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Intro to AI/ML in Azure

Welcome!

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Instructor, Pluralsight

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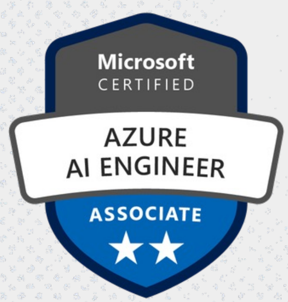
Objectives

At the end of this course, you will be able to:

- Have a good understanding of Azure **Machine Learning Workspace** and **Azure AI Services**
- Be ready to continue your journey and explore taking **DP-100** and **AI-102** Certification



Microsoft Certified: Azure AI Engineer Associate

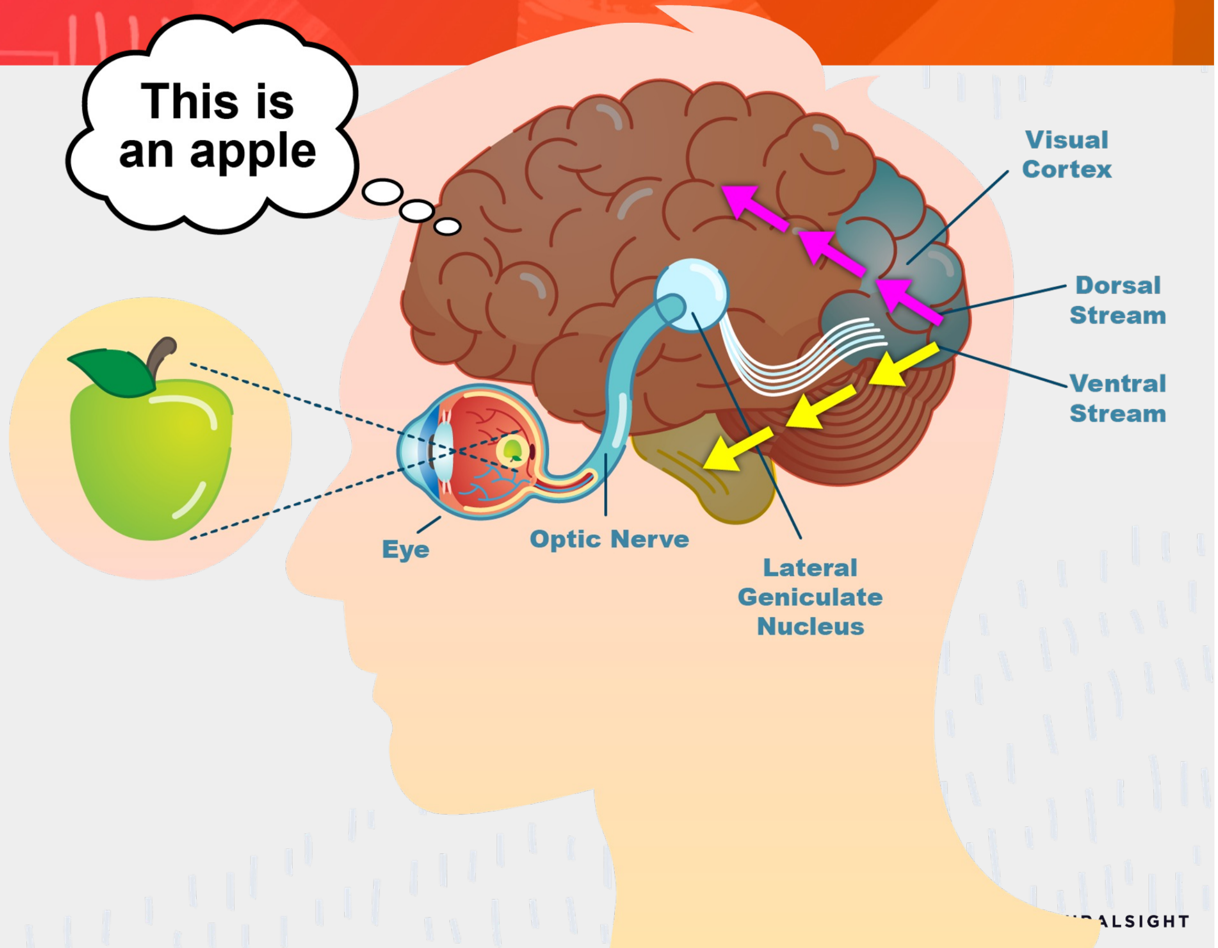
Microsoft Certified: Azure Data Scientist Associate

Artificial Neural Networks (ANN)

Neural Networks

How our brain works:

In order to recognize an image, our brain uses thousands
of neuron connections to find a match between the visual input and a mental representation of an object.

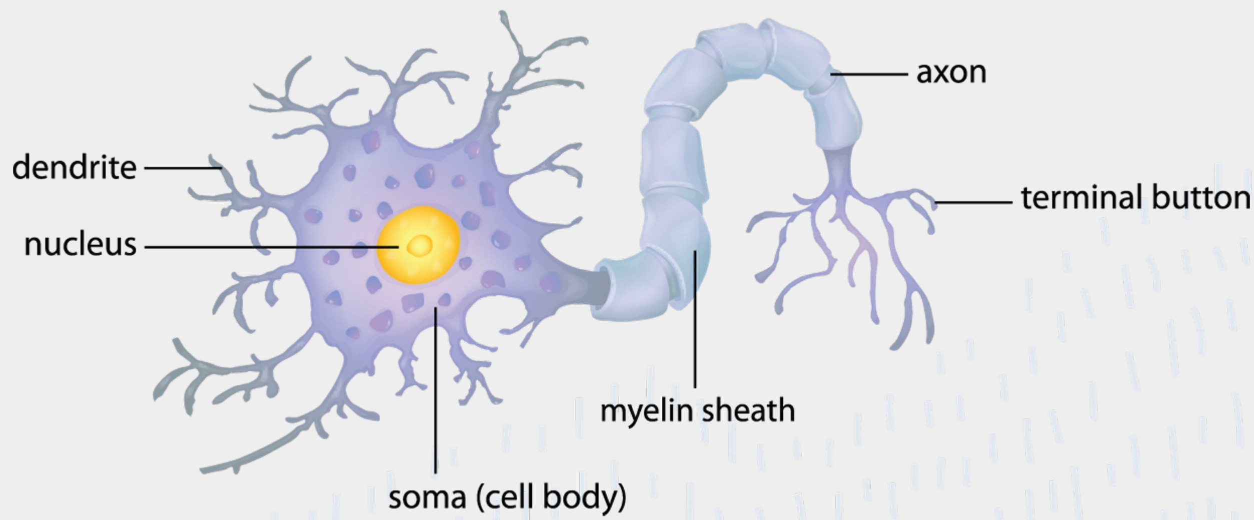


Neural Networks

The ability of the brain to process information and make predictions or interpretations is what inspired neurophysiologists and mathematicians to start the development of artificial neural networks (ANN).

In the same way that biological neurons receive input signals through the dendrites, an ANN receives input variables and processes them by using an activation function.

The output of an ANN is similar to the neuron nucleus in the brain.



History of Neural Networks

1943

Neurophysiologist **Warren McCulloch** and mathematician **Walter Pitts** wrote a paper on how neurons might work.

1949

Donald Hebb wrote *The Organization of Behavior*, which pointed out the fact that neural pathways are strengthened each time they are used.

1959

Bernard Widrow and **Marcian Hoff** of Stanford developed models called ADALINE and MADALINE.

1962

Widrow and **Hoff** developed a learning procedure that examines the value before the weight adjusts it (i.e., 0 or 1) according to the rule: Weight Change = (Pre-Weight line value).

1972

Teuvo Kohonen and **James A. Anderson** each developed a similar network independently of one another. They both used matrix mathematics to describe their ideas but did not realize that what they were doing was creating an array of analog ADALINE circuits.

History of Neural Networks

1982

John Hopfield of Caltech presented a paper to the National Academy of Sciences. His approach was to create more useful machines by using bidirectional lines. Previously, the connections between neurons was only one way.

1982

Joint US-Japan conference on **Cooperative/ Competitive Neural Networks**. Japan announced a new Fifth Generation effort on neural networks, and US papers generated worry that the US could be left behind in the field.

1986

Three independent groups of researchers, including **David Rumelhart**, a former member of Stanford's psychology department, came up with similar ideas which are now called back propagation networks.

1997

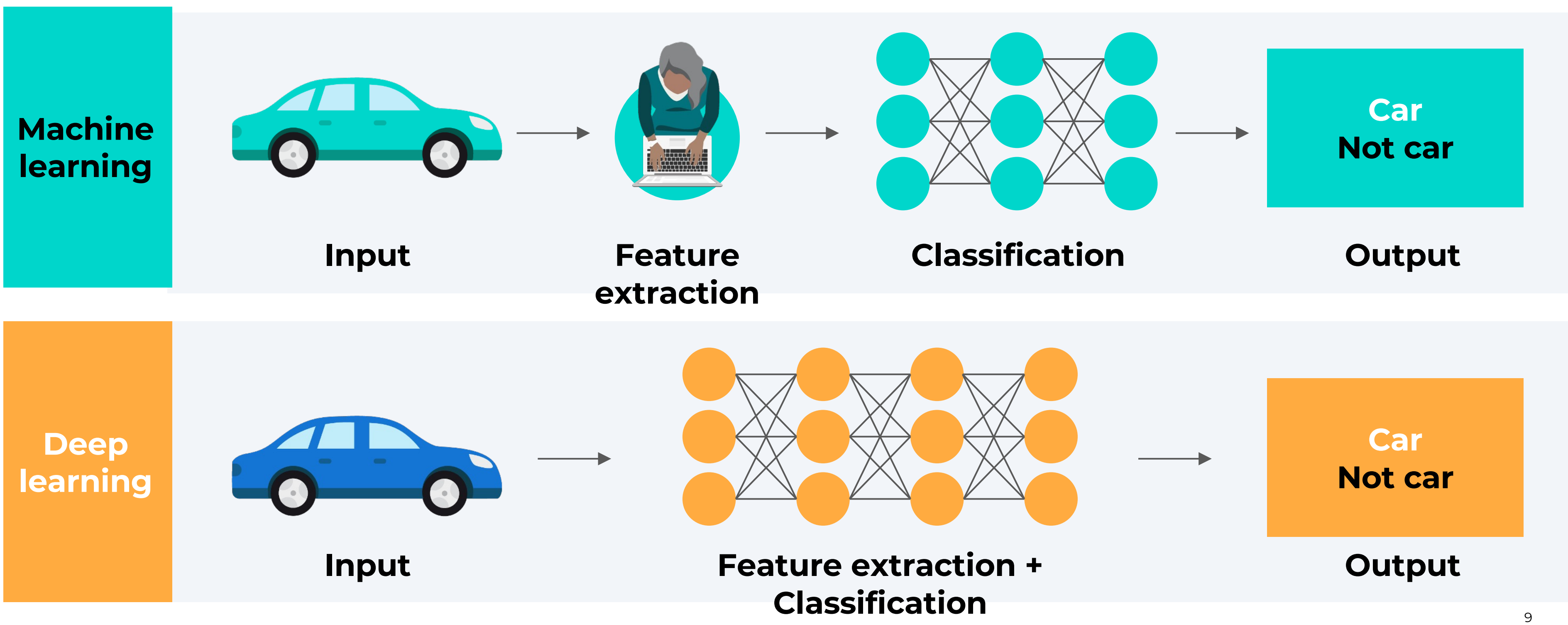
A recurrent neural network framework, LSTM was proposed by **Jürgen Schmidhuber** and **Sepp Hochreiter**.

2000s

Transformers were introduced. Followed by **GANs**, **VAEs**, and **Autoregressive** models which pushed the boundaries of **Generative AI**.

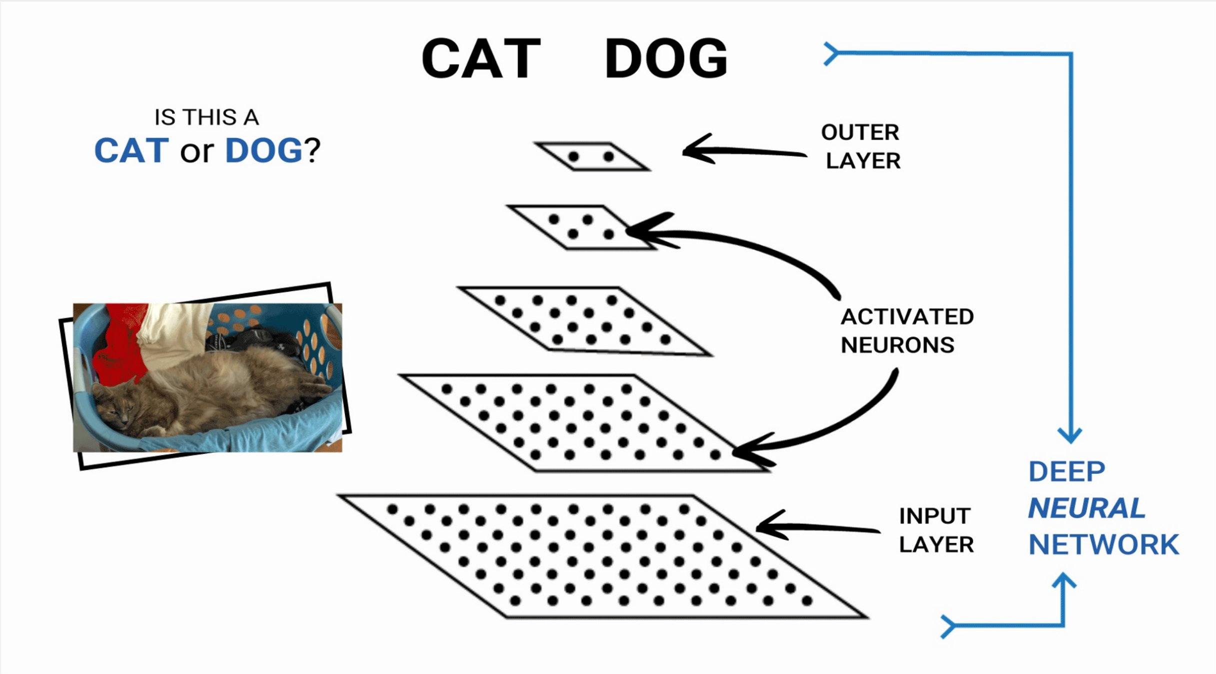
Machine Learning vs. Deep Learning

Deep neural networks are much more effective than traditional machine-learning approaches at discovering nonlinear relationships among data.



