AI-900 Notes

Describe Artificial Intelligence workloads and considerations

Understand the different types of AI workloads

- <u>Anomaly detection</u> – This is a machine learning technique that is used to analyze data over time. It then checks for any deviations or any unusual changes. An example if the detection of any fraudulent transactions
- <u>Computer Vision</u> – This is used to take images or videos and then provide information such as object detection and Image classification.
- <u>Natural Language Processing</u> – This is used to analyze text in documents or other text sources. It can interpret speech and also generate speech. It also has the ability to translate spoken or written phrases between different languages
- <u>Conversational AI</u> – This is used for solutions that are normally used to interact with humans. Here you can design bots to manage conversation with users.

<u>Remember all the principles of responsible AI</u>

- Fairness
- Reliability and safety
- Privacy and security
- Inclusiveness
- Transparency
- Accountability

Describe fundamentals principles of machine learning on Azure

The Machine Learning Model
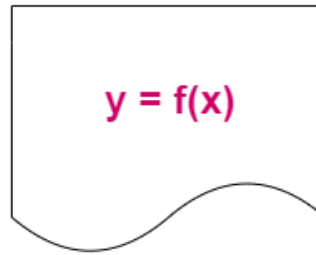
A Machine Learning Model is a function

$$y = f(x)$$

Machine Learning Algorithm

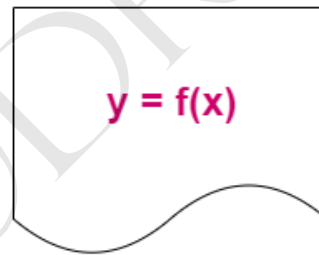**A Machine Learning Model is a function**

$$y = f(x)$$

Training data

To train your model, you first give it data

A Machine Learning Model is a function

$$y = f(x)$$

Actual data

Once your model is trained, you can feed it actual data

A Machine Learning Model is a function

Training data

$$y = f(x)$$

70% is used to train the model

30% is used to test the model

If data changes, then you should retrain your model to make better decisions

The Machine Learning Algorithm
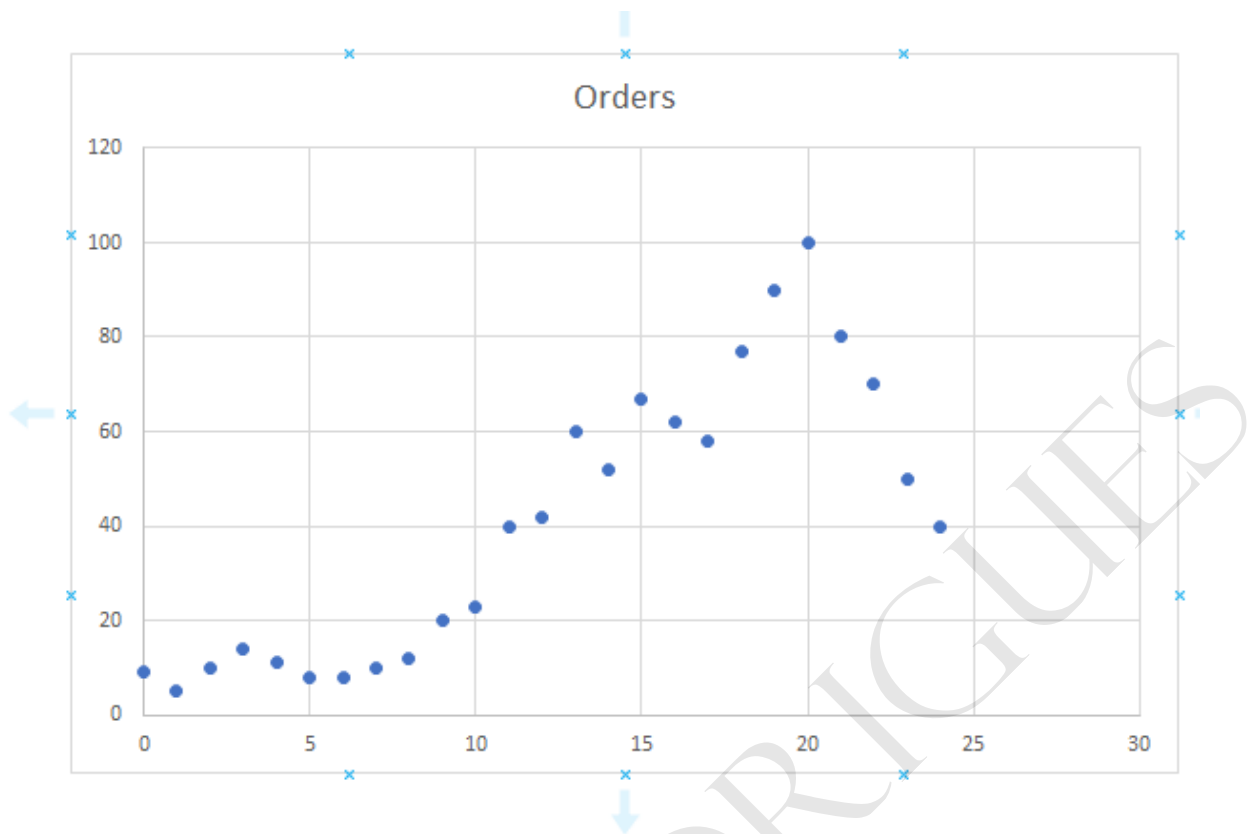
A Machine Learning Model is a function

