

AI-900

Azure AI Fundamentals

Getting Started

In 28
Minutes



Machine Learning



Text Analytics



Cognitive Services



Speech

- Azure has 200+ services. Exam expects you to understand 20+ services related to AI.
- Exam *tests* your AI fundamentals and **decision making abilities**:
 - Which AI/ML service do you choose in which situation?
- This course is **designed** to help you *make these choices*
- **Our Goal** : Help you get certified and start your journey with Azure and AI

Our Approach

In 28
Minutes

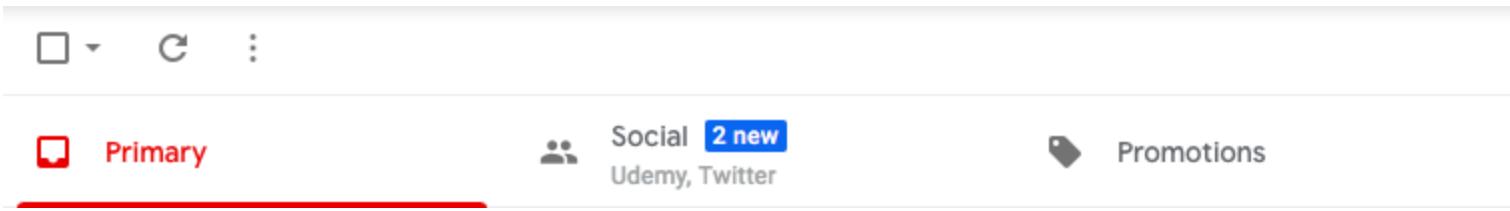
- Three-pronged approach to reinforce concepts:
 - Presentations (Video)
 - Demos (Video)
 - **Two kinds of quizzes:**
 - Text quizzes
 - Video quizzes
- (Recommended) Take your time. Do not hesitate to replay videos!
- (Recommended) Have Fun!



Artificial Intelligence

Artificial Intelligence - All around you

In 28
Minutes



- Self-driving cars
- Spam Filters
- Email Classification
- Fraud Detection

What is AI? (Oxford Dictionary)

In 28
Minutes

The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages

Understanding Types of AI

In 28
Minutes

- **Strong artificial intelligence (or general AI):**
Intelligence of machine = Intelligence of human
 - A machine that can solve problems, learn, and plan for the future
 - An expert at everything (including learning to play all sports and games!)
 - Learns like a child, building on its own experiences
 - We are far away from achieving this! (Estimates: few decades to never)
- **Narrow AI (or weak AI):** Focuses on specific task
 - Examples: Self-driving cars and virtual assistants
 - **Machine learning:** Learn from data (examples)



Tags:

Water 100% confidence Sky 100% confidence
Lake 95% confidence Outdoor 95% confidence
Skyscraper 89% confidence Reflection 61% confidence
Overlooking 33% confidence Day 12% confidence

Description:

a city skyline with water 27% confidence

Racy Content: Adult Content:

False 75% confidence False 78% confidence

Exploring Machine Learning Examples

In 28
Minutes

- Identifying objects from images
 - <https://ai.demos.microsoft.com/computer-vision>
- Alpha Go
- House Price Calculation



Tags:

Water 100% confidence Sky 100% confidence
Lake 95% confidence Outdoor 95% confidence
Skyscraper 89% confidence Reflection 61% confidence
Overlooking 33% confidence Day 12% confidence

Description:

a city skyline with water 27% confidence

Racy Content: Adult Content:

False 75% confidence False 78% confidence

Home size (Square Yds)	Age	Condition (1-10)	Price \$\$\$
300	10	5	XYZ
200	15	9	ABC
250	1	10	DEF
150	2	34	GHI

Exploring Machine Learning vs Traditional Programming

In 28
Minutes

- **Traditional Programming:** Based on Rules

- IF this DO that
- Example: Predict price of a home
 - Design an algorithm taking all factors into consideration:
 - Location, Home size, Age, Condition, Market, Economy etc

- **Machine Learning:** Learning from Examples (NOT Rules)

- Give millions of examples
- Create a Model
- Use the model to make predictions!

- **Challenges:**

- No of examples needed
- Availability of skilled personnel
- Complexity in implementing MLOps

Home size (Square Yds)	Age	Condition (1-10)	Price \$\$\$
300	10	5	XYZ
200	15	9	ABC
250	1	10	DEF
150	2	34	GHI

What you will learn?

In 28
Minutes

- Three approaches to building AI solutions in Azure
 - **Use Pre-Trained Models:** Azure Cognitive Services
 - Get intelligence from text, images, audio, video
 - **Build simple models:** Without needing data scientists
 - Limited/no-code experience
 - Example: Custom Vision
 - Example: Azure Machine Learning
 - Automated machine learning
 - **Build complex models:** Using data scientists and team
 - Build Your Own ML Models from ZERO (code-experienced)
 - Example: Using Azure Machine Learning
- Use AI with caution!
 - Challenges, risks and principles



Tags:

Water 100% confidence Sky 100% confidence
Lake 95% confidence Outdoor 95% confidence
Skyscraper 89% confidence Reflection 61% confidence
Overlooking 33% confidence Day 12% confidence

Description:

a city skyline with water 27% confidence

Racy Content: Adult Content:

False 75% confidence False 78% confidence

Machine Learning Fundamentals - Scenarios

In 28
Minutes

Scenario	Solution
Categorize: Building a computer system as intelligent as a human. An expert at everything (all sports and games!)	Strong AI
Categorize: Building a computer system that focuses on specific task (Self-driving cars, virtual assistants, object detection from images)	Narrow AI (or weak AI)
Category of AI that focuses on learning from data (examples)	Machine learning
How is ML different from traditional programming?	Traditional Programming: Rules. Machine Learning: Examples
Which Azure service helps you use Pre-Trained Models?	Azure Cognitive Services
Which Azure services helps you build simple models without needing data scientists or AI/ML skills?	Azure Machine Learning(Automated machine learning), Custom Vision
Which Azure service helps you build complex ML models?	Azure Machine Learning

Pre-Trained Models (APIs)

Exploring Pre-Trained Models - Cognitive Services

In 28
Minutes

- **Cognitive Services** - "bring AI within reach of every developer"
 - AI without building custom models
 - Does NOT need machine-learning expertise
 - Exposed as APIs
- Help programs **see, hear, speak, search, understand** (just like humans):
 - Get intelligence from:
 - **Images/videos:** Computer vision, Face API, Form Recognizer
 - **Text:** Text Analytics, Translator Text, Text-to-Speech API
 - **Audio :**Speech-to-Text API, Language Understanding Intelligent Service - LUIS
 - **Others:**
 - Conversations (QnA Maker, Azure Bot Service)
 - Anomaly Detector service, Content moderator



Result:

Statue of Liberty 95% confidence

Exploring Vision Related APIs

In 28
Minutes

- **Vision:** Get intelligence from videos & images
 - <https://aidemos.microsoft.com/computer-vision>
 - <https://azure.microsoft.com/en-in/services/cognitive-services/computer-vision/#overview>
 - <https://aidemos.microsoft.com/video-indexer>
- Identify and analyze content within images and video
- Important APIs:
 - **Computer Vision** - Analyze content in images and videos
 - **Face API** - Detect and identify people and emotions in images
 - **Custom Vision** - Customize image recognition to fit your business



Result:

Statue of Liberty 95% confidence

Exploring Vision - Some Terminology

- **Image analysis:** Extract tags from image
 - Create text description about an image
- **Image classification:** Classify image into different groups
- **Object detection:** Identify objects in image
 - For each object:
 - class of object, confidence level, coordinates of a bounding box
 - Goes deeper than image classification
- **Face detection:** Detect human faces
 - Face detection and analysis: Security, tag friends on facebook, Identity validation
- **Optical character recognition (OCR):** Detect text in images (license plates, invoices etc)