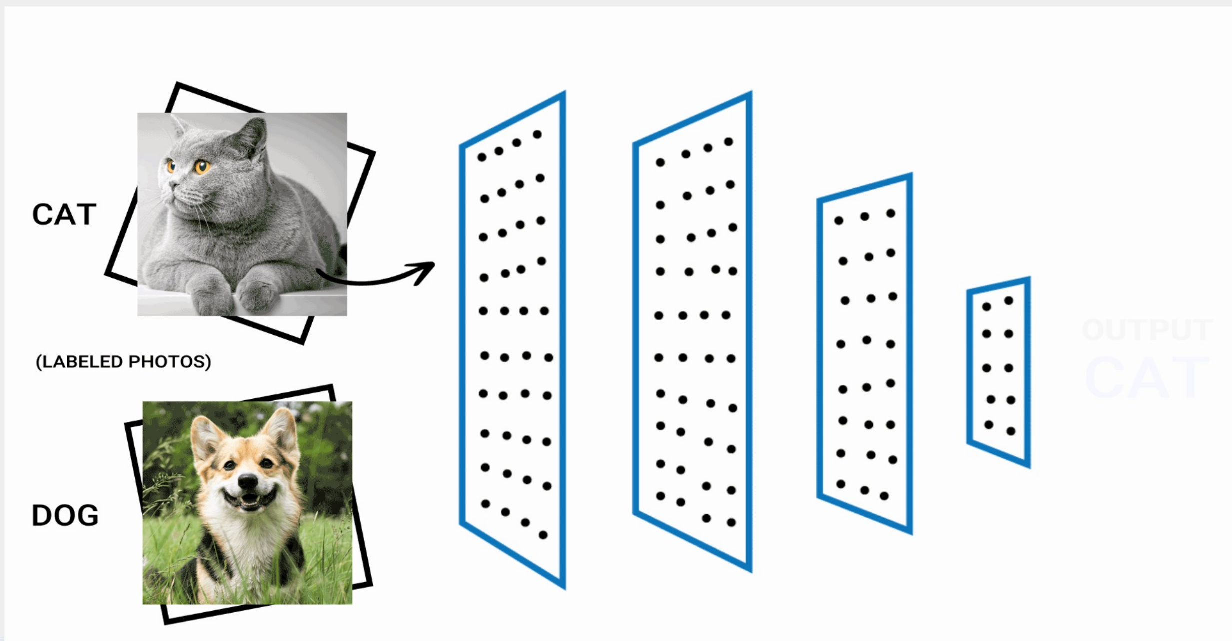
Neural Networks

Neural networks calculate the weights of various input data and pass them to the next layer of neurons. This process continues until the data reaches the output layer, which makes the final decision on the predicted category or numerical value of an instance.



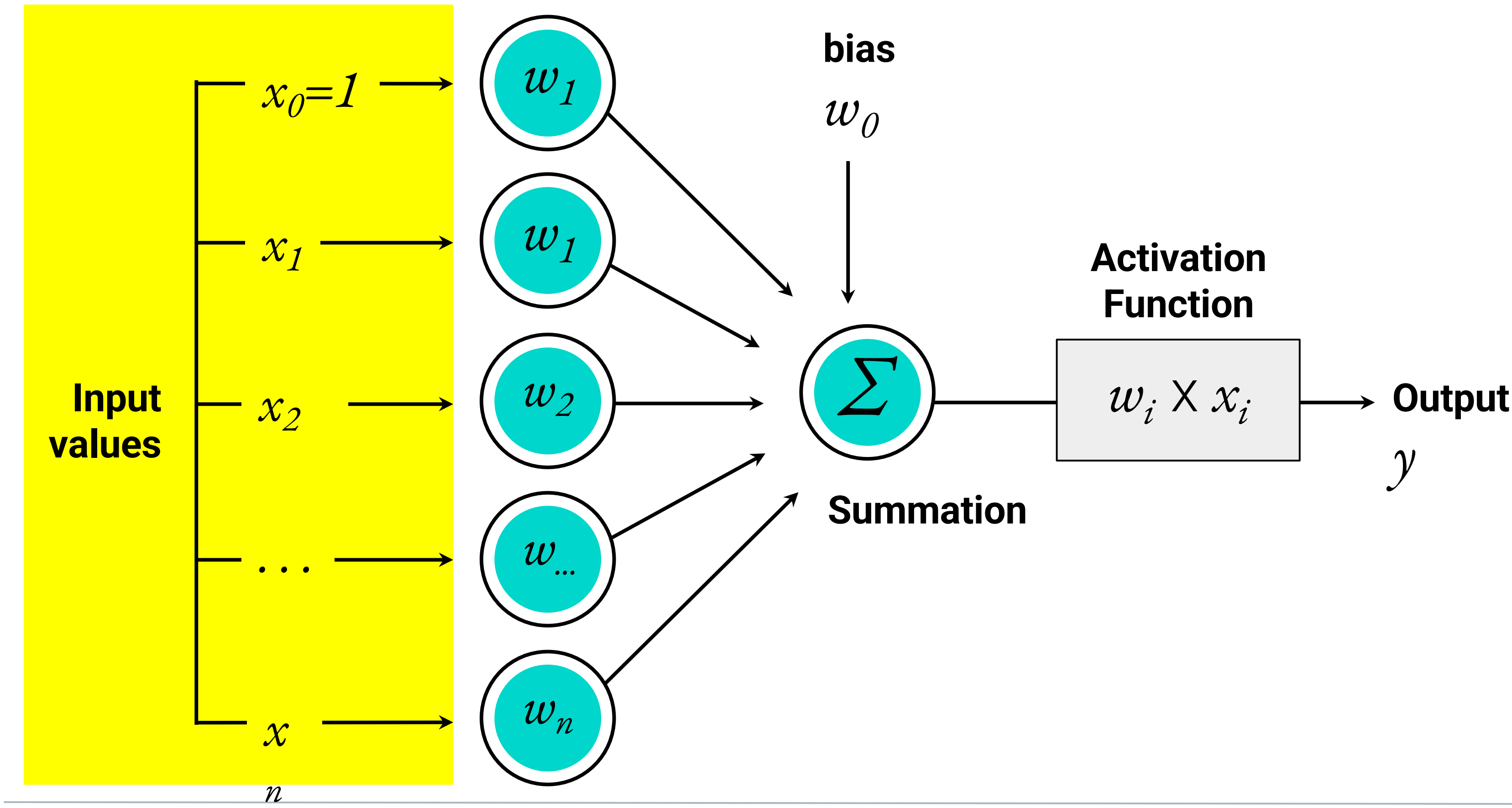
Neural Networks

While definitions vary, we can consider neural networks with more than one hidden layer to be deep learning models. The decreasing cost and greater availability of computing power has increased our ability to create and use these models.

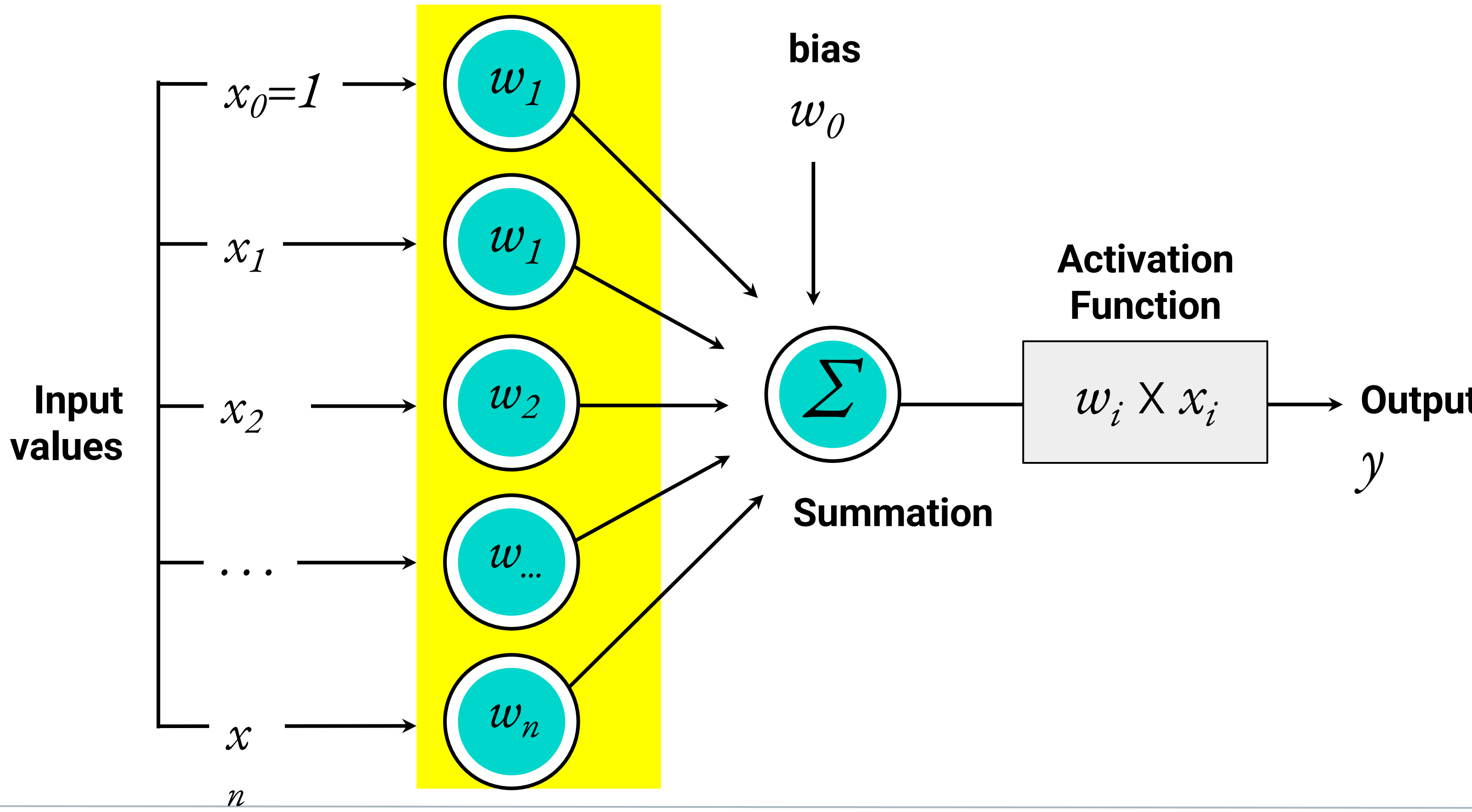


The perceptron model has four major components.

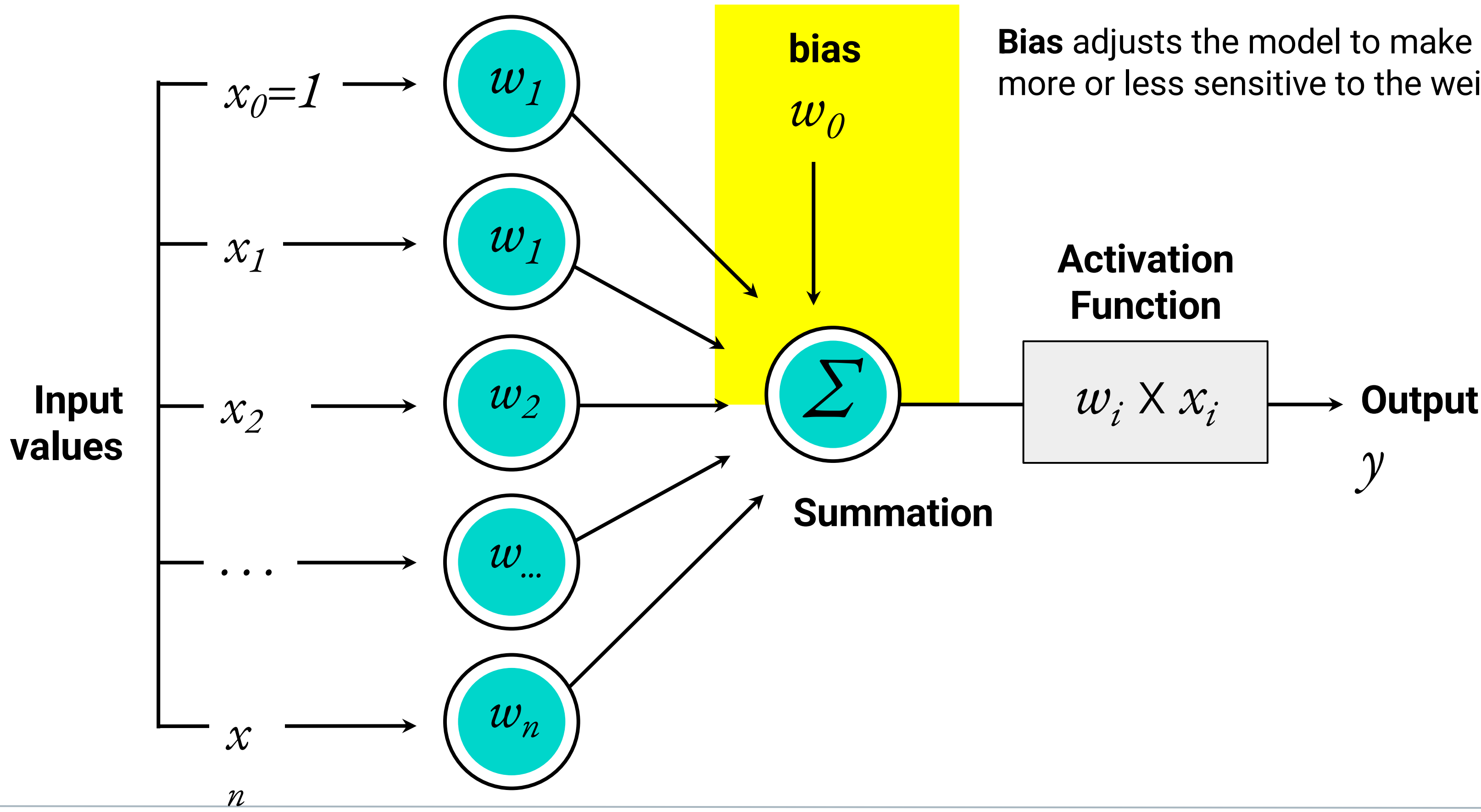
Input Values (shown as *x*'s)



Weight Coefficients (denoted as *w*'s)

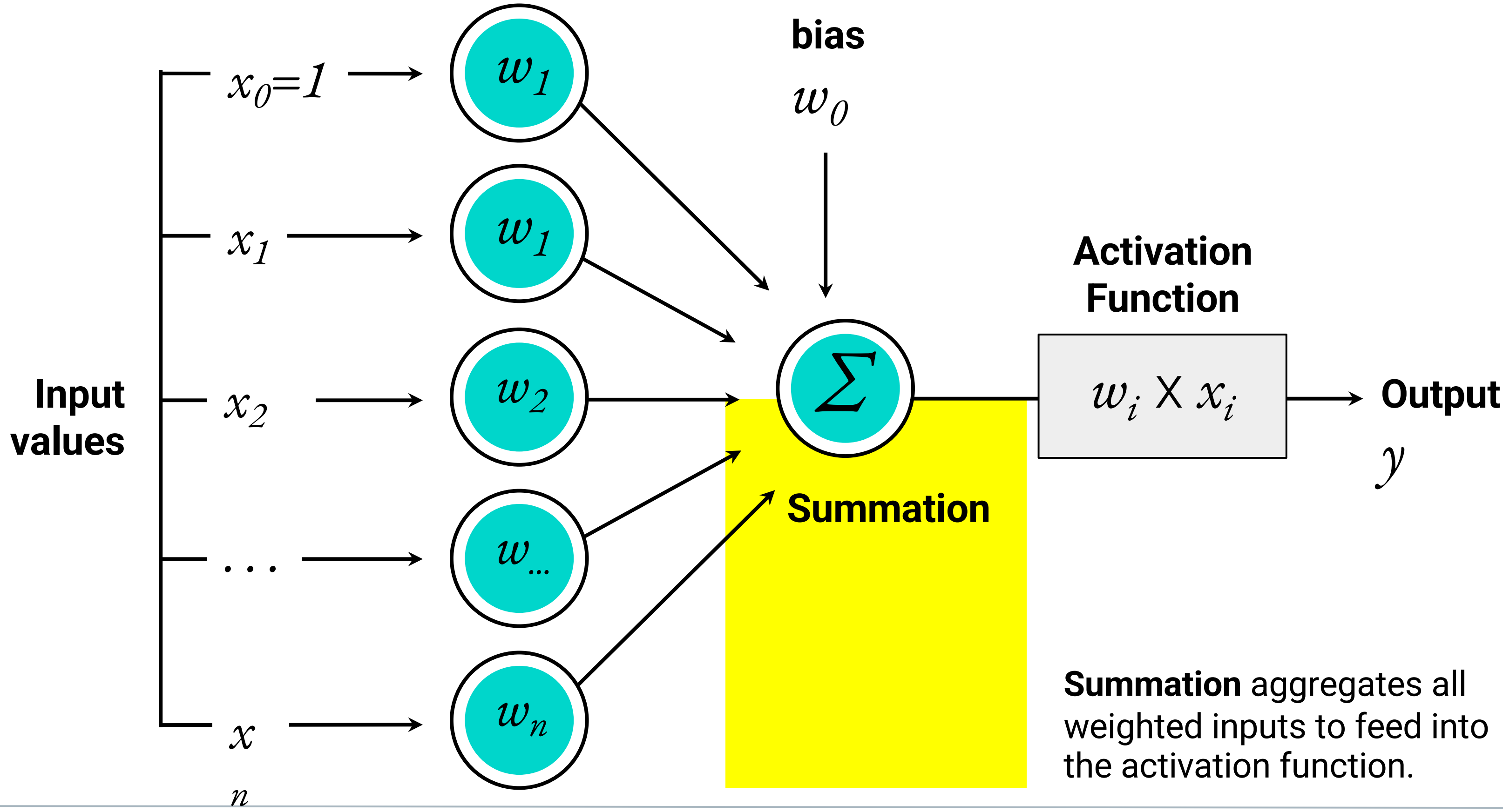


A Constant Value Called Bias



Bias adjusts the model to make it either more or less sensitive to the weights.