$$y = f(x)$$

Linear Regression Algorithm

This is the approach to determining the relationship between a scalar response and one or more variables

If you just gave one input variable, its called simple linear regression

If you have multiple input variables, its called multiple linear regression

Orders

To predict the line you feed in data

Linear regression equation - Simple regression

Hour	Orders
0	9
1	5
2	10
3	14
4	11
5	8
6	8
7	10
8	12
9	20
10	23
11	40
12	42
13	60
14	52
15	67
16	62
17	58
18	77
19	90
20	100
21	80
22	70
23	50

x * weight + bias = y

Here x is the Hours

Here x is also known as a feature

Here y is the Orders

Here y is also known as our prediction

Here the model needs to predict what is the number of Orders that would be placed in an hour

So based on the input data and the algorithm the model needs to determine what is the ideal relationship or function to be used between x and y

For that the model needs to determine what is the best representation of the weight and bias variable

The Machine Learning Techniques

Machine Learning Techniques

Supervised Learning - Here the algorithms make a prediction based on a set of labeled examples that you provide.

CourseID	UnitPrice	Length	TotalSaleAmount
1	90	100	1200
2	110	120	1000
3	99	80	600
4	149	160	1000
5	100	90	1500
6	110	140	2000
7	89	100	1000
8	30	60	800
9	50	90	900
10	89	120	1100

Unsupervised Learning - Here the data points are not labeled. Here the algorithm will try to organize the data and decide on what the outcome could look like

The different Machine Learning Algorithms

Regression algorithms

This is used to predict the value of a new data point based on historical data

Hour	Orders
0	9
1	5
2	10
3	14
4	11
5	8
6	8
7	10
8	12
9	20
10	23
11	40
12	42
13	60
14	52
15	67
16	62
17	58
18	77
19	90
20	100
21	80
22	70
23	50
24	40

Orders

Classification algorithms

This is used to assign a category to the new data values

Two-class (binary) classification algorithm

Will the stock price go up tommorrow? Yes/No

Multiclass classification algorithms

To add multiple categories to data

Which ticket class might the customer purchase :
Economy/Business/First

Anomaly detection algorithms

Here you identify data points that fall outside the defined
parameters for what is defined as normal

Trying to find out if a credit card purchase is fraudulent

Time series algorithms

See how values change over time, then you can predict the
value for the future

Stock prices in the future

Clustering algorithms

Here the algorithm will divide the data into multiple groups.
Here similarity of data points are taken into account

What types of food do customers like to order?

Starting with Machine Learning on Azure

› In Azure , you have the Azure Machine Learning service that provides you a complete cloud-based environment to train, deploy, automate, manage and track your Machine Learning models.