Objects	[{ "rectangle": { "x": 112, "y": 711, "w": 269, "h": 243 }, "object": "Bicycle wheel", "parent": { "object": "Wheel", "confidence": 0.775 }, "confidence": 0.574 }, { "rectangle": { "x": 723, "y": 268, "w": 268, "h": 243 }, "object": "Wheel", "confidence": 0.585 }, { "rectangle": { "x": 96, "y": 566, "w": 759, "h": 409 }, "object": "bicycle", "parent": { "object": "cycle", "parent": { "object": "Land vehicle", "parent": { "object": "Vehicle", "confidence": 0.928 }, "confidence": 0.927 }, "confidence": 0.923 }, "confidence": 0.911 }]
Tags	[{ "name": "text", "confidence": 0.9999137 }, { "name": "grass", "confidence": 0.999893069 }, { "name": "outdoor", "confidence": 0.9880197 }, { "name": "bicycle", "confidence": 0.697462 }, { "name": "bicycle wheel", "confidence": 0.897627 }, { "name": "sign", "confidence": 0.842304945 }, { "name": "bike", "confidence": 0.7690854 }, { "name": "wheel", "confidence": 0.7583429 }, { "name": "land vehicle", "confidence": 0.6875147 }, { "name": "vehicle", "confidence": 0.575855851 }]

Getting started with Computer Vision API

In 28
Minutes

- **Computer Vision API:** Process images and return information

- Docs: <https://centralus.dev.cognitive.microsoft.com/docs/services/>

- **Analyze Image:** Extract visual features from image content:

- Can you describe the image? (description/caption)?
 - Can you categorize the image? (tags)
 - What is in the image?
 - objects/faces/celebrities/monuments with box co-ordinates
 - What type of image is it? (clip art/line drawing)
 - What kind of color scheme is used in the image?
 - Does an image have mature content?

- **Simple Operations:**

- **Describe Image:** Can you describe the image? (description/caption - multiple)
 - **Detect Objects:** Performs object detection on the specified image
 - **Recognize Domain Specific Content:** Identify celebrities, landmarks
 - **Tag Image:** Generates a list of words, or tags relevant to a image

- **Get Area of Interest:** most important area of the image

- **Get Thumbnail:** Generates a thumbnail image (user-specified width and height)



Tags:

Water 100% confidence Sky 100% confidence
Lake 95% confidence Outdoor 95% confidence
Skyscraper 89% confidence Reflection 61% confidence
Overlooking 33% confidence Day 12% confidence

Description:

a city skyline with water 27% confidence

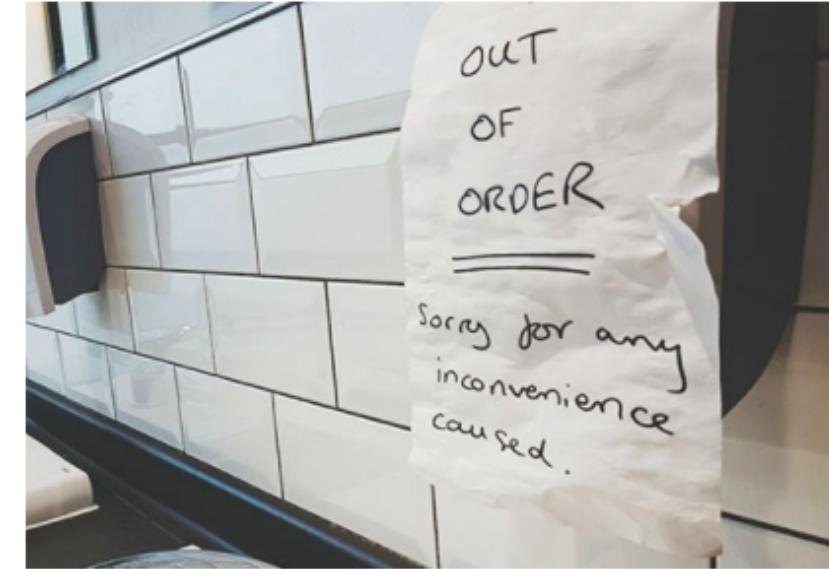
Racy Content: Adult Content:

False 75% confidence False 78% confidence

Understanding Computer Vision API - OCR Operations

In 28
Minutes

- **OCR:** Simple OCR (detects text in an image)
 - Quick extraction of small amounts of text (immediate results)
 - Result: Lines > Words (each with bounding box coordinates)
- **Read:** Perform OCR on complex documents
 - Optimized for text-heavy images OR multi-page documents OR documents with multiple languages
 - Executes asynchronously
 - Additional call to get the result
 - Result: Pages > Lines > Words (each with bounding box coordinates)



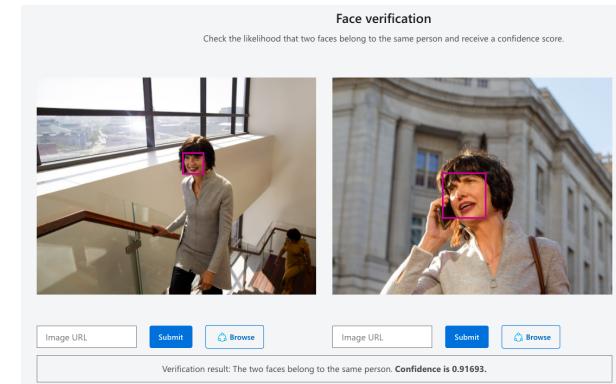
Transcript:

OUT
OF
ORDER
Sorry for any
inconvenience
caused .

Getting Started with Face API

In 28
Minutes

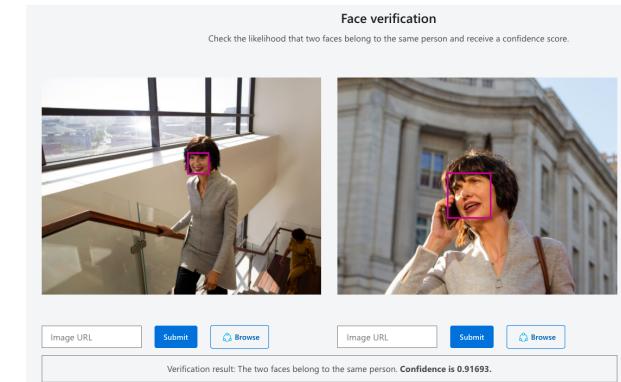
- Face API: Advanced Face detection:
 - Age, Emotion, Glasses, Hair, Makeup
 - Detect human faces, find similar faces, match face with a group ..
 - Demo: <https://azure.microsoft.com/en-in/services/cognitive-services/face/#features>
- (Remember) Improve accuracy of face identification:
 - Quality of images (Higher face image quality)
 - Recommendations: frontal, clear, and face size - 200x200 pixels or bigger
 - Variety of images: From diff. angles in variety of lighting setups
- Important concepts:
 - FaceList (up to 1K faces) & LargeFaceList (up to 1M faces)
 - PersonGroup (up to 1K persons) & LargePersonGroup (up to 1M persons)
 - Each person can have multiple face images



Understanding Face API Operations

In 28
Minutes

- **Detect:** Detect human faces (box co-ordinates)
 - Options to request for age, gender, headPose, smile, facialHair, glasses, emotion, hair, makeup, occlusion, accessories, blur, exposure, noise and mask details
 - Up to 100 faces in an image
- **Find Similar:** Find similar faces (Find images of this specific person)
 - Input 1: Image to match for (facelId)
 - Input 2: Images to match against (facelId array or FaceListId or LargeFaceListId)
 - Output: Array of the most similar faces [along with confidence]