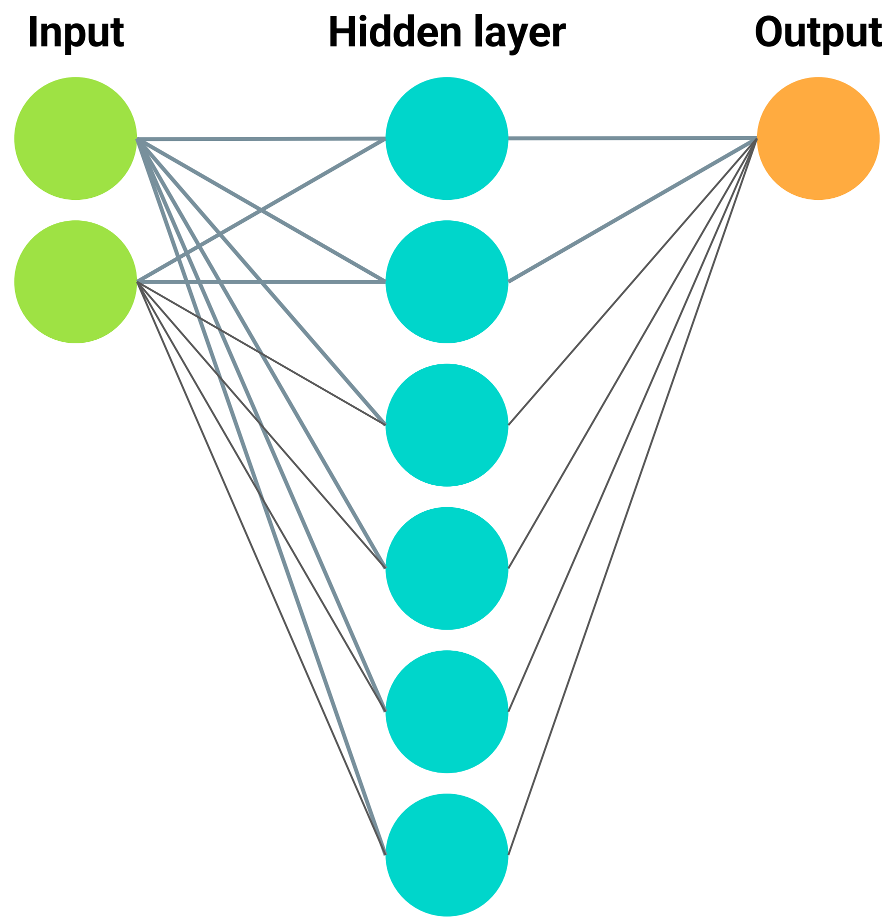
Net Summary Function (the Summation)



Summation aggregates all weighted inputs to feed into the activation function.

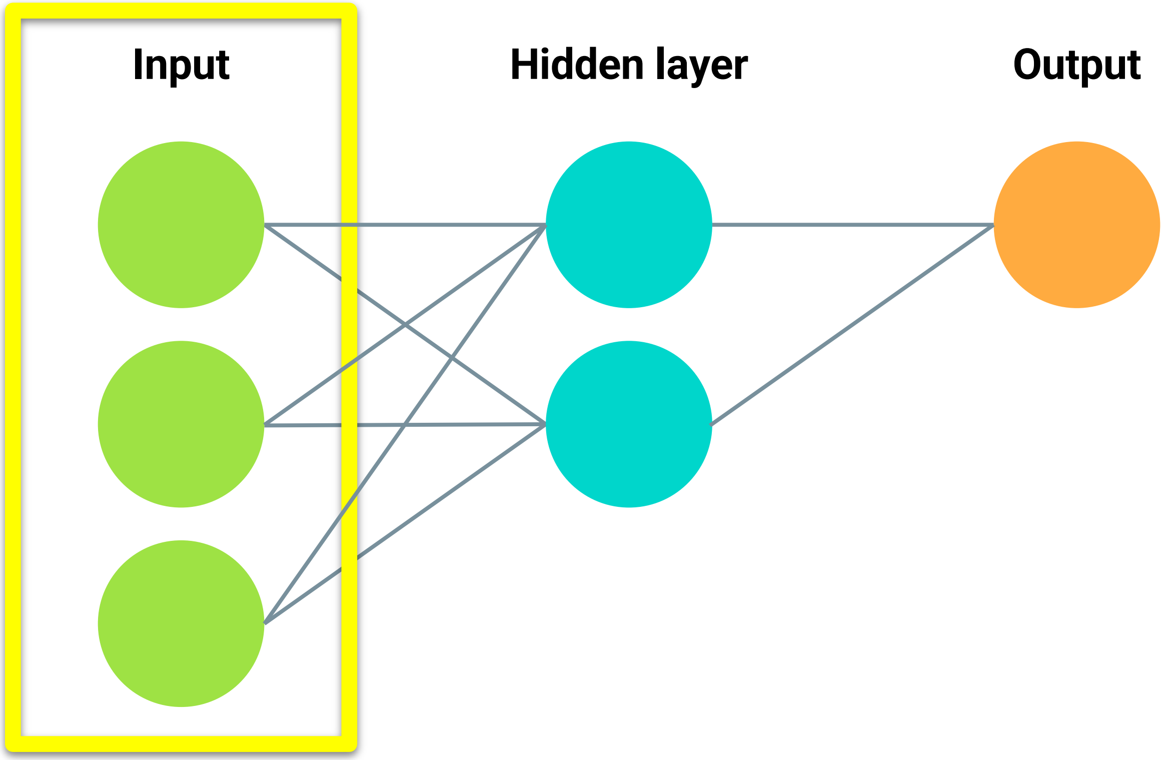
The Neural Network

A modern neural network model is a structure composed of several connected perceptrons that learn from input data to produce an output.