› In the service, you have the **Azure Machine Learning studio**

› This is a web-based experience available in Azure for Machine Learning. There are low-code and no-code options for working with your ML models.

› In the Machine learning studio, you can make use of the Azure Machine Learning Designer – Here you can drag-n-drop modules that can be used to build your experiments.

› An experiment can be used to perform the following functions

  – Process your data

  – Analyze your data

  – Train and Test your model

Machine Learning – Classification - Results

The results are based on the how the evaluation
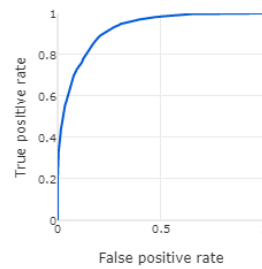of the model on the training data

Confusion Matrix

	Actual	
	<=50K	>50K
Predicted <=50K	7022	828
Predicted >50K	431	1487

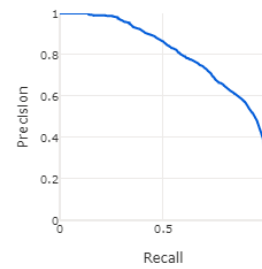| True Positives	False Positives
False Negatives	True Negatives

If the results are not accurate for a chosen
Machine Learning Algorithm, you can choose
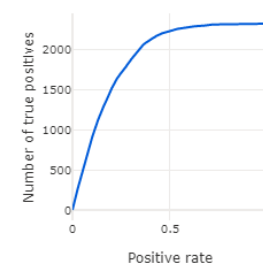another algorithm

ROC curve   Precision-recall curve   Lift curve

ROC Curve - Receiver operating characteristic curve - Relationship between true positive rate and false positive rate

Machine Learning – Regression - Results

Mean_Absolute_Error	Root_Mean_Squared_Error	Relative_Squared_Error	Relative_Absolute_Error	Coefficient_of_Determination
1828.836337	2594.009142	0.107672	0.327059	0.892328
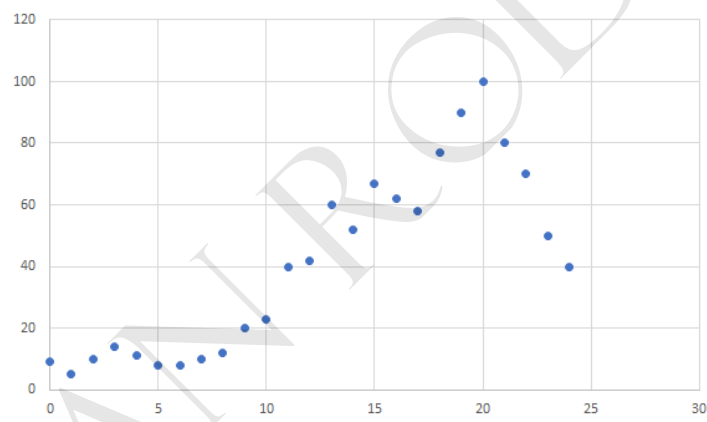
Mean absolute error - This is the expected value of absolute value of difference between the target and the prediction

Root mean squared error - This is the square root of the expected squared difference between the target and the prediction

Feature Engineering

- **feature engineering**: This process attempts to create additional relevant features from the existing raw features in the data, and to increase predictive power to the learning algorithm.
- **feature selection**: This process selects the key subset of original data features in an attempt to reduce the dimensionality of the training problem.

https://docs.microsoft.com/en-us/azure/machine-learning/team-data-science-process/select-features

Automated Machine Learning

› This is a feature available with Azure Machine Learning.

› The entire purpose of this feature is to automate the process of time consuming and iterative task that might be involved in machine learning development.

› Normally for a data scientist, they might need to check the accuracy of models against different Machine Learning algorithms.

› This can be a time-consuming task

› This can be automated with the help of Automated Machine Learning.

› This can be used for your classification and regression models.

Describe features of computer vision workloads on Azure

- **Computer Vision service**
  - This service can be used to analyze an image.
  - It will evaluate the objects that are detected in the image.
  - It will then return phrases based on what it has detected in the image.
  - It will also provide a confidence score
  - With the analysis of the image, it will also generate tags.
  - These tags are like metadata for the image that help to describe the image

Computer Vision – Object Detection

- With object detection, it can also detect bounding box coordinates.