Understanding Face API Operations - 2

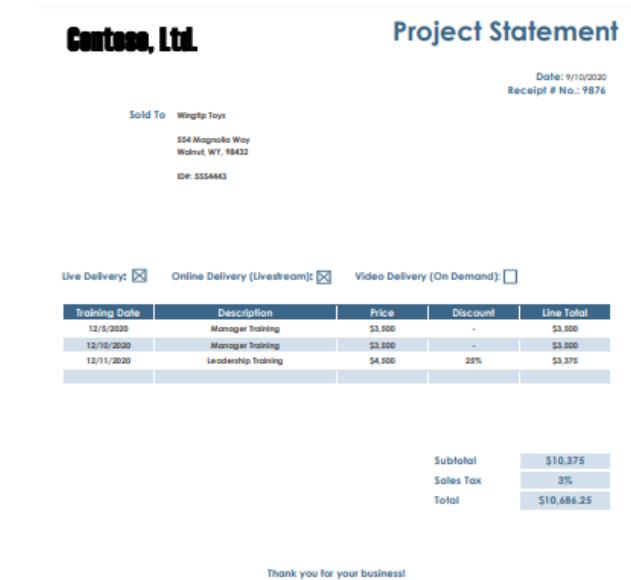
In 28
Minutes

- **Group:** Divide candidate faces (3-1000) into groups based on face similarity
 - Input: faceIds
 - Output: Matching groups of faceIds
- **Identify:** 1-to-many identification
 - Find closest matches of the specific query person face.
 - Input 1: Image to match for (faceId)
 - Input 2: Images to match against (faceId array or FaceListId or LargeFaceListId)
 - Output: Person candidates for that face (ranked by confidence)
- **Verify:** Two things you can do
 - Do two faces belong to same person?
 - Input: faceId1 vs faceId2
 - Does a face belong to a specific person?
 - Input: faceId vs (personId in a (personGroupId OR largePersonGroupId))
 - Output: { "isIdentical": true, "confidence": 0.9 }

Exploring Form Recognizer API

In 28
Minutes

- **Form Recognizer:** Get intelligence from scanned forms
 - Extract information from forms & images
 - DEMO: <https://azure.microsoft.com/en-in/services/form-recognizer/#features>
- **Operations (over pdf or image):**
 - Analyze Business Card (Get Analyze Business Card Result)
 - Analyze ID Document
 - Analyze Invoice
 - Analyze Receipt
 - **Custom Form:** Design & extract key-value pairs, tables, and semantic values from custom documents - pdf or image



Cognitive Services - Vision - Scenarios

In 28
Minutes

Scenario	Solution
Recommend Service: Detect and identify people and emotions in images	Face API
Recommend Service: Extract visual features from image content (description/tags)	Computer Vision API
Recommend Service: Get intelligence from scanned forms	Form Recognizer API
When do you use Read operation to perform OCR?	Text-heavy images OR multi-page documents OR documents with multiple languages
How can you improve accuracy of face identification?	Images - frontal, clear, and face size - 200x200 pixels or bigger. Variety of images: From diff. angles in variety of lighting setups

Cognitive Services - Face API - Scenarios

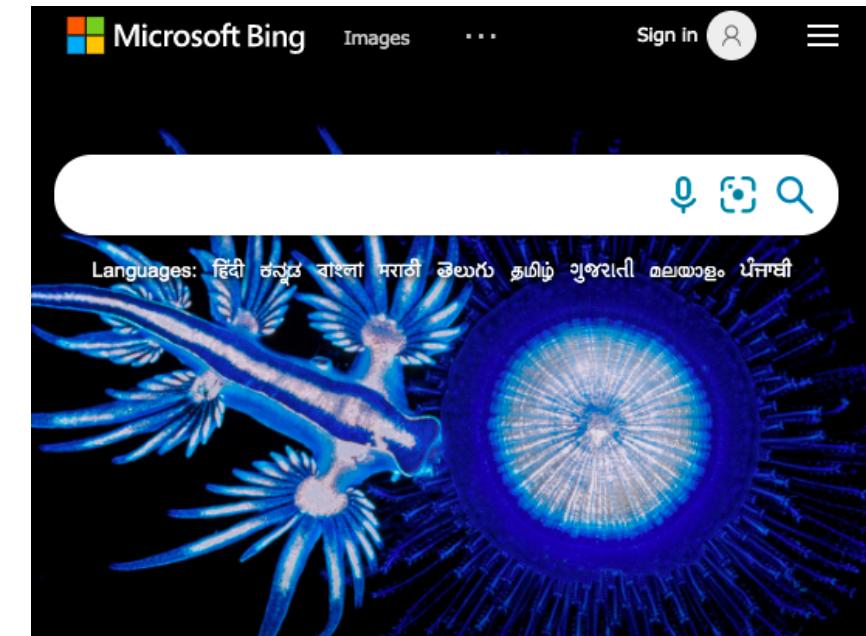
In 28
Minutes

Scenario	Solution
Recommend Face API Operation: Divide candidate faces (3-1000) into groups based on face similarity (Do all the faces belong to a group?)	Group
Recommend Face API Operation: Find closest matches of the specific query person face in a group	Identify
Recommend Face API Operation: Do two faces belong to same person?	Verify
Recommend Face API Operation: Does a face belong to a specific person?	Verify

Exploring Search APIs (Bing)

In 28
Minutes

- **Web Search API:** Execute web search using API
- **Image Search API:** search for relevant images
- **News Search API:** search for relevant news articles
- **Visual Search API:** search based on an image



Cognitive Services - Natural Language Processing

In 28
Minutes

- Get intelligence from a conversation, speech or written text in human languages
 - **Language:** Extract meaning from unstructured text
 - **Text analytics:** Detect sentiment, key phrases and named entities.
 - <https://ai.demos.microsoft.com/text-analytics>
 - **Translator:** Translate to/from 90 languages
 - **Speech:** Integrate speech into apps and services
 - **Speech service:** Speech to text, Text to speech, Translation and Speaker recognition
 - **Build Conversations:**
 - **QnA maker:** Conversational question and answer layer
 - **Luis:** Language Understanding Intelligent Service
 - Understands spoken (and text) commands
 - Get info from users natural language utterances
 - Examples: Book me a flight to Cairo, Order me 2 pizzas
 - <https://ai.demos.microsoft.com/luis/demo>

< Language Understanding



Make a statement about lighting and Luis will interpret and adjust the house accordingly

Make a statement (voice or text)
Turn lights off

Apply

Exploring Text Analytics API

In 28
Minutes

- **Text Analytics:** Natural language processing (NLP)
 - Demo: <https://azure.microsoft.com/en-in/services/cognitive-services/text-analytics/#overview>
 - Sentiment analysis, key phrase extraction & language detection
 - **Operations:**
 - Detect Language
 - Language Name, ISO 6391 Code, Score (NaN-ambiguous)
 - Entities containing personal information: returns a list of entities with personal information ("SSN", "Bank Account" etc) in the document
 - Key Phrases: returns a list of strings denoting the key phrases
 - Example: Summarize a document
 - Named Entity Recognition: list of general named entities in a given document
 - Person, Location, Organization, Quantity, DateTime, URL, Phone Number, IP Address etc
 - Sentiment: detailed sentiment analysis
 - positive/negative review - example: 0.1(negative), 0.9(positive)

We went to Contoso Steakhouse located at midtown NYC last week for a dinner party, and we adore the spot! They provide marvelous food and they have a great menu. The chief cook happens to be the owner (I think his name is John Doe) and he is super nice, coming out of the kitchen and greeted us all. We enjoyed very much dining in the place! The Sirloin steak I ordered was tender and juicy, and the place was impeccably clean. You can even pre-order from their online menu at www.contososteakhouse.com, call 312-555-0176 or send email to order@contososteakhouse.com! The only complaint I have is the food didn't come fast enough. Overall I highly recommend it!