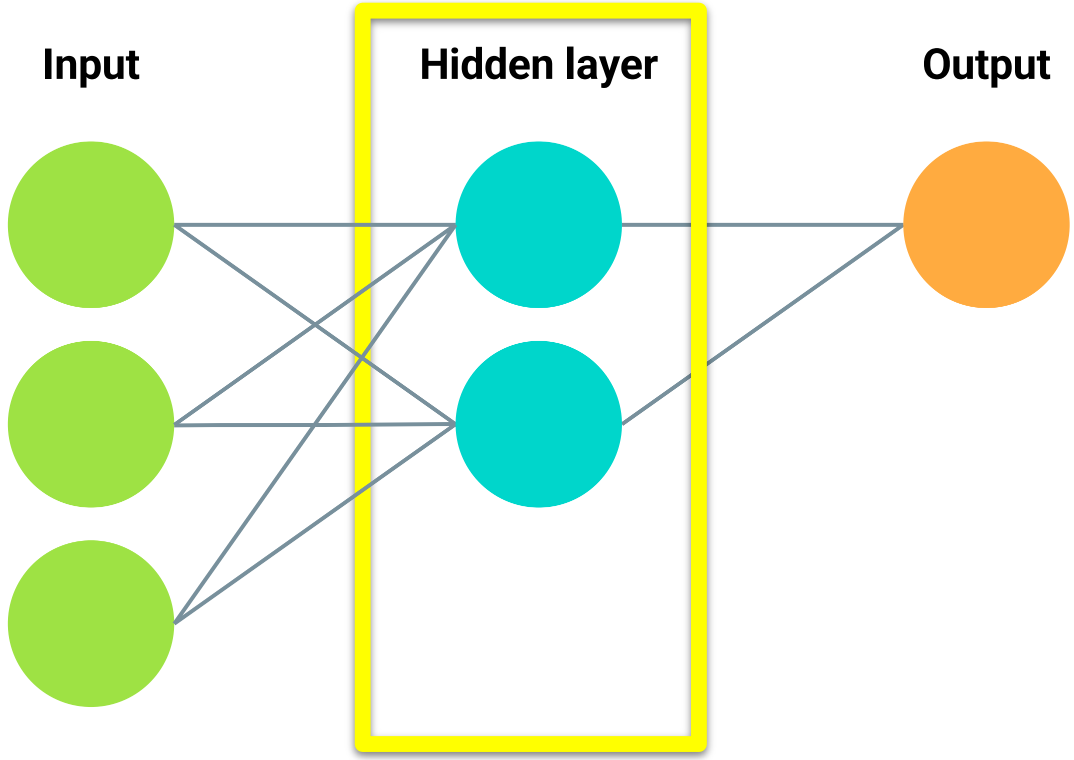
The Structure of a Neural Network

An **input layer** of input values transformed by weight coefficients



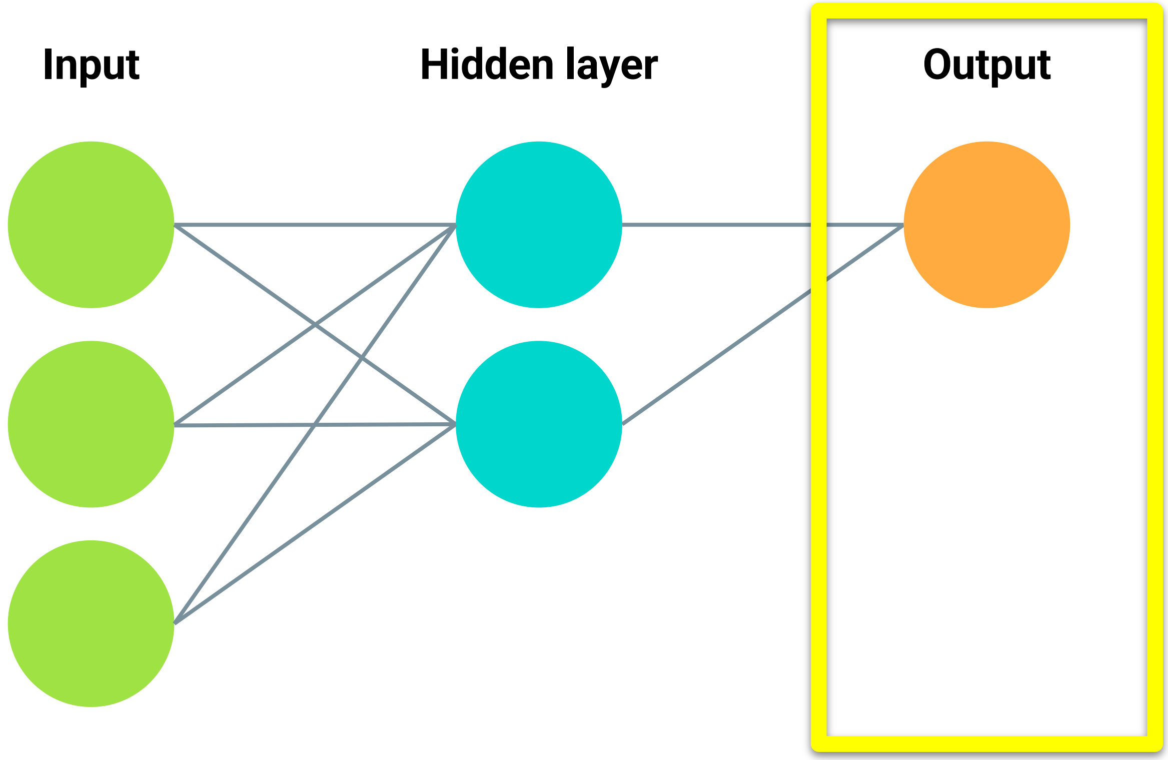
The Structure of a Neural Network

A single **hidden layer** that can contain a single neuron or multiple neurons



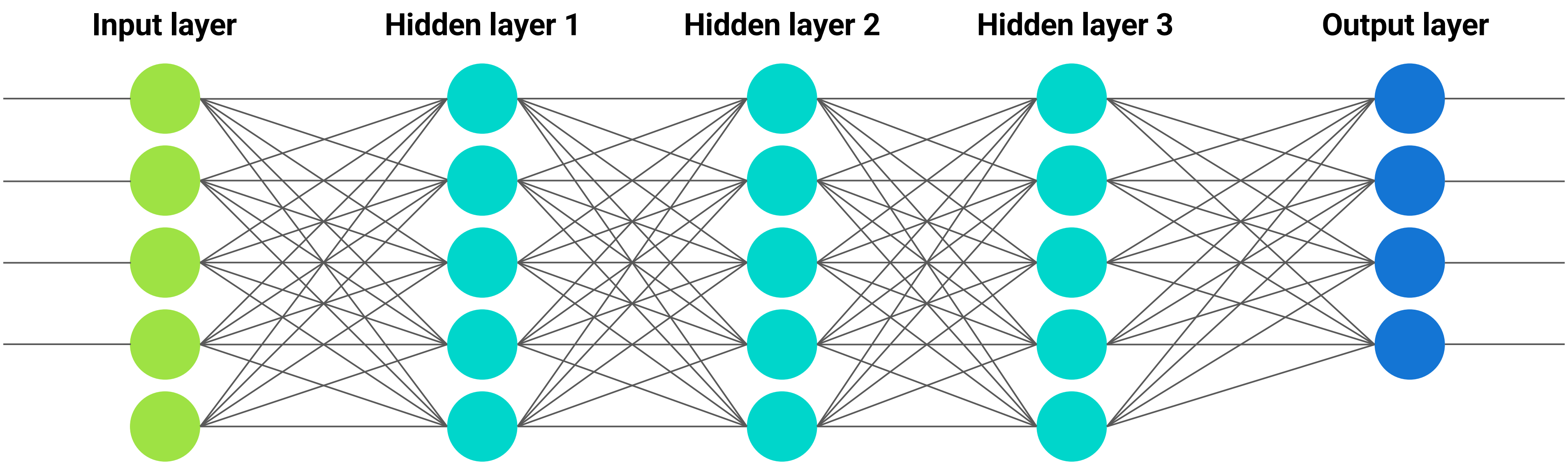
The Structure of a Neural Network

An **output layer** that reports the outcome of the value



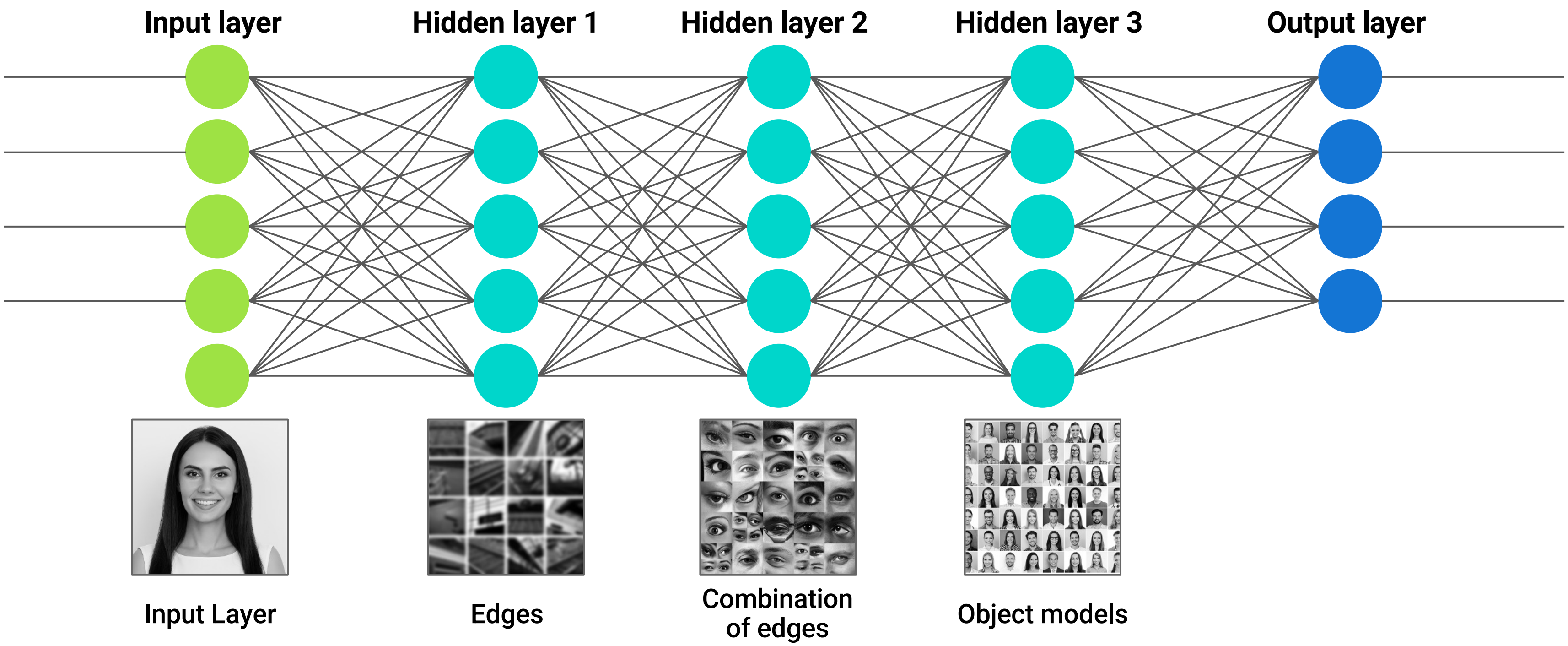
Deep Neural Networks

Generally speaking, deep learning models are neural networks with more than one hidden layer.



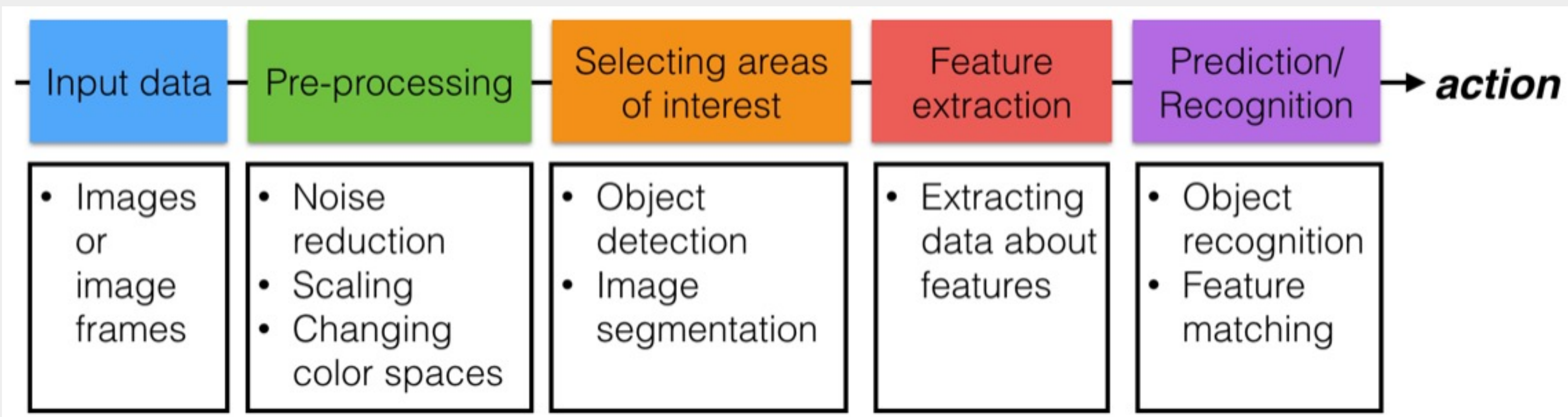
Deep Neural Networks

In image recognition, each layer can identify different image features in the process of defining or identifying the image.



Computer Vision

Computer Vision Pipeline



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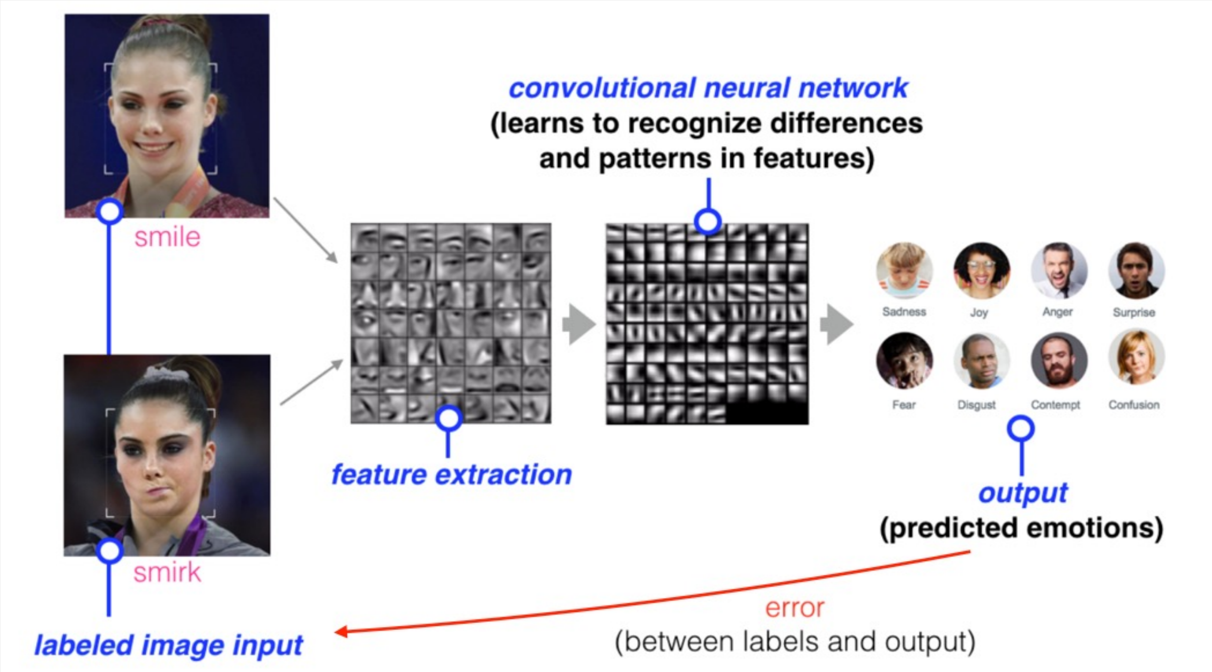
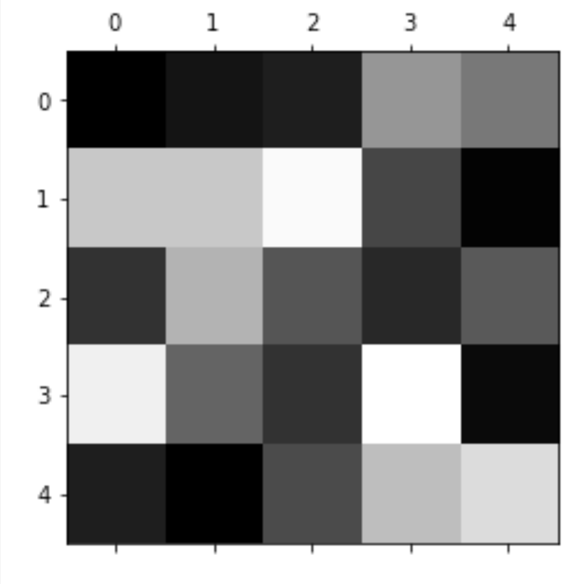
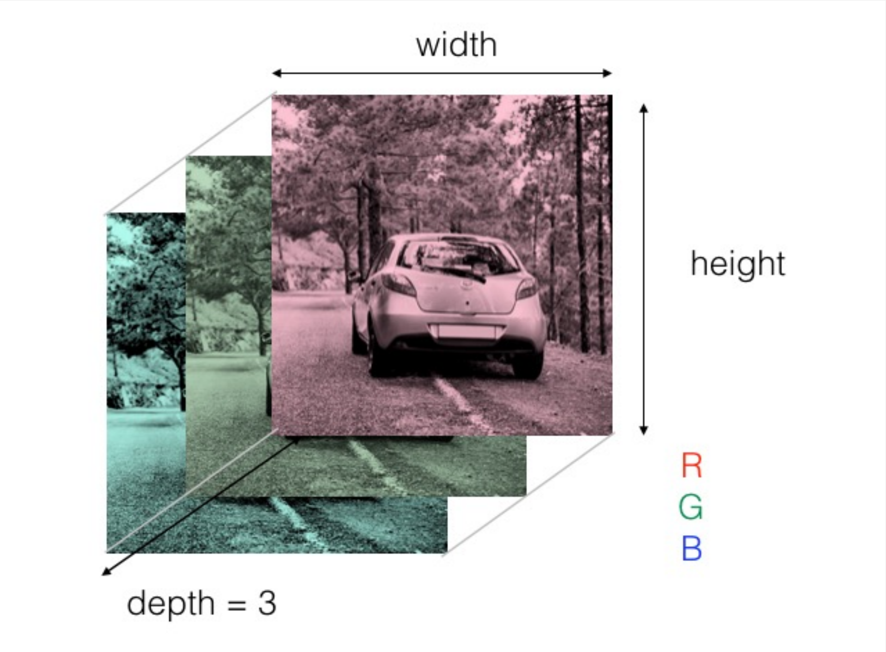
Training a Neural Network



Training a Neural Network



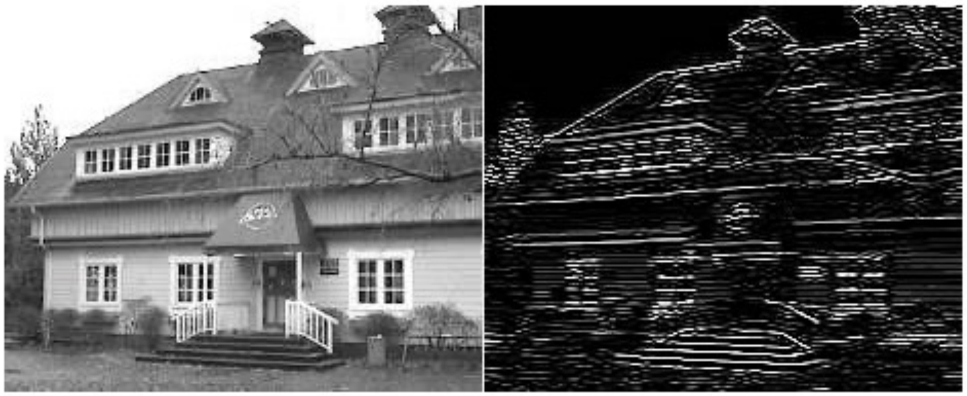
Training a Neural Network



Convolution Kernels – ex Blur

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Convolution Kernels – ex Line Detection



