Prepare to develop AI solutions on Azure

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What is AI
AI in general can be seen as a software that exhibits one or more human-like capabilities

Understand AI-related terms

Data Science

Data science is a discipline that applies statistical techniques to uncover and visualize relationships and patterns in the data

Where Data science might be used: A data scientist can analyze an endangered species by applying statistical techniques that will show the trends and the impact of human activity on the wildlife population.

Machine Learning
Machine learning is a subset of data science that deals with the training and validation of predictive models

Where ML (Machine Learning) can be used it can be used to predict the annual growth or decline in population of a species based on factors such as the number of nesting sites observed, the area of land designated as protected and etc.

Artificial Intelligence
AI(Artificial Intelligence)builds on ML to create software that emulates one or more characteristics of human intelligence.

Where AI can be used: For example, balancing the need for wildlife conservation against economic development requires accurate monitoring of the population. So it may not be feasible to rely on human experts who can positively identify the animal. In this case, a predictive model could be trained to analyze images data taken by motion-activated cameras in remote locations and predict whether a photograph contains a sighting of the animal or not.

Understand considerations for AI Engineers

Model Training and inferencing

Many AI systems rely on predictive models .
The training process analyzes the data and determines:

- Relationships between the features in the data (The data values that will generally be present in new observations)
  And
- Labels(The value that the model is being trained to predict)

After the model has been trained, you can submit new data that includes known feature values and have the model predict the most likely label.

Using model to make prediction is referred to as ***inferencing***

Many of the services and frameworks that software engineers use requires a development process that involves training a model from existing data so it can be used to inference new values in an application.

Probability and confidence scores

There isn't a predictive model that is infallible, so software engineers should make use of confidence score values to evaluate predictions and apply appropriate thresholds to optimize reliability and mitigate the risk of predictions that may be made based on marginal probabilities.

Responsible AI and ethics
It's important for software engineers to consider the impact of their software on users
when the application is imbued with artificial intelligence, these considerations are particularly important due to the nature of how AI systems work and inform decisions; often based on probabilistic models, which are in turn dependent on the data with which they were trained.

Understand considerations for responsible AI

Core principles for responsible AI

Fairness
- AI systems should treat all people fairly. The model should make predictions of whether or not the loan should be approved. Without incorporating any bias based on gender, ethnicity, or other factors that might result in an unfair advantage.

Reliability and safety
AI systems should perform reliably and safely. For example, consider an AI-based software system for an autonomous vehicle; or a ML model that diagnoses patient symptoms and recommends prescriptions. Unreliability in these kinds of system can result in substantial risk to human life.

Privacy and security
AI systems should be secure and respect privacy. The data used for training should be kept private.

Inclusiveness
AI systems should empower everyone and engage people. AI should bring benefits to all parts of society, regardless of physical ability, gender, sexual orientation, ethnicity, or other factors

Transparency
AI systems should be understandable. Users should be made fully aware of the purpose of the system, how it works, and what limitations may be expected.

For example, when an AI system is based on a ML model, you should generally make users aware of factors that may affect the accuracy of its predictions

Accountability
People should be accountable for AI. Although many AI systems seem to operate autonomously, ultimately it’s the responsibility of the developers who trained and validated the models they use to always pay attention to it.

Understand capabilities of Azure Machine Learning

Azure Machine Learning
A cloud based platform for running experiments at scale to train predictive models from data, and publish the trained models as services

Azure ML provides the following features:

Feature	Capability
Automated machine learning	This feature enables non-experts to quickly create an effective machine learning model from data.
Azure Machine Learning designer	A graphical interface enabling no-code development of machine learning solutions.
Data and compute management	Cloud-based data storage and compute resources that professional data scientists can use to run data experiment code at scale.
Pipelines	Data scientists, software engineers, and IT operations professionals can define pipelines to orchestrate model training, deployment, and management tasks.

Data scientists can use Azure Machine Learning throughout the entire machine learning lifecycle to:
- Ingest and prepare data
- Run experiments to explore data and train predictive models
- Deploy and manage trained models as web services

Software engineers may interact with Azure ML in the following ways:
- Use automated ML or Azure ML designer to train ML models and deploy them as services that can be integrated into AI-enabled applications

- Collaborate with data scientists to deploy models based on common frameworks such as Scikit-Learn, PyTorch, and TensorFlow as web services, and consume them in applications
- Using Azure ML SDKs or CLI scripts to orchestrate DevOps processes that manage versioning, deployment, and testing of machine learning models as part of an overall application delivery solution

Understand capabilities of Azure AI Services

Think of Azure AI Services as individual services that you can use as building blocks to compose sophisticated intelligent applications

Azure AI services offer a wide range of prebuilt AI capabilities across multiple categories, with examples shown in the following table:

Natural language processing	Knowledge mining and document intelligence	Computer vision	Decision support	Generative AI
Text analysis	AI Search	Image analysis	Content safety	Azure OpenAI Service
Question answering	Document Intelligence	Video analysis	Content moderation	DALL-E image generation
Language understanding	Custom Document Intelligence	Image classification		
Translation	Custom skills	Object detection		
Named entity recognition		Facial analysis		
Custom text classification		Optical character recognition		
Speech		Azure AI Video Indexer		
Speech Translation				

Understand capabilities of the Azure OpenAI Service

GenAI is relatively new and is a field of AI focuses on AI models that generate content such as text,code,images etc.

GenAI models depend on LLM (Language large models) based on the transformer architecture that evolved from years of machine learning progress.

Azure OpenAI Service is an Azure AI service for deploying, utilizing, and fine-tuning models developed by OpenAI. The models behind ChatGPT uses are available through the Azure OpenAI Service. You can develop applications that use the powerful generative AI models in Azure OpenAI to further utilize this technology.

AI engineers can develop applications that use powerful gen AI models in Azure OpenAI to to further utilize this technology. Both REST and language specific SDKs are available when developing applications.

Understand capabilities of Azure Cognitive Search

Searching for information is a common requirement in many applications from dedicated search engines web sites to mobile apps that can find context-appropriate information based on where you are and what you want to accomplish

Azure AI Search is an Applied AI Service that enables you to ingest and index data from various sources, and search the index to find, filter and sort information extracted from the source data

Azure AI Search enables you to define an enrichment pipeline that uses AI skills to enhance the index with insights derived from the source data - for example, by using computer vision and natural language

processing capabilities to generate descriptions of images, extract text from scanned documents, and determine key phrases in large documents that encapsulate their key points.

Not only does this AI enrichment produce a more useful search experience, the insights extracted by your enrichment pipeline can be persisted in a knowledge store for further analysis or integration into a data pipeline for a business intelligence solution.