the Analytics end-to-end with Azure Synapse reference with potential implementations of a custom ML model trained in Azure ML and consumed by an end user on a custom application built using the Power Platform.

Here, Azure Machine Learning fulfills the role of a low code GUI for ML development leveraging Automated ML and deployment to batch or real time endpoints. Power Platform - Power Apps and Power Automate, provide access to an industry leading low code toolkit to rapidly build a custom application and workflow consuming your machine learning algorithm. End business users can now build production grade ML applications to transform bespoke business processes.



1. **Ingest:** Use Azure Synapse pipelines to pull batch data from a wide variety of sources, both on-premises and in the cloud. Pipelines can be triggered based on a pre-defined schedule, in response to an event, or can be explicitly called via REST APIs. Alternatively use Azure Event Hubs or Azure IoT Hubs to ingest data streams generated by client applications or IoT devices. Event Hub or IoT Hub will then ingest and store streaming data preserving the sequence of events received. Consumers can then connect to Event Hub or IoT Hub endpoints and retrieve messages for processing.
2. **Store:** Ingested data can be landed directly in raw format and then transformed on the Azure Data Lake Gen 2. Data once curated and transformed to relational structures can be presented for consumption in Azure Synapse Analytics.

3. **Train and Deploy Model:** Azure Machine Learning provides an enterprise grade machine learning service for building and deploying models faster. It enables users across all skill levels with a low code designer, automated machine learning and a hosted Jupyter notebook environment to support for your own preferred IDE of choice. Models can be deployed either as real time endpoints on Azure Kubernetes Service or as an Azure Machine Learning Managed Endpoint. For batch inferencing of machine learning models, you can use Azure Machine Learning pipelines.
4. **Consume:** Models (both batch and real-time) published in Azure ML can generate a REST Endpoint that can be consumed in a custom application built using the low code Power Apps platform. Alternatively, you can call a real-time Azure ML endpoint from a Power BI report to present predictions in business reports.

Note: *Both Azure ML and the Power Platform stack have a range of built-in connectors to help ingest data directly which could be useful for one off MVPs. However, the 'Ingest' and 'Store' sections of the architecture below advise on the role of standardized data pipelines for the sourcing and storage of data from different sources at scale – patterns that are typically implemented and maintained by the enterprise data platform teams.*

Components

- **Power Platform Services:**
  - Power Apps: Power Apps is a suite of apps, services, connectors, and data platform that provides a rapid application development environment to build custom apps for your business needs.
  - Power Automate: Power Automate is a service that helps you create automated workflows between your favorite apps and services to synchronize files, get notifications, collect data, and more.
  - Power BI: Power BI is a collection of software services, apps, and connectors that work together to turn your unrelated sources of data into coherent, visually immersive, and interactive insights.
- **Azure Services:**
  - Azure Machine Learning: Enterprise-grade machine learning service for building and deploying models faster. It enables users across all skill levels with a low code designer, automated machine learning and a hosted Jupyter notebook environment to support for your own preferred IDE of choice.
    - Azure Machine Learning Managed Endpoints: Managed online endpoints (preview) provide you the ability to deploy your model without the need to create and manage the underlying infrastructure.
  - Azure Kubernetes Service: Azure Machine Learning has varying support across different compute targets - Azure Kubernetes Service is one such target which is a great fit for enterprise grade real time model endpoints.
  - Azure Data Lake Gen2: Combines the power of a Hadoop compatible file system with integrated hierarchical namespace with the massive scale and economy of Azure Blob Storage.

    - Azure Synapse Analytics: Azure Synapse Analytics is a limitless analytics service that brings together data integration, enterprise data warehousing, and big data analytics.
    - Azure Event Hubs or IOT Hubs: Ingest data streams generated by client applications or IoT devices. Event Hub or IoT Hub will then ingest and store streaming data preserving the sequence of events received. Consumers can then connect to Event Hub or IoT Hub endpoints and retrieve messages for processing.
- **Platform Services:**
  In order to improve the quality of your Azure solutions, follow the recommendations and guidelines defined in the Azure Well-Architected Framework five pillars of architecture excellence: Cost Optimization, Operational Excellence, Performance Efficiency, Reliability, and Security.