-1	-1	-1
2	2	2
-1	-1	-1

Horizontal lines

-1	2	-1
-1	2	-1
-1	2	-1

Vertical lines

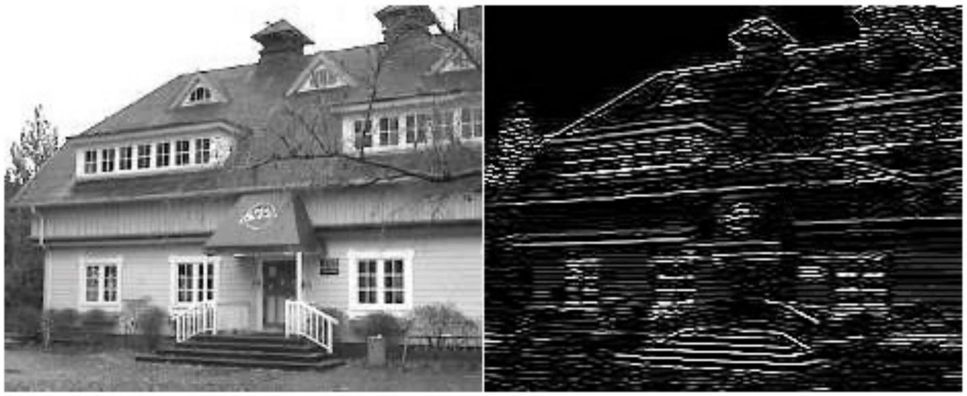
-1	-1	2
-1	2	-1
2	-1	-1

45 degree lines

2	-1	-1
-1	2	-1
-1	-1	2

135 degree lines

Convolution Kernels – ex Line Detection



-1	-1	-1
2	2	2
-1	-1	-1

Horizontal lines

-1	2	-1
-1	2	-1
-1	2	-1

Vertical lines

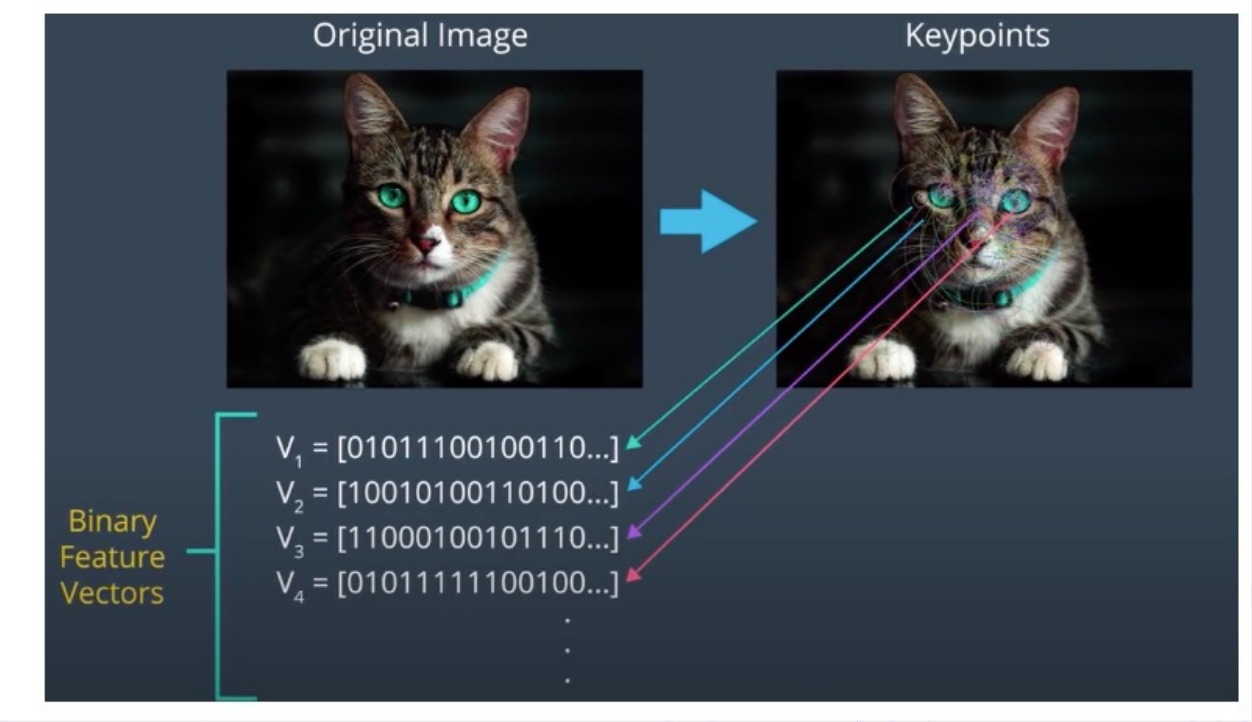
-1	-1	2
-1	2	-1
2	-1	-1

45 degree lines

2	-1	-1
-1	2	-1
-1	-1	2

135 degree lines

Image Classification



Face Detection

Face Detection – Key Point Detection

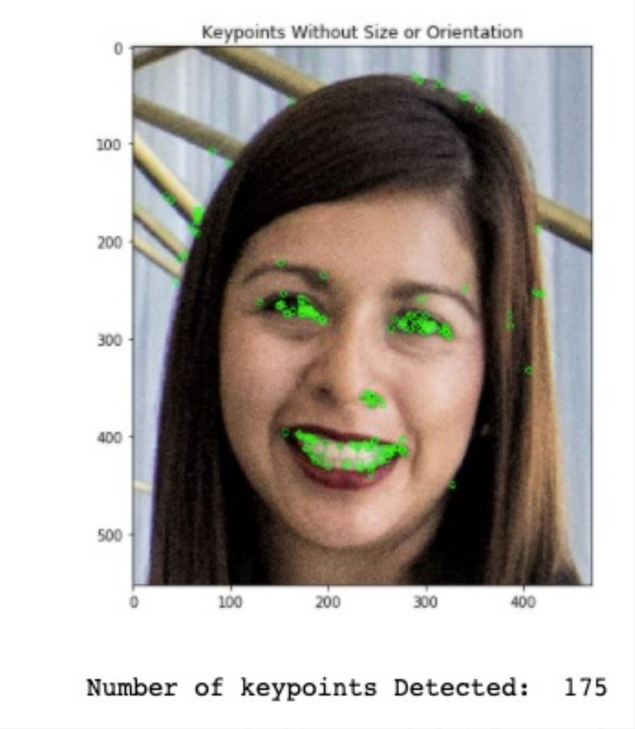


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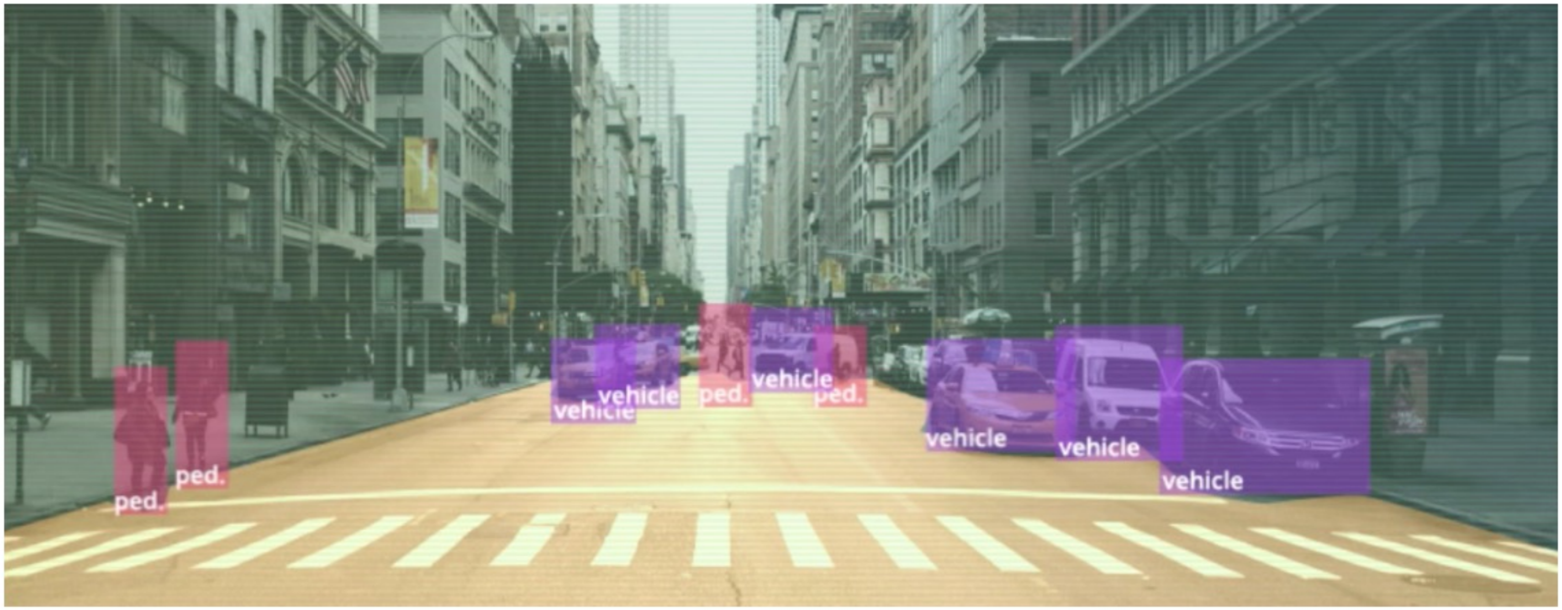
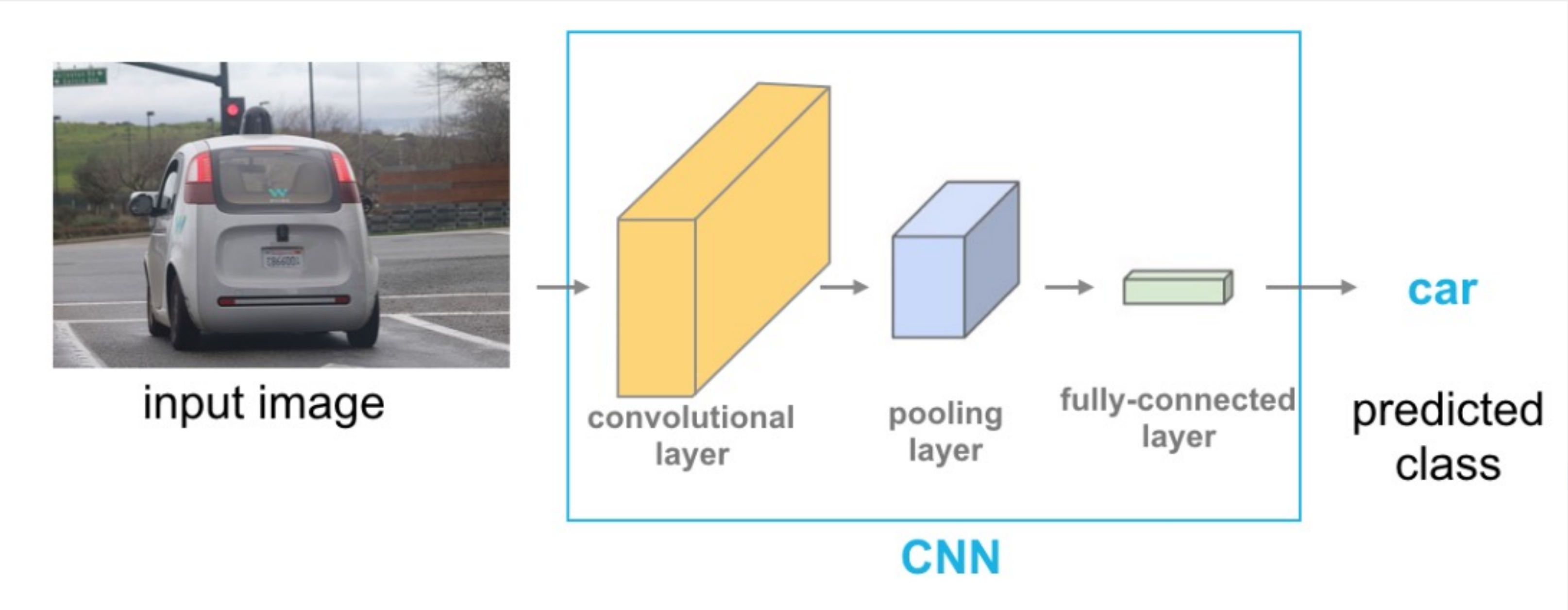
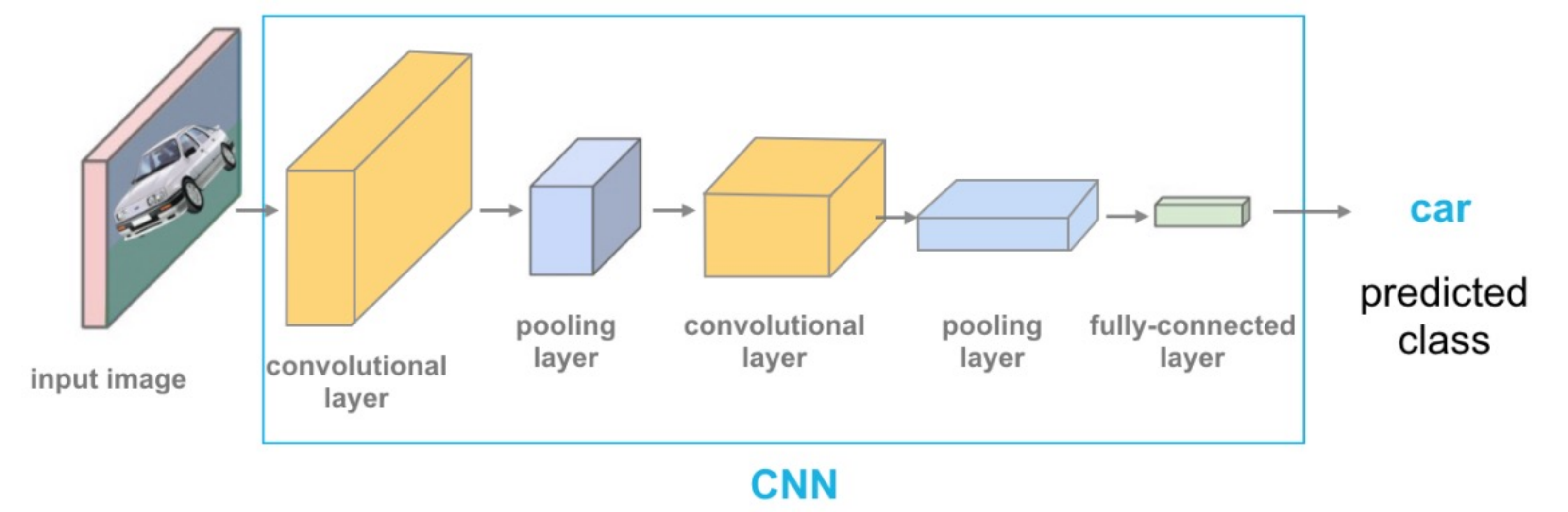
Image Segmentation



Convolutional Neural Networks



Convolutional Neural Networks



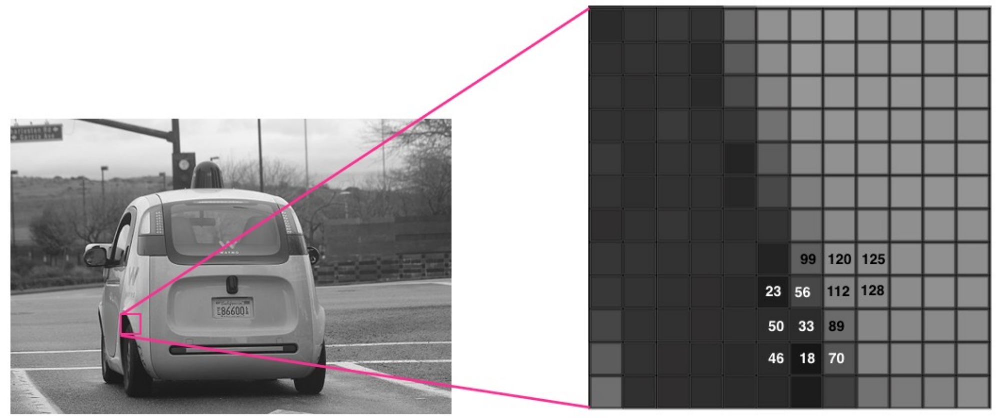
Convolutional Neural Networks

(bus, car, bike, person, …)