Exploring Translator and Speech API

In 28
Minutes

- **Translator Text API:** text-to-text translation
 - One FROM language with multiple TO languages (example: en to fr, de)
- **API involving Speech:**
 - **Speech-to-Text API:** Real-time & Batch transcription (speech recognition)
 - Demo: <https://azure.microsoft.com/en-in/services/cognitive-services/speech-to-text/#features>
 - **Text-to-Speech API:** Speech synthesis
 - Demo: <https://azure.microsoft.com/en-in/services/cognitive-services/text-to-speech/#overview>
 - **Translation:** Speech-to-Text and Speech-to-Speech API
 - Demo: <https://azure.microsoft.com/en-in/services/cognitive-services/speech-translation/#features>

Try Speech Translation with this demo app, built on our JavaScript SDK

Source Language

English (India) ▾

Target Language

Finnish* ▾

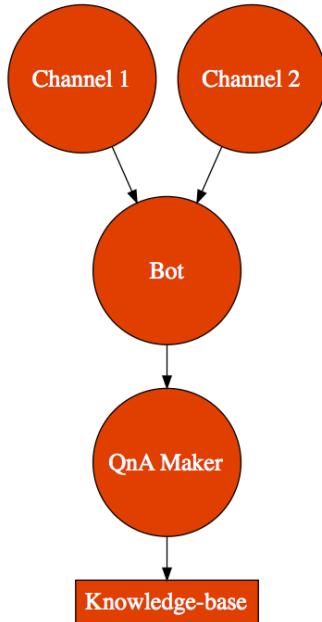
 Speak

 Upload File

Getting Started with Conversational AI

In 28
Minutes

- Software that can carry a conversation like humans (Talk with humans like a human)
- Demo: <https://www.microsoft.com/en-us/research/project/health-bot/> (I have fever)
- Use cases: Customer support, Reservations, Automation
- Services:
 - **QnA Maker:** Convert your FAQ into a Q&A Bot
 - You need a knowledge base (cannot talk to db)
 - **Azure Bot Service:** Build your own bots
 - Enable multiple conversation channels
 - Channels: Alexa, Office 365 email, Facebook, Microsoft Teams, Skype, Slack, Telegram
 - **Recommended Architecture:** QnA Maker service + Azure Bot Service



Exploring LUIS: Language Understanding Intelligent Service

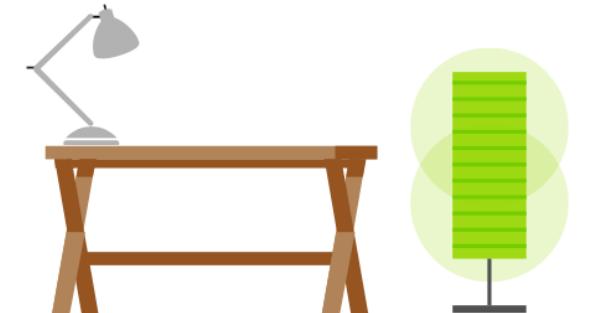
40
Minutes

- Understands spoken (and text) commands
 - Get info from users natural language utterances
 - Book me a flight to Cairo
 - Order me 2 pizzas
 - Demo 1: <https://aidemos.microsoft.com/luis/demo>
 - Demo 2
 - Demo 3: <https://www.luis.ai>
- Detects:
 - Intents (FoodOrder, BookFlight) and
 - Entities (Pizzas, Cairo)
- Integrate with Azure Bot Services for an end-to-end conversational solution

turn the table light off

all lights off

Smart Light Application in action



LUIS application response ⓘ

```
[{"query": "turn the table light off", "topScoringIntent": {"intent": "TurnOff", "score": 0.91770214}, "entities": [{"entity": "table", "type": "Light", "startIndex": 9, "endIndex": 13, "resolution": null, "score": 0.8063946}]}]
```

Cognitive Services - NLP - Scenarios

In 28
Minutes

Scenario	Solution
Categorize: Get intelligence from a conversation, speech or written text in human languages	Natural Language Processing
Recommend Service: Detect sentiment, key phrases and named entities from text	Text Analytics API
Recommend Service: Detect Key Phrases from a document	Text Analytics API
Recommend Service: Perform text-to-text translation	Translator Text API
Recommend Service: Speech recognition	Speech-to-Text API
Recommend Service: Speech synthesis	Text-to-Speech API

Cognitive Services - NLP - Scenarios - 2

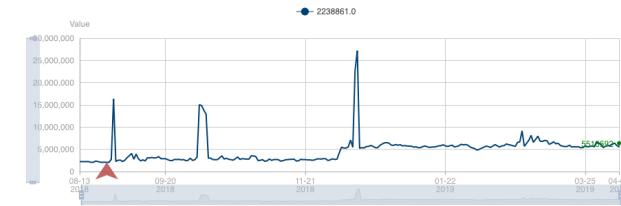
In 28
Minutes

Scenario	Solution
Recommend Service: Translate speech in one language to text in another	Speech-to-Text
Categorize: Software that can carry a conversation like humans	Conversational AI
Recommend Service: Convert your FAQ into a Question and Answer REST API	QnA Maker
Recommend Service: Build a chat bot to answer questions from your knowledge base	QnA Maker service + Azure Bot Service
QnA Maker service: Can you directly connect QnA Maker service to a database or an external system?	No. You need to import the question and answers first.
Recommend Service: Understands spoken (and text) commands (Get intent and entities)	LUIS: Language Understanding Intelligent Service
Recommend Service: Perform sentiment analysis on reviews posted on a website	Text Analytics API

Understanding Decision Services: Make smarter decisions

28 Minutes

- **Anomaly Detector:** Find anomalies
 - Unusual actions, behavior or errors
 - Batch or real-time
 - Example Usecases:
 - Find Fraud
 - Unusual transactions on a credit card
 - Defective parts
 - Demo: <https://centralus.dev.cognitive.microsoft.com/docs/services/AnomalyDetector>
- **Content moderator:** Detect unwanted content
 - Image, Text (PII, custom list) & Video moderation
 - Returns content assessment results to your systems
 - You can use this information to take decisions
 - Take content down, send to human judge ..
 - Examples APIs:
 - **Image-Evaluate:** Returns probabilities of image having racy or adult content
 - **Text-Screen:** Profanity scan in 100+ languages (custom & shared blacklists)



Cognitive Services - Decision Services and Others

In 28
Minutes

Scenario	Solution
Recommend Service: Unusual actions, behavior or errors (Unusual transactions on a credit card or Fraud)	Anomaly Detector
Recommend Service: Detect unwanted content (text, image or video)	Content moderator
Recommend Service: Perform profanity scan on reviews posted on a website	Content moderator
Access multiple Azure Cognitive Services with a single key and endpoint	Cognitive Services Multi-service account
What do you need to invoke a Cognitive Service API?	Endpoint (the HTTP address at which your service is hosted) and key (a secret value used by client applications to authenticate themselves)

