



TECH EVENTS WITH PERSPECTIVE

Visual Studio **LIVE!**
EXPERT SOLUTIONS FOR ENTERPRISE DEVELOPERS

SQL Server **LIVE!**
TRAINING FOR DBAs AND IT PROS

TECHMENTOR
IN-DEPTH TRAINING FOR IT PROS

Artificial
Intelligence **LIVE!**
AI FOR DEVELOPERS AND DATA SCIENTISTS

Cloud &
Containers **LIVE!**
CLOUD-NATIVE, PaaS & SERVERLESS COMPUTING

AIM01 - Hands-On Workshop Microsoft Azure AI Fundamentals

Carey Payette and Lino Tadros
Solliance, Inc

Level: Intermediate

The Ultimate Education Destination
ORLANDO 2022

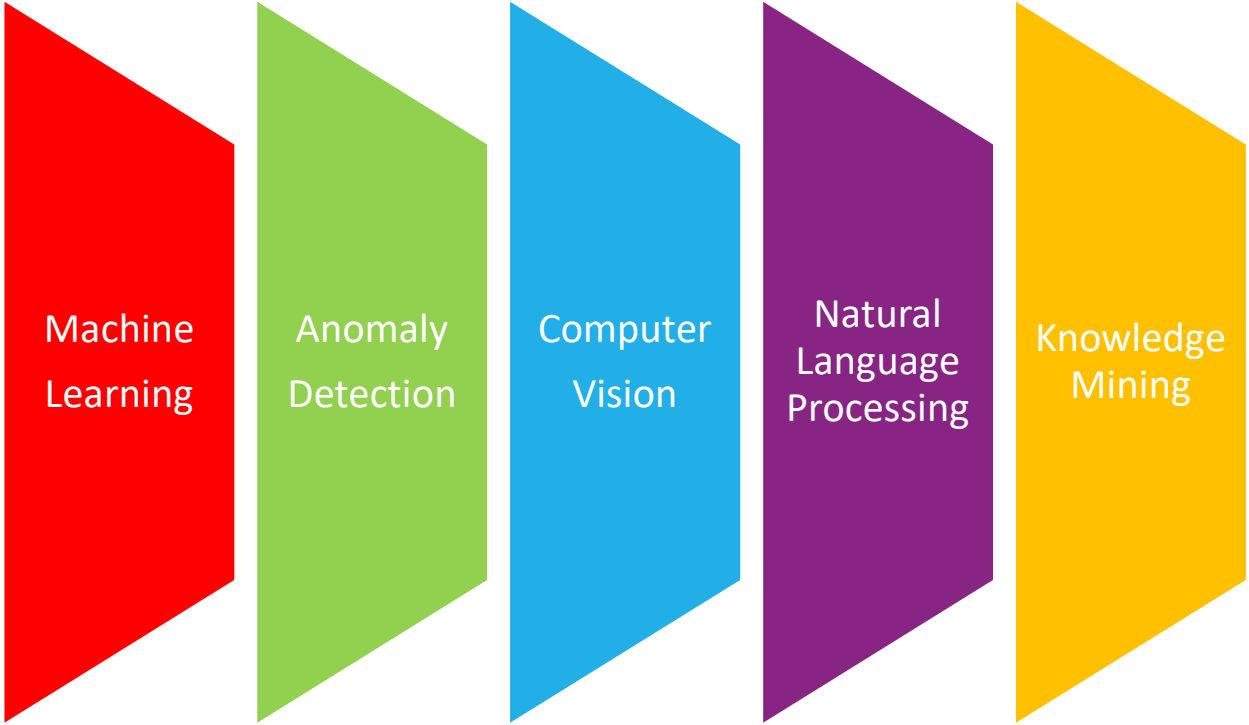
What is artificial intelligence

artificial intelligence

[,ärdə'fiSHəl in'teləjəns]

“the theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.”

Common AI Workloads



The diagram consists of five vertical chevrons pointing to the right, each a different color and containing text. From left to right, the chevrons are red, green, blue, purple, and yellow. The text inside each chevron is white and centered.