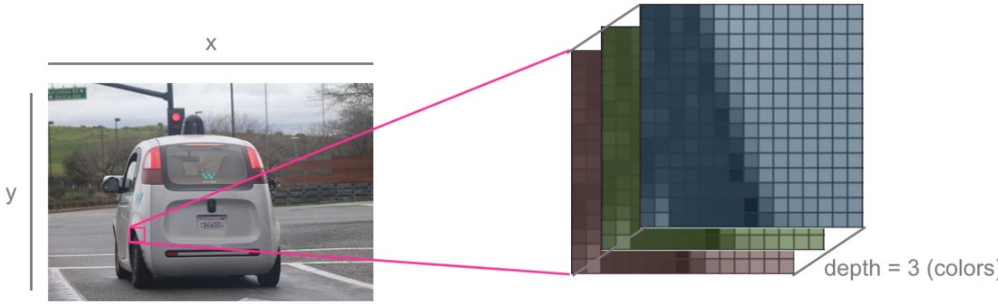
input image

→ CNN → car

Convolutional Neural Networks

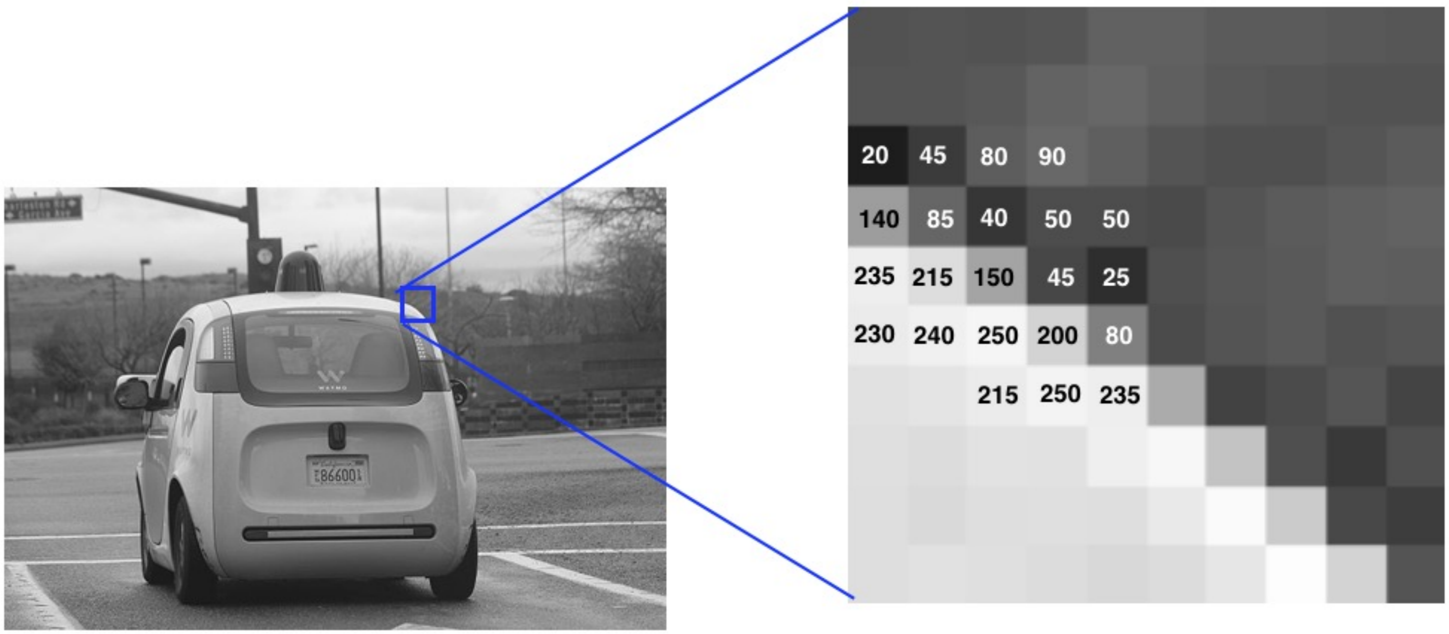


grayscale image



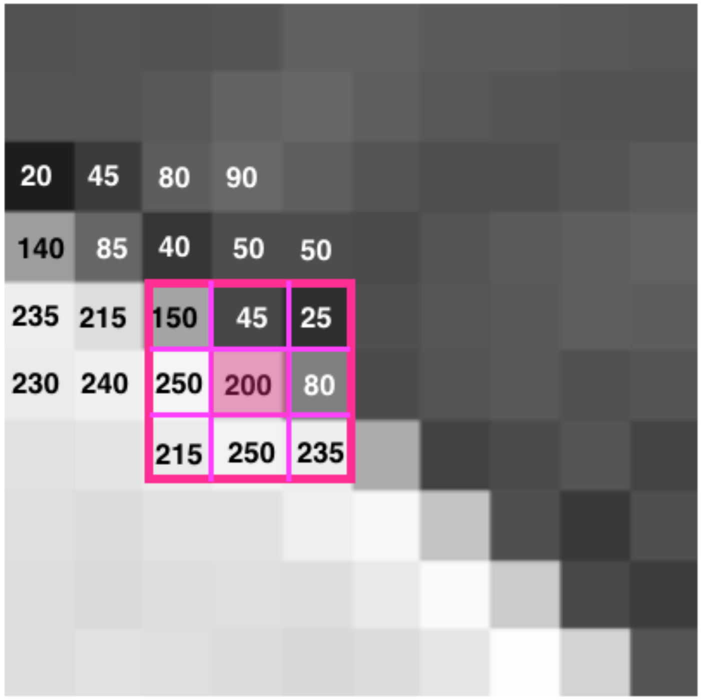
color image

Convolutional Neural Networks



Convolutional Neural Networks

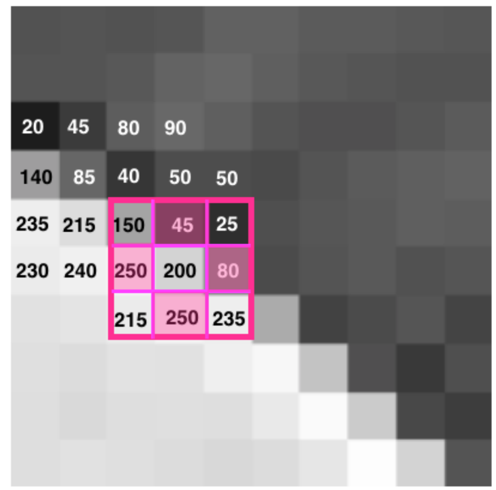
0	-1	0
-1	4	-1
0	-1	0



Convolutional Neural Networks

weights

0	-1	0
-1	4	-1
0	-1	0



$$\mathbf{0} * 150 + \mathbf{-1} * 45 + \mathbf{0} * 25 +$$

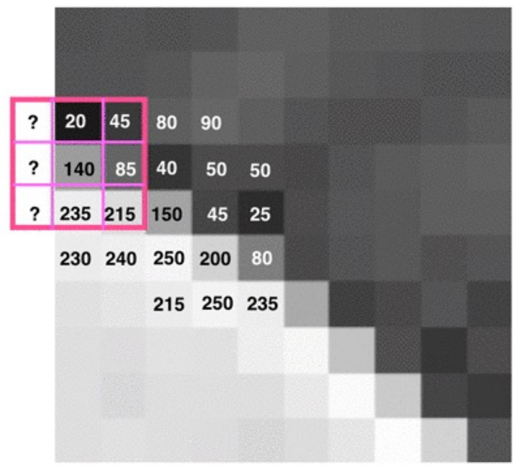
$$\mathbf{-1} * 250 + \mathbf{4} * 200 + \mathbf{-1} * 80 +$$

$$\mathbf{0} * 215 + \mathbf{-1} * 250 + \mathbf{0} * 235$$

$$= 175$$

Convolutional Neural Networks

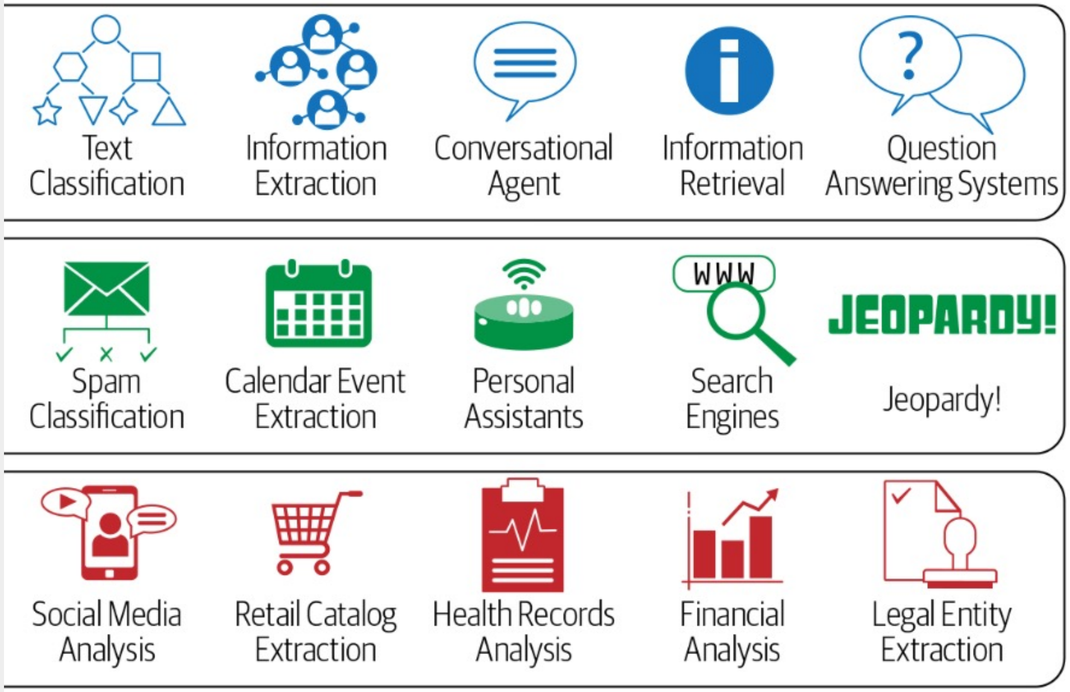
0	-1	0
-1	4	-1
0	-1	0

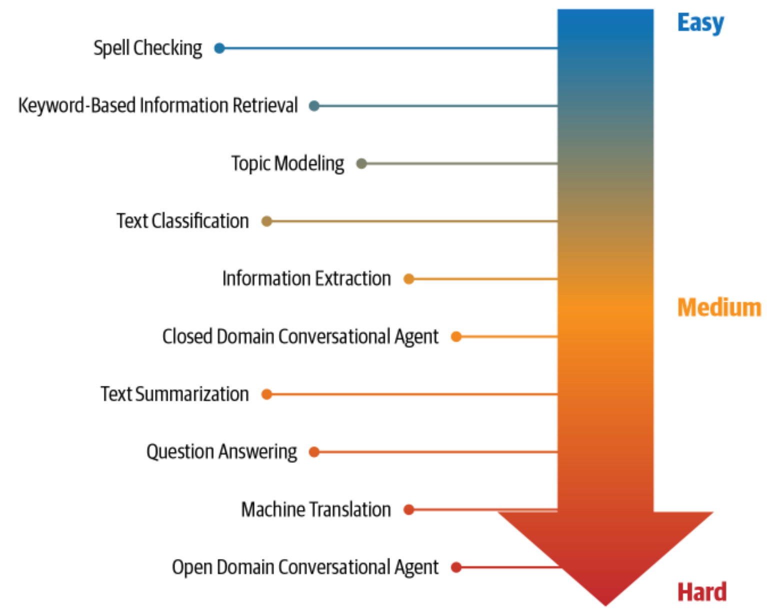


What to do at the edges?

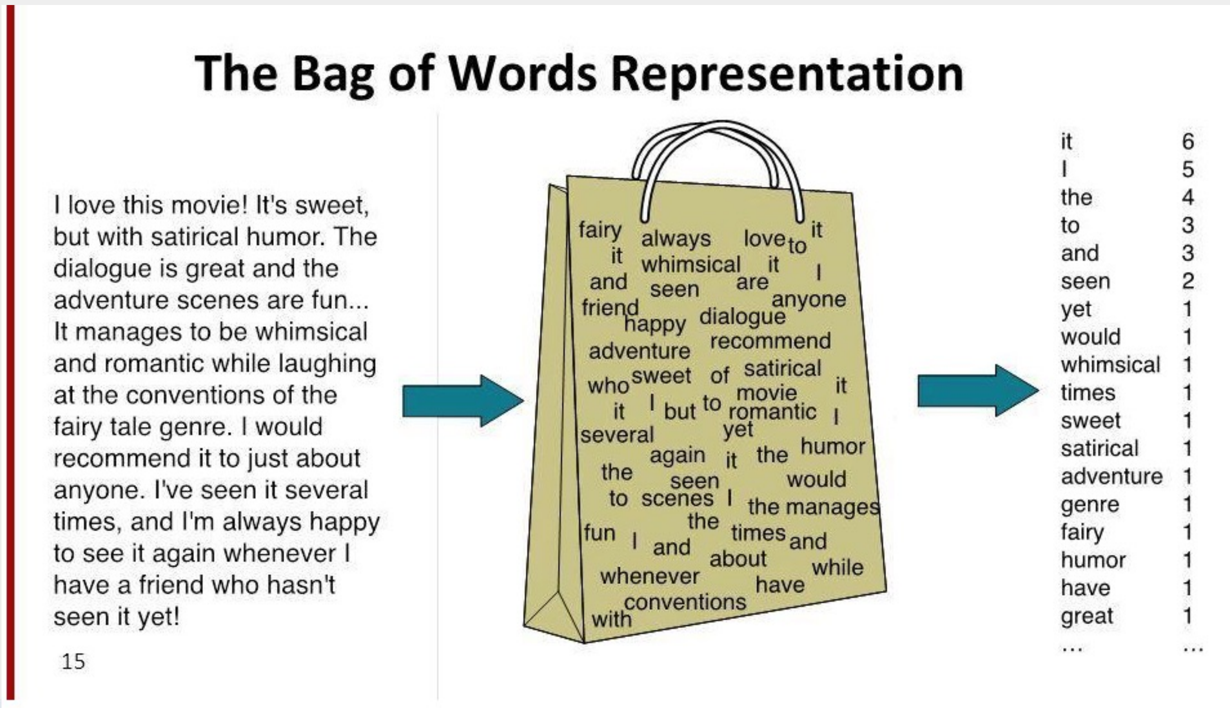
Natural Language Processing

NLP Tasks


Text Classification
Information Extraction
Conversational Agent
Information Retrieval
Question Answering Systems
Spam Classification
Calendar Event Extraction
Personal Assistants
WWW
Search Engines
JEOPARDY!
Jeopardy!
Social Media Analysis
Retail Catalog Extraction
Health Records Analysis
Financial Analysis
Legal Entity Extraction

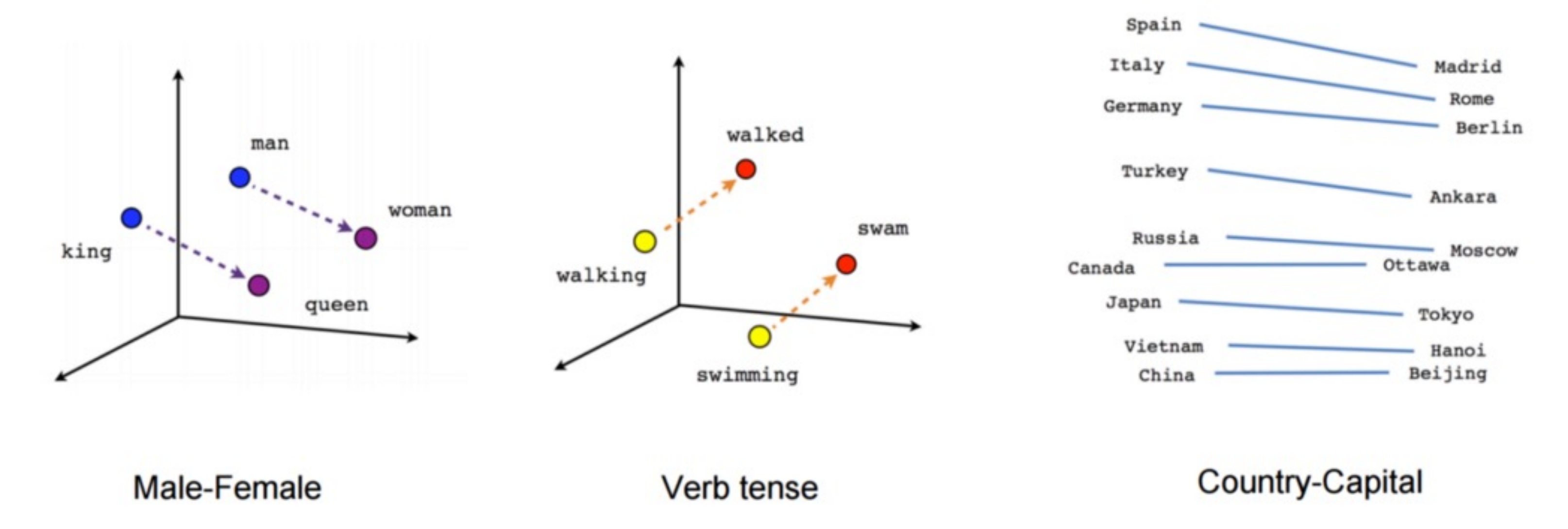

Easy
Spell Checking
Keyword-Based Information Retrieval
Topic Modeling
Text Classification
Information Extraction
Medium
Closed Domain Conversational Agent
Text Summarization
Question Answering
Machine Translation
Open Domain Conversational Agent
Hard

NLP BoW



The Bag of Words Representation
I love this movie! It's sweet, but with satirical humor. The dialogue is great and the adventure scenes are fun... It manages to be whimsical and romantic while laughing at the conventions of the fairy tale genre. I would recommend it to just about anyone. I've seen it several times, and I'm always happy to see it again whenever I have a friend who hasn't seen it yet!
15
fairy always love to it
it whimsical it I
and seen are anyone
friend happy dialogue
adventure recommend
who sweet of satirical it
it I but to movie romantic I
several yet
again it the humor
the seen would
to scenes I the manages
fun I and the times and
about while
whenever have
conventions
with
it 6
I 5
the 4
to 3
and 3
seen 2
yet 1
would 1
whimsical 1
times 1
sweet 1
satirical 1
adventure 1
genre 1
fairy 1
humor 1
have 1
great 1
... ...