Building ML Models

Custom Vision

In 28
Minutes

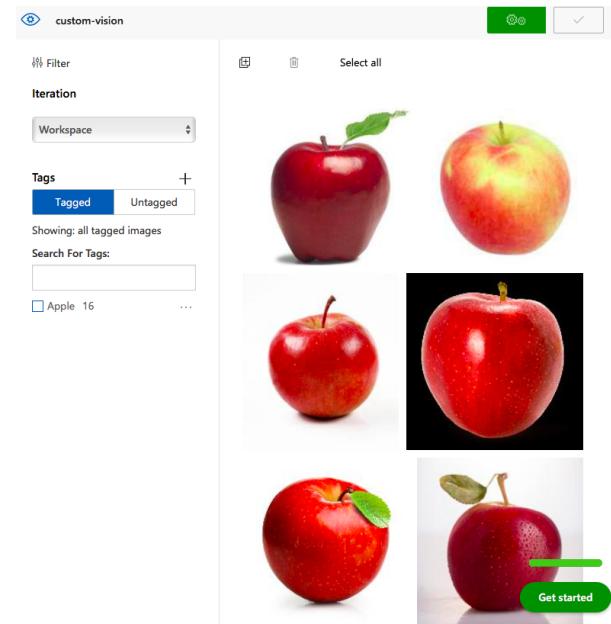
- **Custom Vision:** Create custom models using your own images

- Project Types

- **Classification:** Predict labels for an image
 - Two Classification Types
 - 1: Multilabel (Multiple tags per image)
 - 2: Multiclass (Single tag per image)
- **Object Detection:** Returns coordinates of objects in an image

- **Best Practices:**

- Pick the domain closest to your scenario
 - Different domains are available for Classification and Object Detection projects!
- Sufficient images (Add more images to improve accuracy)
- From different angles



Understanding Machine Learning

In 28
Minutes

- Traditional Programming: Based on Rules
- Machine Learning: Learning from Examples

Home size (Square Yds)	Age	Condition (1-10)	Price \$\$\$
300	10	5	XYZ
200	15	9	ABC
250	1	10	DEF
150	2	34	GHI

Creating Machine Learning Models - Features and Labels

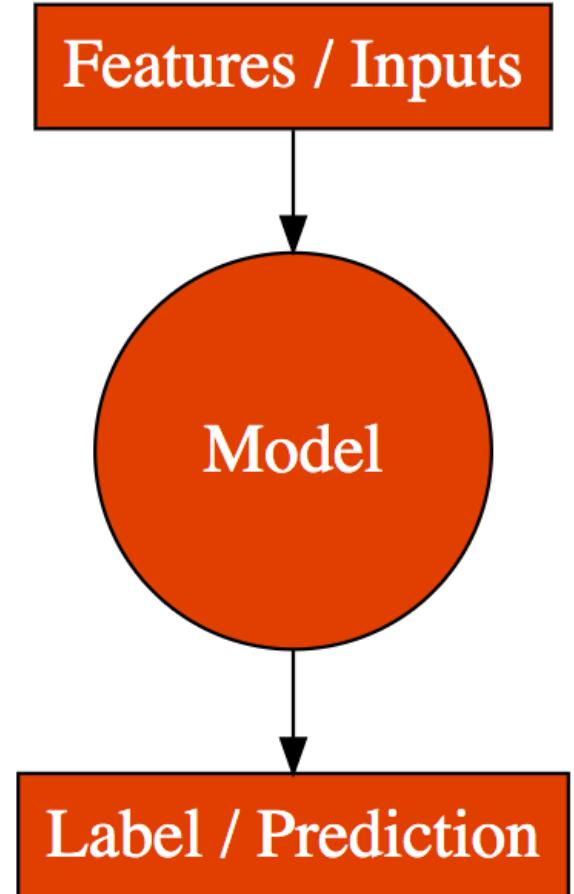
In 28
Minutes

- **Goal of Machine Learning:** Create a Good Model

- Give inputs to a model
- Model returns the prediction
- Inputs are called Features
- Prediction is called Label

- **Example:** House Price Prediction Model

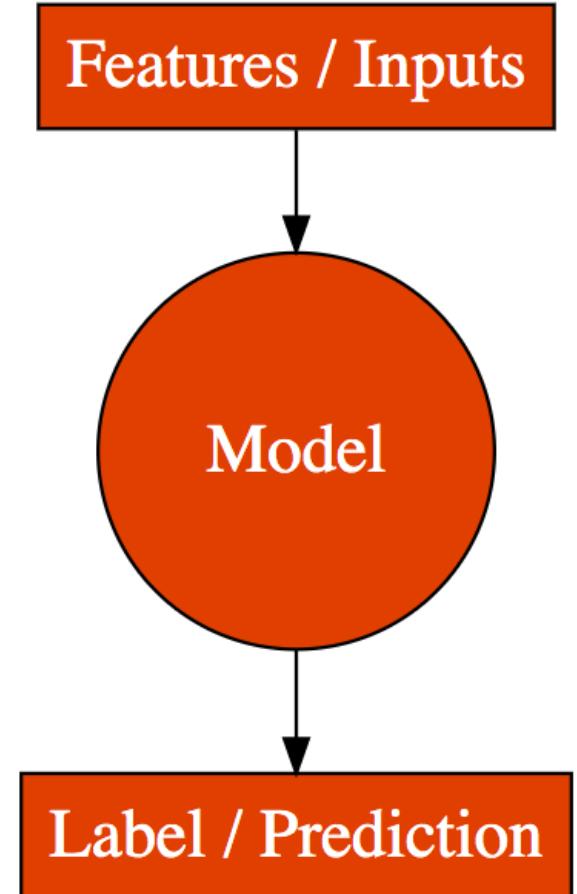
- **Label:** price
- **Features:**
 - area: Total area of house (m^2)
 - rooms: No. of rooms
 - bedrooms: No. of bedrooms
 - furniture: Is it furnished?
 - floor: Which floor?
 - age: How many years?
 - balcony: has balcony or not
 - garden: has garden or not
 - price: Price of the house



Creating ML Models - Features and Labels - Examples

In 28
Minutes

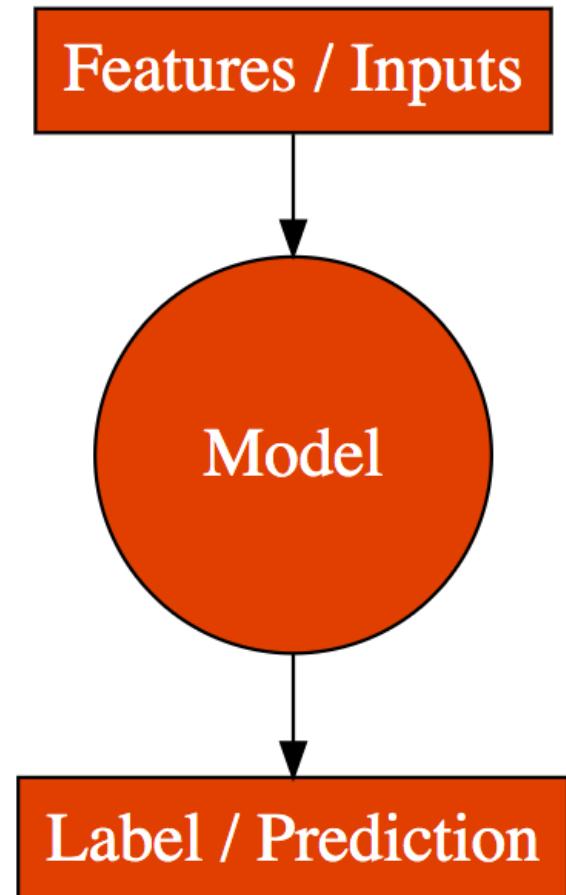
- Used Car Price Prediction Model
 - **Label:** price
 - **Features:** manufacturer, year, model, age, condition, cylinders, location
- Spam Email Classification Model
 - **Label:** isSpam
 - **Features:** sender, subject, content
- Grant a Loan Model
 - **Label:** shouldWeGrantALoan
 - **Features:** doesOwnCar, doesOwnRealEstate, creditScore, isMarried, doesHaveChildren, totalIncome, totalCredit