  Following these recommendations, the services below should be considered as part of the design:

    - Azure Active Directory: identity services, single sign-on and multi-factor authentication across Azure workloads.
    - Azure Cost Management: financial governance over your Azure workloads.
    - Azure Key Vault: secure credential and certificate management.
    - Azure Monitor: collect, analyze, and act on telemetry information of your Azure resources to proactively identify problems and maximize performance and reliability.
    - Azure Security Center: strengthen and monitor the security posture of your Azure workloads.
    - Azure DevOps & GitHub: implement DevOps practices to enforce automation and compliance to your workload development and deployment pipelines for Azure Synapse and Azure ML.
    - Azure Policy: implement organizational standards and governance for resource consistency, regulatory compliance, security, cost, and management.

Alternatives

Machine Learning MVPs benefit from speed to outcome, and hence depending on the use case, the needs of a custom model could be proven and potentially met with a pretrained one. In such cases, you could utilize the range of pre-trained Azure Cognitive Services, Azure Applied AI Services or the Power Apps AI Builder could present a fit for purpose alternative.

Considerations

While it is quick and easy to deploy these services towards a Proof of Concept or MVP, it does require further design considerations to be met to make it enterprise grade and production ready. Here frameworks such as the Azure Well-Architected Framework provide reference guidance and best practices to apply to your architecture.

Availability

Most of the components used in this example scenario are managed services that will automatically scale. The availability of the services used in this example varies by region.

Apps based on machine learning typically require one set of resources for training and another for serving. Resources required for training generally don't need high availability, as live production requests don't directly hit these resources. Resources required for serving requests need to have high availability.

DevOps

DevOps practices are used to orchestrate the end-to-end approach used in this example. If your organization is new to DevOps, the DevOps Checklist can help you get started.

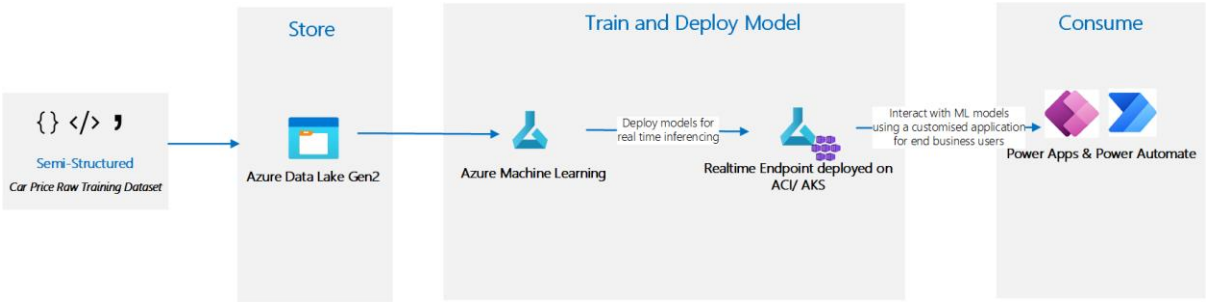
The Machine Learning DevOps Guide presents best practices and learnings on adopting MLOps in the enterprise with Azure Machine Leaning.

DevOps automation can be applied to the Power Platform solution provided in this example. See here for more information about Power Platform DevOps Microsoft Power Platform Build Tools for Azure DevOps - Power Platform | Microsoft Docs