NLP Vector Semantic

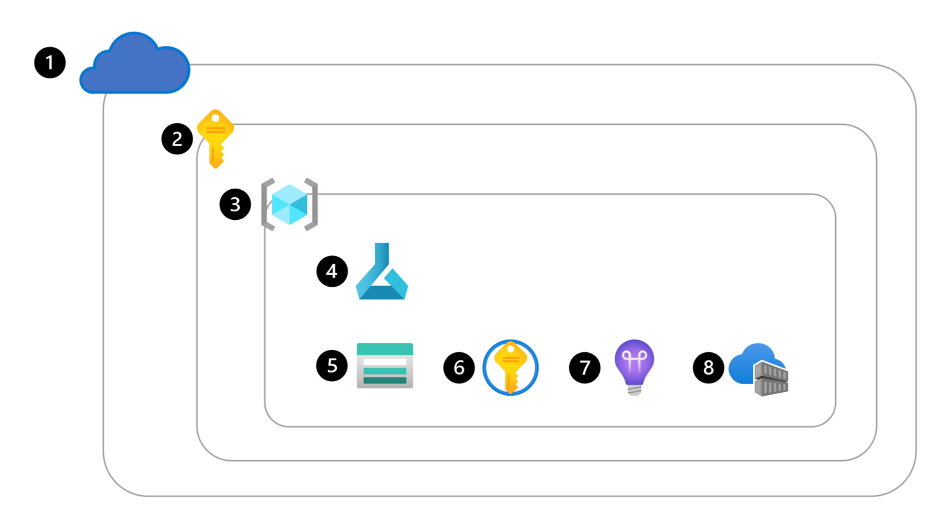


Azure AI and Machine Learning Services

https://azure.microsoft.com/en-us/products

Azure ML Services

- When a **workspace** is provisioned, Azure will automatically create other Azure resources within the same resource group to support the workspace:
- **Azure Storage Account**: To store files and notebooks used in the workspace, and to store metadata of jobs and models.
- **Azure Key Vault**: To securely manage secrets such as authentication keys and credentials used by the workspace.
- **Application Insights**: To monitor predictive services in the workspace.
- **Azure Container Registry**: Created when needed to store images for Azure Machine Learning environments.



Azure ML Compute Instances

A compute instance is a fully managed cloud-based workstation optimized for your machine learning development environment.

- **Compute instances**: Similar to a virtual machine in the cloud, managed by the workspace. Ideal to use as a development environment to run (Jupyter) notebooks.
- **Compute clusters**: On-demand clusters of CPU or GPU compute nodes in the cloud, managed by the workspace. Ideal to use for production workloads as they automatically scale to your needs.
- **Kubernetes clusters**: Allows you to create or attach an Azure Kubernetes Service (AKS) cluster. Ideal to deploy trained machine learning models in production scenarios.
- **Attached computes**: Allows you to attach other Azure compute resources to the workspace, like Azure Databricks or Synapse Spark pools.
- **Serverless compute**: A fully managed, on-demand compute you can use for training jobs.

Datastores

The workspace doesn't store any data itself. Instead, all data is stored in **datastores**, which are references to Azure data services.

- workspaceartifactstore: Connects to the azureml container of the Azure Storage account created with the workspace. Used to store compute and experiment logs when running jobs.
- workspaceworkingdirectory: Connects to the file share of the Azure Storage account created with the workspace used by the **Notebooks** section of the studio. Whenever you upload files or folders to access from a compute instance, it's uploaded to this file share.
- workspaceblobstore: Connects to the Blob Storage of the Azure Storage account created with the workspace. Specifically the azureml-blobstore-... container. Set as the default datastore, which means that whenever you create a data asset and upload data, it's stored in this container.
- workspacefilestore: Connects to the file share of the Azure Storage account created with the workspace. Specifically the azureml-filestore-... file share.

ML Assets

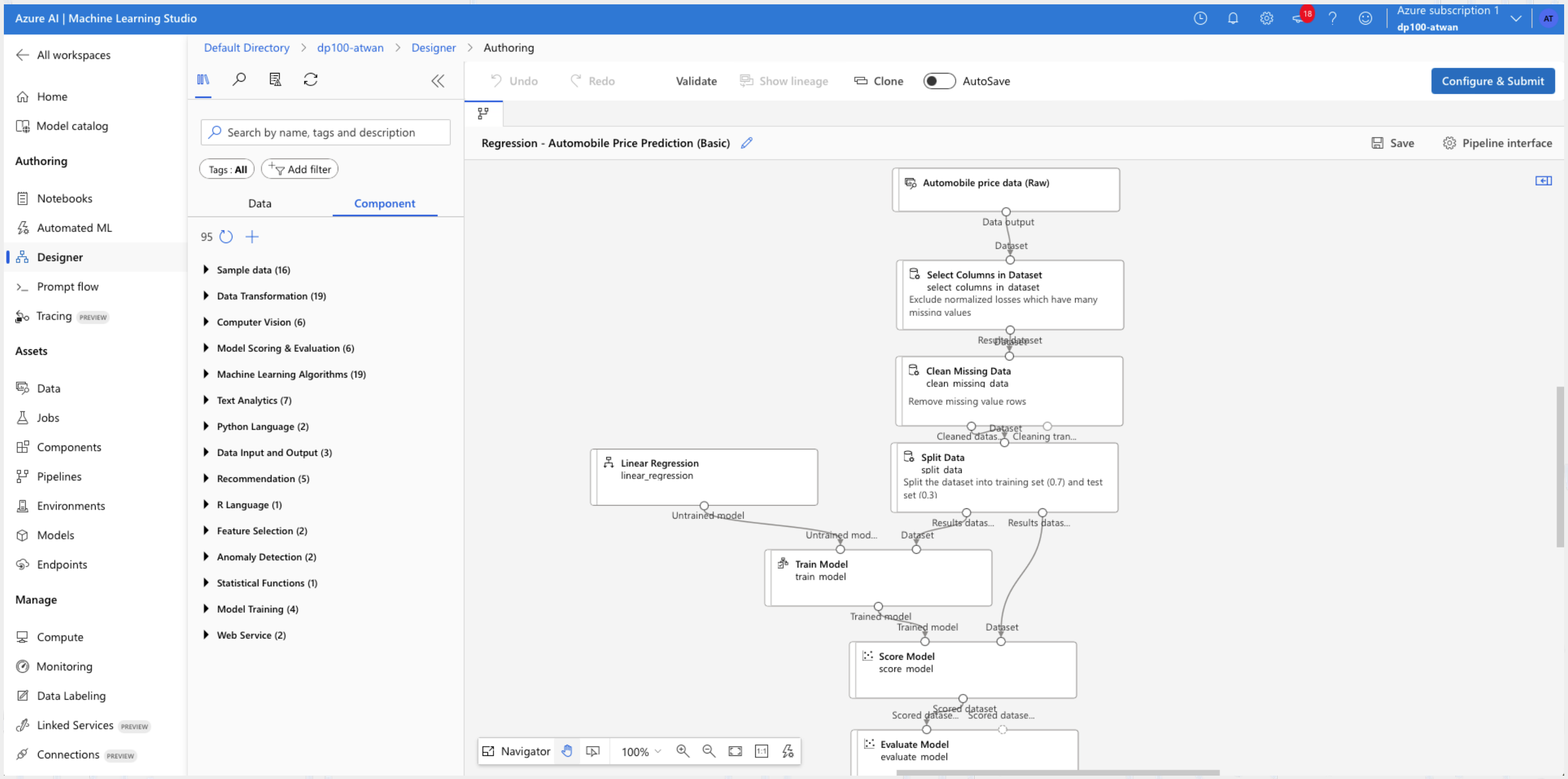
- Models
- Environments
- Data
- Components

Authoring within ML Workspace

Authoring

- Notebooks
- Automated ML
- Designer
- Prompt flow
- Tracing PREVIEW

Designer



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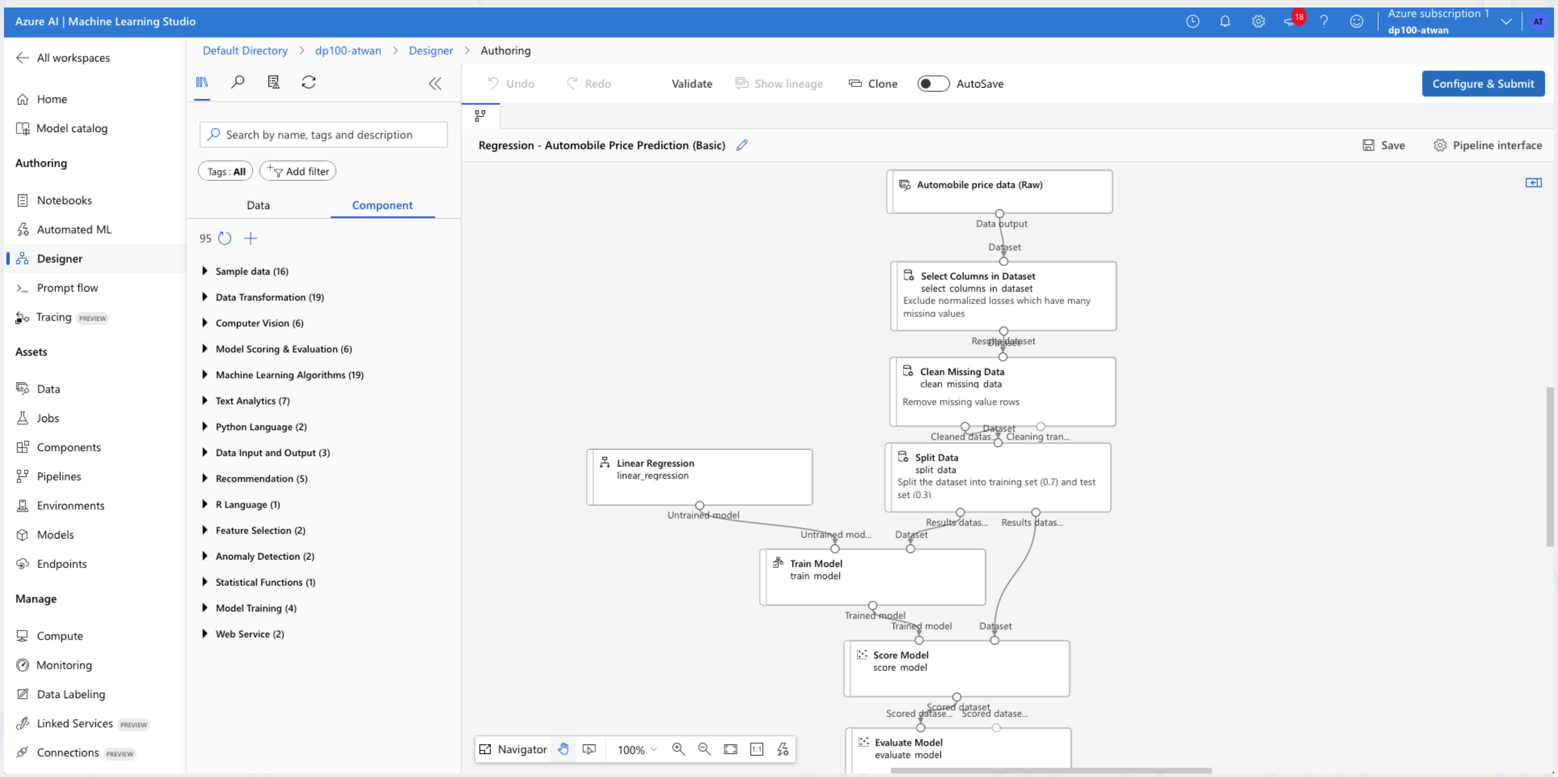
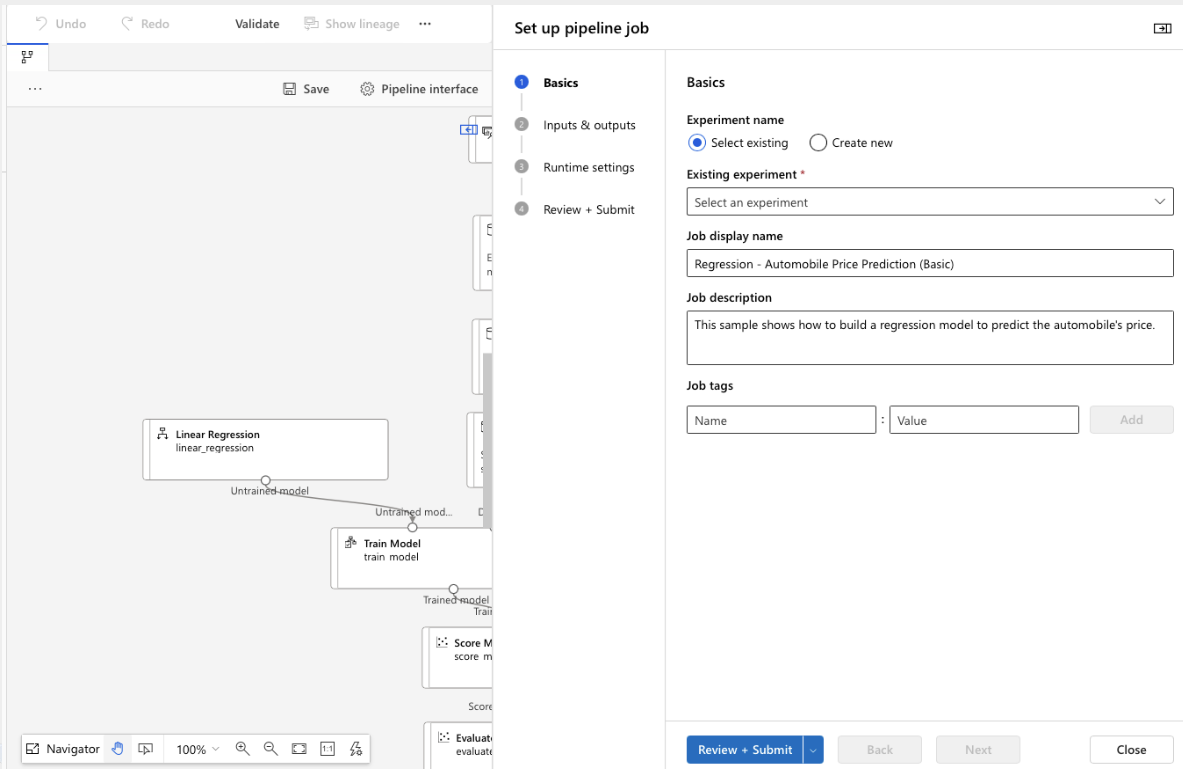
Designer