Creating ML Models - Choosing Technique

In 28
Minutes

- **Supervised Learning:** Features & Label
 - Label is a numeric value with a range of possibilities => **Regression**
 - Example: Used Car Price Prediction, House Price Calculation, Predicting sea level, Predicting no of vehicles that use a specific high way
 - How much will it rain tomorrow?
 - Label has limited set of possibilities (YES or NO, 0 or 1, Type 1 or Type 2 or Type 3) => **Classification**
 - Spam Email, Grant a Loan, Determine the type of cloud
 - Will it rain today?
 - Summary: Supervised machine learning models
 - Classification: Predicting category
 - Regression: Predicting numeric value
- **Unsupervised Learning:** No Label
 - **Clustering:** Divide customers into groups
 - Group similar entities based on their features



Machine Learning Fundamentals - Scenarios

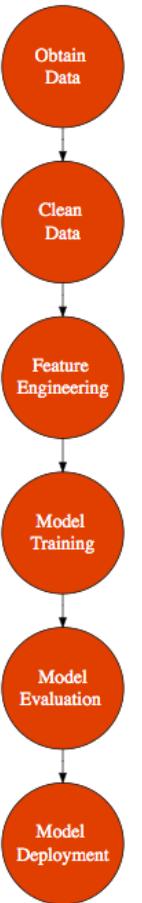
In 28
Minutes

Scenario	Solution
Categorize into features and labels for house price prediction: price, area, rooms, age	price is label. Others can be features
Categorize into features and label for used vehicle price prediction: manufacturer, year, model, age, condition, cylinders, location, price	price is label. Others can be features
Categorize: Used Car Price Prediction	Regression
Categorize: Spam Email Identification	Classification
Categorize: Predict amount of rainfall in the next year	Regression
Categorize: Should we grant a loan?	Classification
Categorize: Identify the type of vehicle in an image	Classification
Categorize: Find a specific dance form in a video	Classification
Categorize: Divide customers into groups	Clustering

Creating Machine Learning Models - Steps

In 28
Minutes

- 1: Obtain Data
- 2: Clean Data
- 3: Feature Engineering: Identify Features and Label
- 4: Create a Model using the Dataset and the ML algorithm
- 5: Evaluate the accuracy of the model
- 6: Deploy the model for use



Understanding Machine Learning Terminology

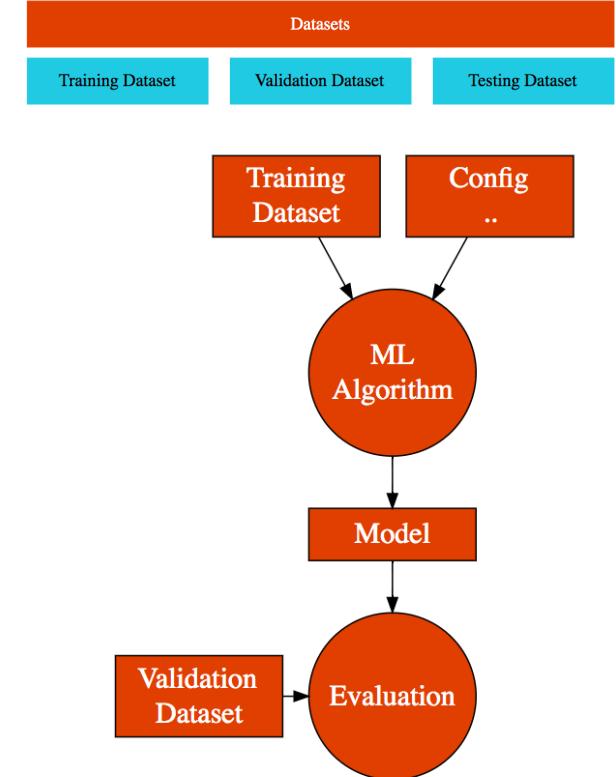
In 28
Minutes

- **Process**

- **Training:** The process of creating a model
- **Evaluation:** Is the model working?
- **Inference:** Using model to do predictions in production

- **Dataset:** Data used to create, validate & test the model

- **Features:** Inputs
- **Label:** Output/Prediction
- **Dataset Types**
 - **Training Dataset:** Dataset used to create a model
 - **Validation Dataset:** Dataset used to validate the model (and choose the right algorithm) - Model Evaluation
 - **Testing Dataset:** Dataset used to do final testing before deployment



ML Stages and Terminology - Scenarios

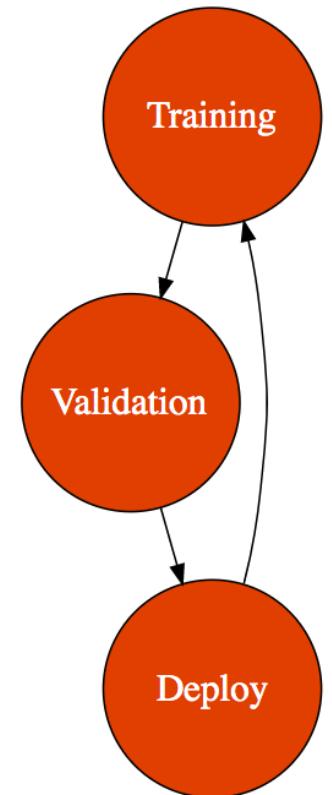
In 28
Minutes

Scenario	Solution
Determine Stage: You remove data having null values from your dataset	Clean Data (Data Preparation)
Determine Stage: Normalize or split data into multiple features	Feature Engineering
Determine Stage: You evaluate the accuracy metrics of a model	Model Evaluation
Terminology: Using model to do predictions in production	Inference
Terminology: The process of creating a model	Training
Terminology: Dataset used to (train) or create a model	Training Dataset
Terminology: Dataset used to evaluate a model	Validation Dataset
Terminology: Dataset used to do final testing before deployment	Testing Dataset