- This will provide a set of coordinates.

- This will be the top, left, width and height of the detected object.

- This can also be used to identify the location of the object in the image.

- It can also detect brands.

- It already has an existing database of globally recognized logos from commercial brands of products

Image requirements for Object detection for Computer Vision

- The image must be presented in JPEG, PNG, GIF, or BMP format

- The file size of the image must be less than 4 megabytes (MB)

- The dimensions of the image must be greater than 50 x 50 pixels

- For the Read API, the dimensions of the image must be between 50 x 50 and 10000 x 10000 pixels

Computer Vision – Face Detection

- When it comes to Face Recognition

- It can detect and analyze human faces in an image.

- It has the ability to determine the age of the person in the image.

- It also provides a bounding box rectangle for the location of the face in the image.

- If you need a comprehensive analysis of the face then you can opt to use the Face service

Face API

Computer Vision API

You can get the coordinates of the face

You can get the age and gender

Face API

Here you can get extra face attributes

Head pose, emotion , glasses

With the Verify API, you can also check if two faces belong to the same person

Custom Vision Service

- This service allows you to build, deploy your own image identifiers.

- This service uses a machine learning algorithm to analyze images.

- You will upload the images and tag them accordingly.

- Then you will train the model based on the uploaded images.

- You can create projects in the Custom Vision Service based on either Image classification or Object detection

Form Recognizer service

- This is a service that helps to identify and extract text, key/value pairs, selection marks, tables and structure from documents.
- This service contains pre-built models for invoices, receipts and business cards.
- The following services are available when it comes the Form Recognizer
- **Layout API** - Extract text, selection marks, and tables structures, along with their bounding box coordinates, from documents.
- **Custom models** - Extract text, key/value pairs, selection marks, and table data from forms. These models are trained with your own data, so they're tailored to your forms.
- **Pre-built models** – This can be used to extract data from form types such as Invoices, Sales receipts and business cards.

Describe features of Natural Language Processing workloads on Azure (Also Conversational AI)

Natural Language Processing

In the field of Artificial Intelligence, it defines how well a computer is able to process l amounts of natural data

Does it understand the data that is trying to be relayed

1. Key Phrase Extration

Life is too short to wait

Life   short   wait

The food was amazing

food   amazing

2. Entity Recognition

The ability to read text and then categorize them

if the text being read has information about a person - Name , Phone number, email address

3. Sentiment Analysis

Here the text is read and understands if the content is relaying anything "positive", "negative", "neutral"

4. Translation

This is the ability to translate either text or speech from one language to another

5. Speech Recognition

Here you are able to listen to the speech and generate content

6. Speech Sythesis

Here you generate speech

Speech Service

- This service has a lot of features

- **Speech-to-text** – This provides a real time feature of converting speech to text.

- Here the audio streams or local files can be transcribed in real time.

- **Text-to-speech** – This can be used to convert input text to human-like synthesized speech.

- **Speech Translation** – This provides real-time and multi-language translation of speech.

- **Voice assistants** – This service empowers developers to create natural, human-like conversational interfaces for their applications and experiences

- **Speaker Recognition** – This helps to verify and identify speakers.

QnA Maker Service

- Use the QnA Maker when you have static information. If you have information about Questions and Answers in PDF's or URLs, then ensure to use that information in the QnA Maker.

- If you need to provide the same answer to a request , then consider using the QnA Maker.

- If you need to filter information based on meta-information, like the use of metadata tags, then consider the use of the QnA Maker.

- If you need the abilities of the Bot service to converse with the static information, then consider the user of the QnA Maker

QnA Maker

This service helps to provide a natural conversational layer over your data - Knowledge base of information

You can import your Question and Answers into the knowledge base with the help of the QnA maker

Type of data that you can import - FAQ's , product manuals, spreadsheets or a web page

QnA Maker	This is used for Authoring and query prediction
Cognitive Search	Data storage and searching
App Service	Query prediction endpoint
Application Insights	Query prediction telemetry