Deploy this scenario

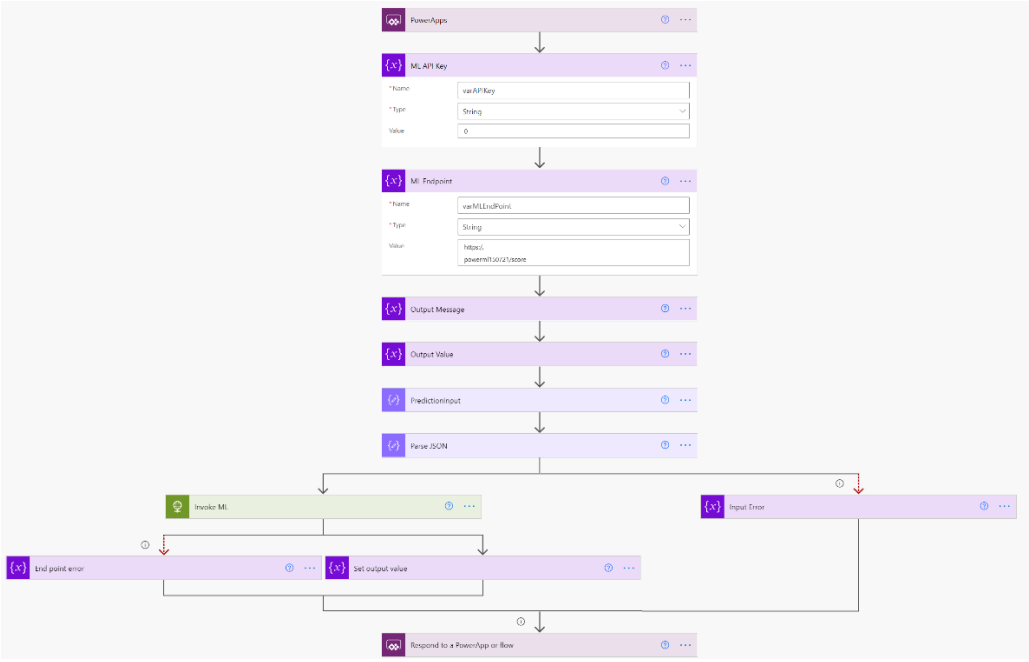
Take for example a simple business scenario requiring where a field business agent is looking to input the different variables of a car and get a prediction on its estimated market price. Here Azure ML can help quickly prototype an ML model using a feature rich low code designer and powerful Auto ML features and deploy it as a real time REST endpoint.

While this is great outcome, an end business user has no easy way to consume a model available as a REST API. The Power Platform can then help close this last mile as represented below.



Here, Power Apps provides a low code interface to build and publish a custom user interface for the end user to interact with, enter information and view a prediction.

Power Automate can then help build a low code workflow to parse the user's input, pass it to the Azure ML endpoint to score and get a prediction, and return it back to the Power App for consumption. Alternatively, Power BI can be used to interact with the Azure ML model in a custom business report or dashboard.



To deploy this end-to-end example, follow these step by step instructions using this sample Power App.

Extended scenarios

Deploying to Microsoft Teams

The sample Power Apps provided in the example above can also be deployed to Microsoft Teams. Microsoft Teams provide a great distribution channel for your apps and provides your users with a collaborative app experience. For more information about deploying a Power Apps to Teams, see Publish your app using Power Apps app in Teams - Power Apps | Microsoft Docs.

Consume the API from multiple apps and automations

In this example, we configure Power Automate Cloud Flow to consume the REST end point as a HTTP action. Alternately, we can set up a custom connector for the REST end point and consume it directly from Power Apps or from Power Automate. This is useful when we want multiple apps to consume the same end point, and to have the ability to provide more governance through the connector DLP policy in Power Platform Administration. To create a custom connector, see Use a custom connector from a Power Apps app | Microsoft Docs. For more information on Power Platform connector DLP, see Data loss prevention policies - Power Platform | Microsoft Docs.

Pricing

Azure Pricing: First party Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) services on Azure use a consumption-based pricing model that varies per service but does not require a 'license' or 'subscription' fee. In general, use the Azure pricing calculator to estimate costs. For other considerations, see Cost Optimization in the Well-Architected Framework.

Power Platform Pricing: Power Apps, Power Automate and Power BI are Software-as-a-Service (SaaS) applications and have their own pricing models such as per app plan, per user etc.

Next steps

How Azure Machine Learning works: Architecture and concepts

Analytics end-to-end with Azure Synapse

End-to-end manufacturing using computer vision on the edge

Related resources

Build intelligent applications infused with world-class AI