Azure Machine Learning

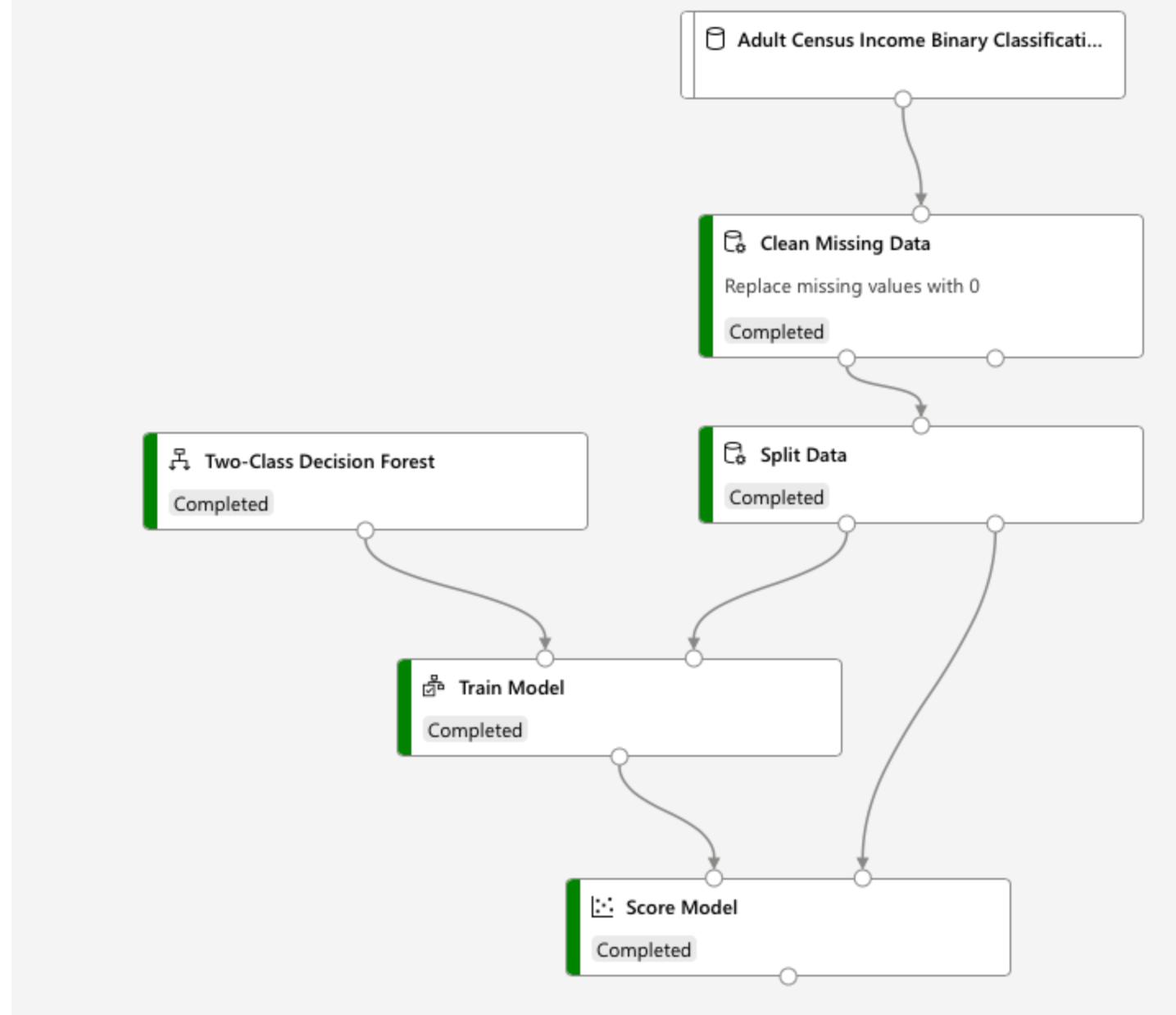
In 28
Minutes

- **Azure Machine Learning:** Simplifies creation of your models
 - Manage data, code, compute, models etc
 - Prepare data
 - Train models
 - Publish models
 - Monitor models
- **Multiple options to create models**
 - **Automated machine learning:** Build custom models with minimum ML expertise
 - **Azure Machine Learning designer:** Enables no-code development of models
 - Build Your Own Models: Data Scientists
 - Data and compute management, pipelines



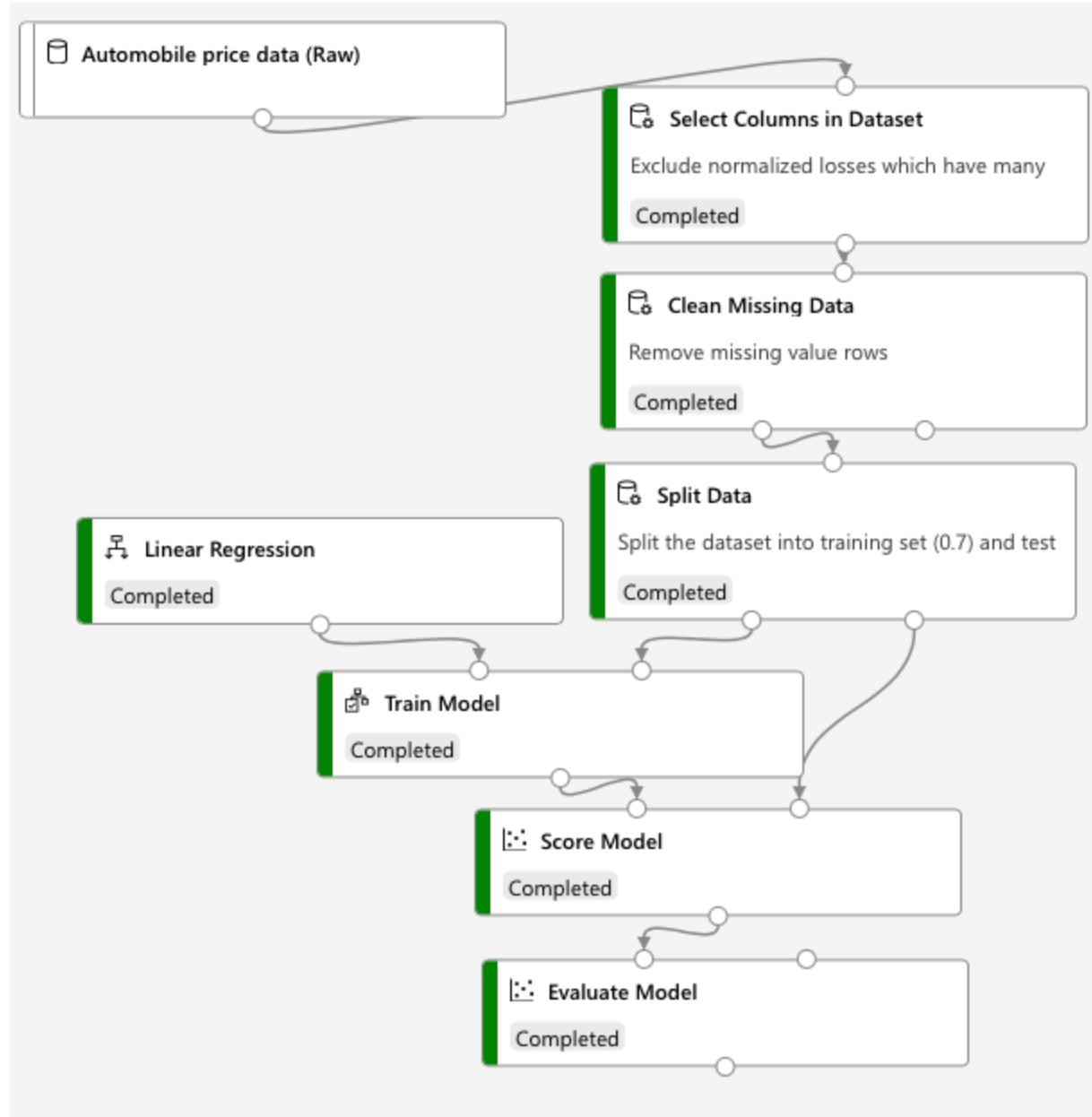
Sample Pipeline - Classification

In 28
Minutes



Sample Pipeline - Regression

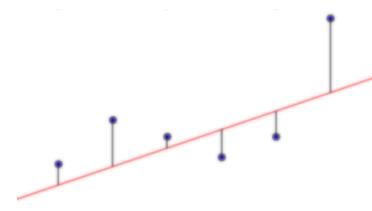
In 28
Minutes



Model Evaluation - Regression Models

In 28
Minutes

- Mean Absolute Error (MAE): How close is a prediction to actual value?
 - Lower the better
- Mean Squared Error (MSE): Average of squares of the distance between actual and predicted
 - When you want to penalize large prediction errors (housing value predictions)
 - Lower the better
 - Alternative:
 - Root Mean Squared Error: Square root of Root of MSE
 - Lower the better