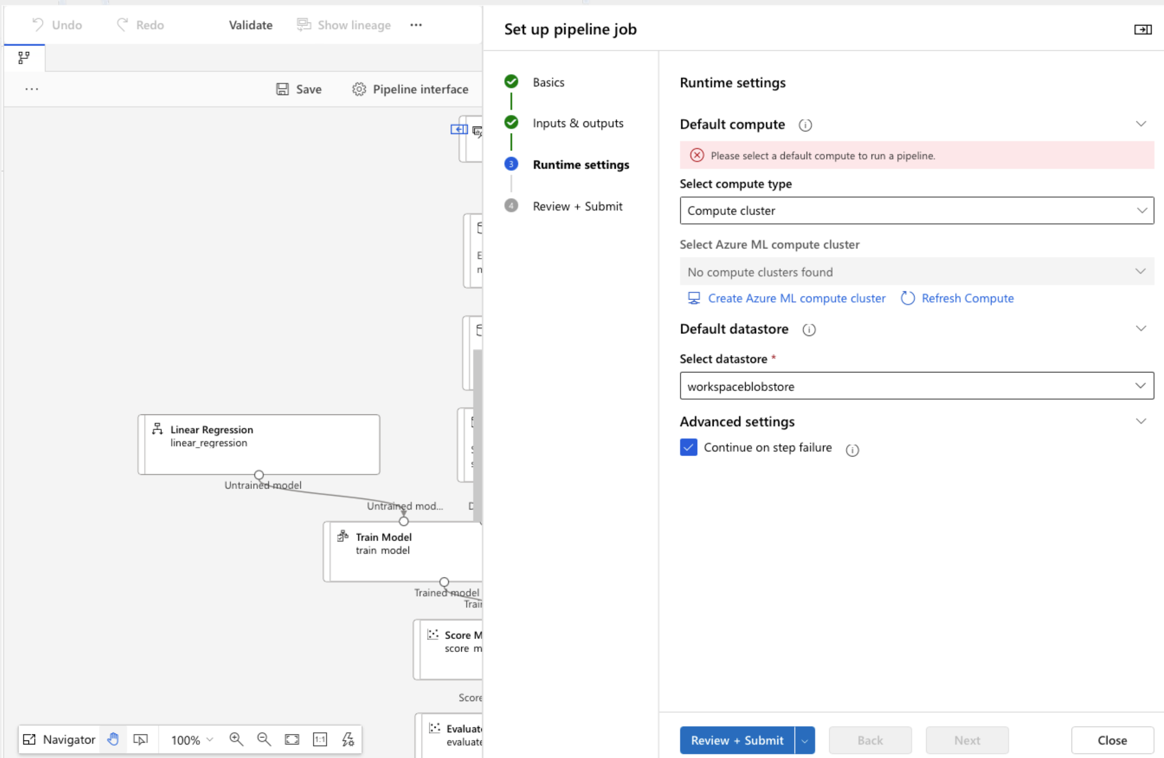

Azure AI | Machine Learning Studio
All workspaces
Home
Model catalog
Authoring
Notebooks
Automated ML
Designer
Prompt flow
Tracing
Assets
Data
Jobs
Components
Pipelines
Environments
Models
Endpoints
Manage
Compute
Monitoring
Data Labeling
Linked Services
Connections
Default Directory > dp100-atwan > Designer > Authoring
Undo
Redo
Validate
Show lineage
Clone
AutoSave
Configure & Submit
Search by name, tags and description
Tags : All
Add filter
Data
Component
Sample data (16)
Data Transformation (19)
Computer Vision (6)
Model Scoring & Evaluation (6)
Machine Learning Algorithms (19)
Text Analytics (7)
Python Language (2)
Data Input and Output (3)
Recommendation (5)
R Language (1)
Feature Selection (2)
Anomaly Detection (2)
Statistical Functions (1)
Model Training (4)
Web Service (2)
Regression - Automobile Price Prediction (Basic)
Save
Pipeline interface
Automobile price data (Raw)
Select Columns in Dataset
select columns in dataset
Exclude normalized losses which have many missing values
Clean Missing Data
clean missing data
Remove missing value rows
Linear Regression
linear_regression
Split Data
split data
Split the dataset into training set (0.7) and test set (0.3)
Train Model
train model
Score Model
score model
Evaluate Model
evaluate model
Navigator
100%

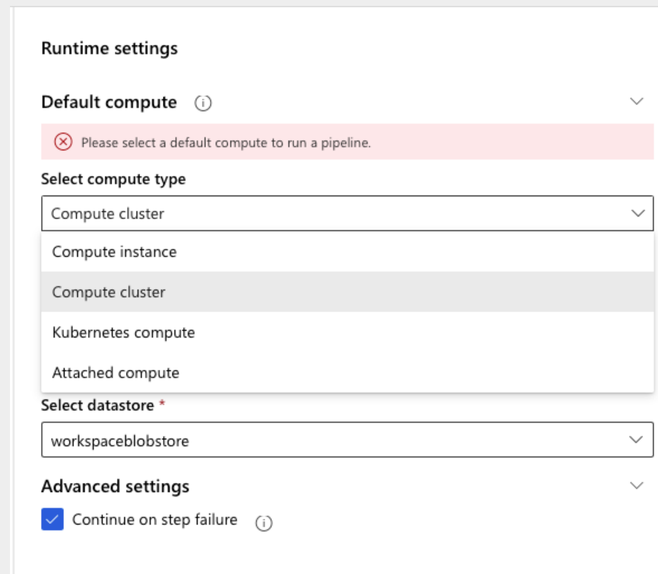
Designer



Undo
Redo
Validate
Show lineage
Save
Pipeline interface
Linear Regression
linear_regression
Untrained model
Untrained mod...
Train Model
train model
Trained model
Navigator
100%
Set up pipeline job
Basics
Inputs & outputs
Runtime settings
Review + Submit
Basics
Experiment name
Select existing
Create new
Existing experiment *
Select an experiment
Job display name
Regression - Automobile Price Prediction (Basic)
Job description
This sample shows how to build a regression model to predict the automobile's price.
Job tags
Name
Value
Add
Review + Submit
Back
Next
Close

Designer – A Compute Cluster





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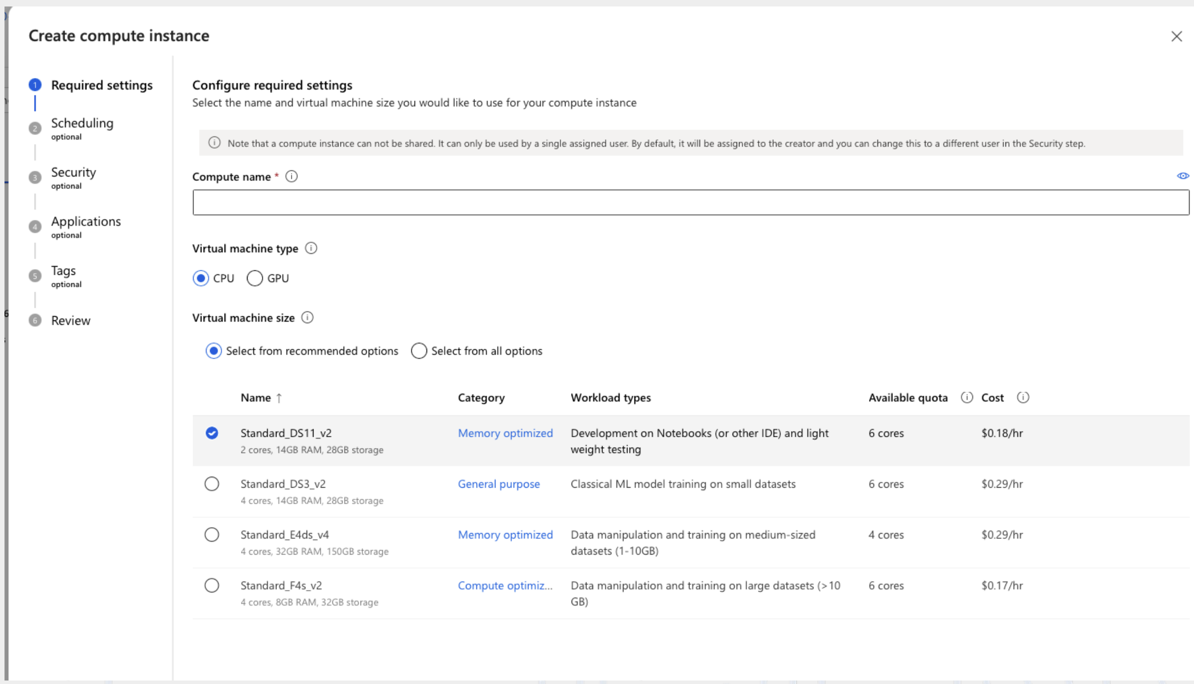
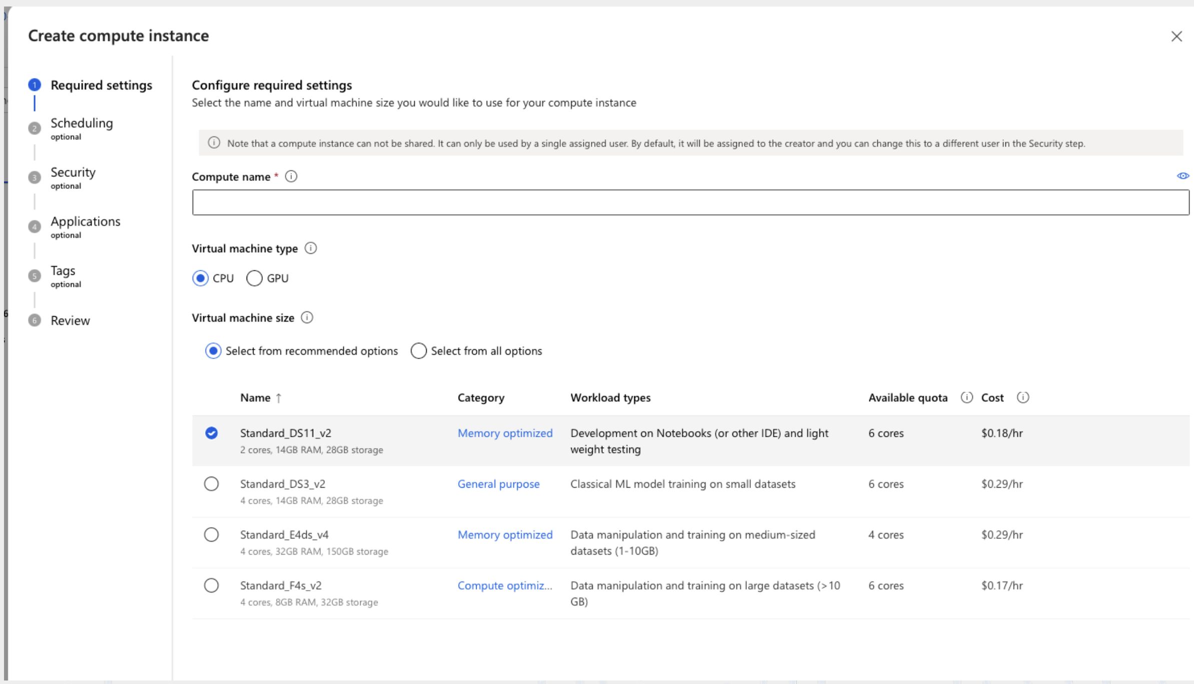
What is a Computer Instance in ML Workspace

- A compute instance is a fully managed cloud-based workstation optimized for your machine learning development environment.



What is a Computer Instance in ML Workspace

- A compute instance is a fully managed cloud-based workstation optimized for your machine learning development environment.



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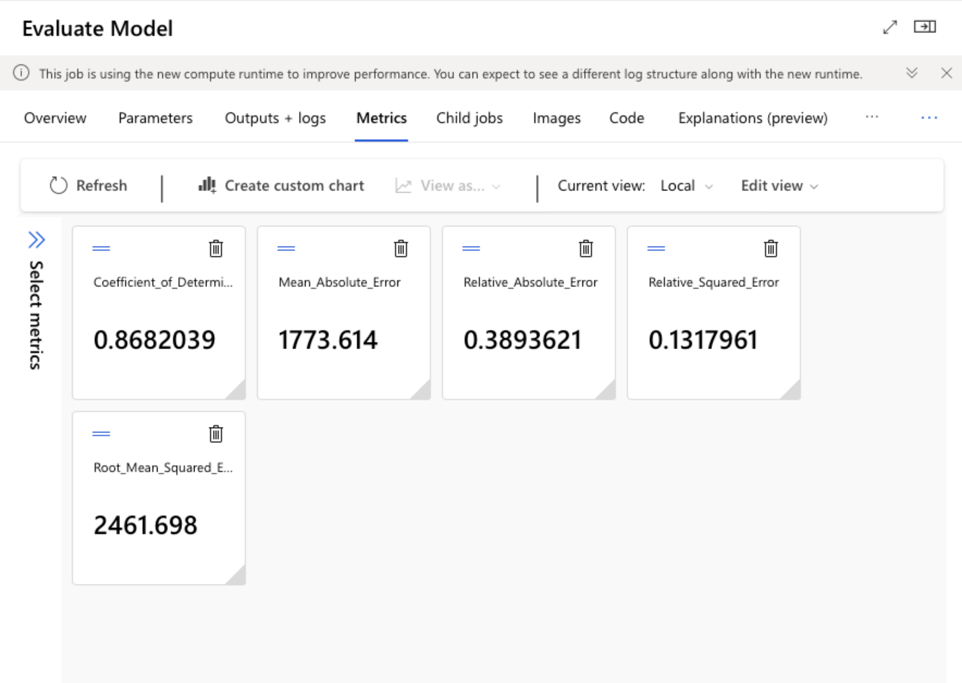
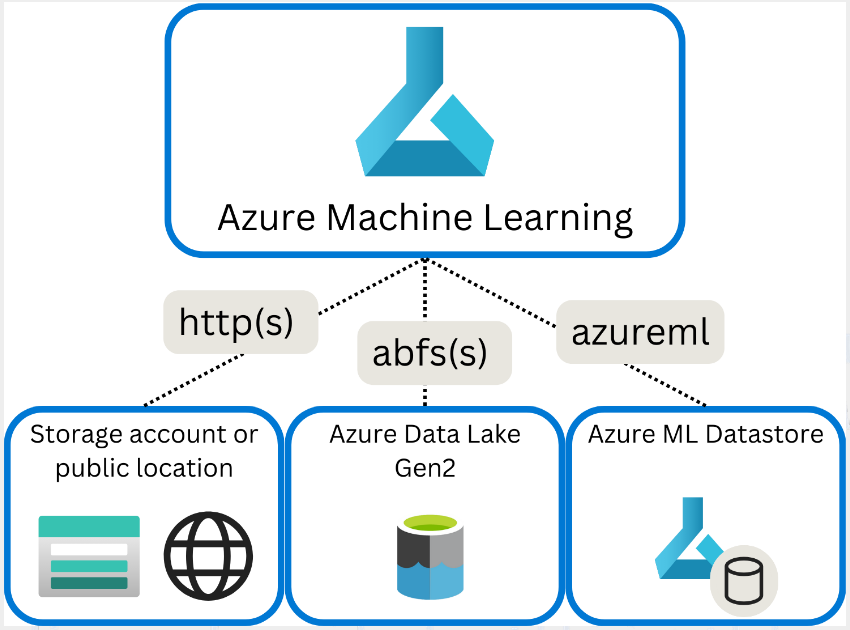


Data in Azure ML Workspace

To find and access data in Azure Machine Learning, you can use **Uniform Resource Identifiers** (**URIs**).

- http(s): Use for data stores publicly or privately in an Azure Blob Storage or publicly available http(s) location.
- abfs(s): Use for data stores in an Azure Data Lake Storage Gen 2.
- azureml: Use for data stored in a datastore.



Thank you!

If you have any additional questions, please ask!If

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