Model Evaluation - Classification Models

In 28
Minutes

- Terminology:
 - **Predicted label:** What's predicated?
 - **True label:** What's expected?
 - **Confusion matrix:** Matrix matching predicted label vs true label
- Different usecases have different needs:
 - Examples: Spam, fraud, sick patient detection
- Metrics:
 - **Accuracy:** Proportion of accurate results to total cases
 - **Precision:** $(\text{True Positive}) / (\text{True Positive} + \text{False Positive})$
 - **Recall:** $(\text{True Positive}) / (\text{True Positive} + \text{False Negative})$
 - **F1 Score:** $2 \left((\text{Precision} \cdot \text{Recall}) / (\text{Precision} + \text{Recall}) \right)$
 - When you need balance between Precision and Recall

		PREDICTION	
		Negative	Positive
ACTUAL	Negative	True Negative	False Positive
	Positive	False Negative	True Positive

ML Model Evaluation - Scenarios

In 28
Minutes

Scenario	Solution
Model Evaluation Terminology: What's predicated?	Predicted label
Model Evaluation Terminology: What's expected?	True label
Model Evaluation Terminology: Matrix matching predicted label vs true label	Confusion matrix
Model Evaluation metrics for Classification	Accuracy, Precision, Recall, F1 Score
Model Evaluation metrics for Regression	Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error(RMSE)

Azure Machine Learning - Terminology

In 28
Minutes

- **Studio:** Website for Azure Machine Learning
- **Workspace:** Top-level resource for Azure Machine Learning
 - **Azure Machine Learning designer:** drag-and-drop interface to create your ML workflows (Canvas)
 - **Pipelines:** Reusable workflows (training and re-training)
 - **Datasets:** Manage your data
 - **Module:** An algorithm to run on your data
 - Data preparation: Data Transformation, Feature Selection
 - Machine learning algorithms: Regression, Classification, Clustering
 - Building and evaluating models: Model Training, Model Scoring and Evaluation
 - **Compute:**
 - Compute Instances: Development machines (CPU or GPU instances) for data engineers and data scientists
 - Pre-configured with tools such as Jupyter, ML packages etc
 - Compute Clusters: Training machines
 - Single or multi node compute cluster for your training
 - Inference Clusters: Deployment machines
 - Deploy your model to Azure Kubernetes Service or Azure Container Instances
 - Attached Compute: Use HDInsight cluster, a Virtual Machine, or a Databricks cluster as target for Azure Machine Learning workspace

Building Custom ML Models in Azure - Scenarios

In 28
Minutes

Scenario	Solution
Recommend Service: Create custom models using your own images	Custom Vision
Terminology: Website for Azure Machine Learning	Azure Machine Learning Studio
Drag-and-drop interface to create your ML workflows	Azure Machine Learning designer
Reusable workflows (training and re-training)	Pipelines
Data used for training	Dataset
What are the components that can be dragged on to canvas to build a pipeline?	Modules
What are training machines for Azure Machine Learning called?	Compute Clusters

Building Custom ML Models in Azure - Scenarios - 2

In 28
Minutes

Scenario	Solution
What are deployment machines for Azure Machine Learning called?	Inference Clusters
Why do you split data when you build a ML model?	To use a part of training and rest of data for validation of model
How can you consume an Azure Machine Learning model?	Publish it and access it as a web service (REST API endpoint)
Languages popularly used with ML	Python and R
Store and version your models. Organize and keep track of your trained models.	Model registration

Most important AI considerations

Challenges in Building AI Solutions

In 28
Minutes

- Importance of Datasets
 - What if the data has a bias? (Bias can affect results)
 - (Solutions may not work for everyone)
 - Obtaining data
- Evolving field
 - What if an AI system causes errors?
 - Accident made by a self driving car
 - Errors may cause harm
 - Scarcity of skills (Data Scientists, ...)
- ML lifecycle (MLOps)
- Security (What if the data used to build the model is exposed?)
- Explainability of model (Users must trust a complex system)
- Who will face the consequences?
 - Who's liable for AI-driven decisions?



Tags:

Water 100% confidence Sky 100% confidence
Lake 95% confidence Outdoor 95% confidence
Skyscraper 89% confidence Reflection 61% confidence
Overlooking 33% confidence Day 12% confidence

Description:

a city skyline with water 27% confidence

Racy Content: Adult Content:

False 75% confidence False 78% confidence

Responsible AI Principles

In 28
Minutes

- AI without unintended negative consequences:
 - **1: Fairness** - Fair to all groups of people
 - "System's decisions don't discriminate or run a gender, race, sexual orientation, or religion bias toward a group or individual"
 - Data should reflect diversity, Model should evolve with time
 - **2: Reliability and safety** - Continues working under high loads, unexpected situations etc
 - What happens in bad weather? What if GPS is down? What happens if data is bad?
 - Test, Test and Test
 - **3: Privacy and security** - Of people and data! (information and controls)
 - Important consideration from day ZERO!
 - **4: Inclusiveness** - Nobody left out
 - Violation: Leaving out a certain group of people (ex: people with disabilities)
 - **5: Transparency** - Explainability, debuggability
 - Clear explanation to users
 - **6: Accountability** - Meets ethical and legal standards
 - AI is NOT the final decision maker. An enterprise, a team or a person is.



Tags:

Water 100% confidence Sky 100% confidence
Lake 95% confidence Outdoor 95% confidence
Skyscraper 89% confidence Reflection 61% confidence
Overlooking 33% confidence Day 12% confidence

Description:

a city skyline with water 27% confidence

Racy Content: Adult Content:
False 75% confidence False 78% confidence

AI considerations - Scenarios

In 28
Minutes

Scenario	Solution
Identify violated principle: You find that a ML model does not grant loans to people of certain gender	Fairness
Identify violated principle: More accidents caused by a self driving car in bad weather	Reliability and Safety
Identify related principle: Securing data used to create the model	Privacy and security
Identify related principle: Making sure that the dataset used does not have any errors (missing values etc)	Reliability and Safety
Identify violated principle: People with disabilities cannot use a specific AI solution	Inclusiveness

AI considerations - Scenarios - 2

In 28
Minutes

Scenario	Solution
Identify related principle: Giving your customers control/choice over the data that is used by your AI system	Privacy and security
Identify related principle: Ensuring that an AI system works reliably under unexpected situation	Reliability and Safety
Identify violated principle: You do not know how a AI system reached a specific inference	Transparency
Identify related principle: Ensuring that there is sufficient information to debug problems with an AI system	Transparency
Identify related principle: Having a team that can override decision made by an AI system	Accountability

Get Ready

Certification Exam

In 28
Minutes

- Certification Home Page
 - <https://docs.microsoft.com/en-gb/learn/certifications/exams/AI-900>
- Different Types of Multiple Choice Questions
 - Type 1 : Single Answer - 2/3/4 options and 1 right answer
 - Type 2 : Multiple Answer - 5 (or more) options and 2 (or more) right answers
- No penalty for wrong answers
 - Feel free to guess if you do not know the answer
- 40 questions and 60 minutes
 - Should be a pretty easy exam
 - Mark questions for future consideration and review them before final submission
- Result immediately shown after exam completion
- Email with detailed scores (a couple of days later)

You are all set!

Let's clap for you!

In 28
Minutes

- Congratulations
- You have put your best foot forward to become Microsoft Certified: Azure AI Fundamentals
- Make sure you prepare well and
- Good Luck!

Do Not Forget!

In 28
Minutes

- Recommend the course to your friends!
 - Do not forget to review!
- Your Success = My Success
 - Share your success story with me on LinkedIn (Ranga Karanam)
 - Share your success story and lessons learnt in Q&A with other learners!

<https://github.com/in28minutes/learn>

- Learn Other Cloud Platforms:
 - Gartner predicts a multi cloud world soon
 - Get certified on AWS, Azure and Google Cloud
- Learn DevOps (Containers and Container Orchestration)
- Learn Full Stack Development