Machine
Learning

Anomaly
Detection

Computer
Vision

Natural
Language
Processing

Knowledge
Mining

Artificial Intelligence In Azure

Azure Machine Learning (AML)

Cognitive Services

Azure Bot Services

Azure Cognitive Search

With great power comes great responsibility

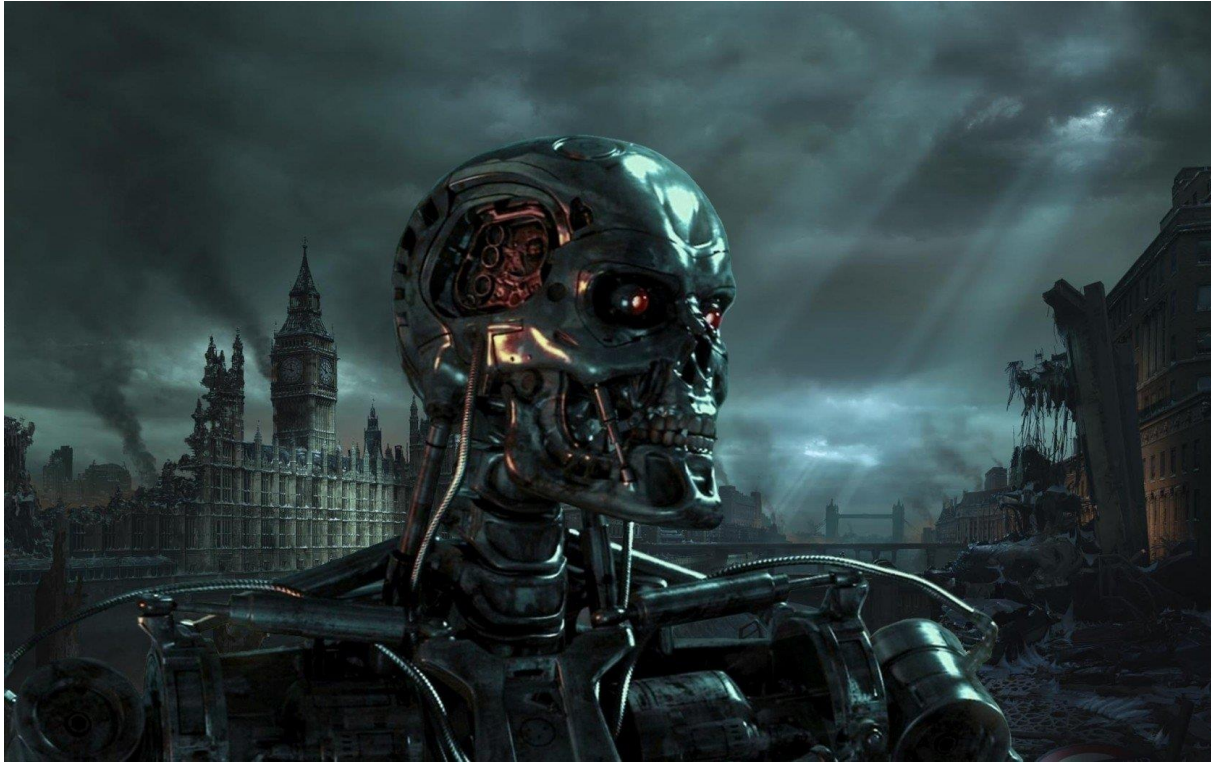


Image source: <https://wall.alphacoders.com/big.php?i=294343>

Challenges and risks of AI

Challenge or Risk	Example
Bias can affect results	A loan-approval model discriminates by gender due to bias in the data with which it was trained
Errors may cause harm	An autonomous vehicle experiences a system failure and causes a collision
Data could be exposed	A medical diagnostic bot is trained using sensitive patient data, which is stored insecurely
Solutions may not work for everyone	A predictive app provides no audio output for visually impaired users
Users must trust a complex system	An AI-based financial tool makes investment recommendations - what are they based on?
Who's liable for AI-driven decisions?	An innocent person is convicted of a crime based on evidence from facial recognition – who's responsible?

Principles of responsible AI

Fairness

“AI systems should treat all people fairly”

Reliability & Safety

“AI systems should perform reliably and safely”

Privacy & Security

“AI systems should be secure and respect privacy”

Inclusiveness

“AI systems should empower everyone and engage people”

Transparency

“AI systems should be understandable”

Accountability

“People should be accountable for AI systems”

AI Stories – Dover Fueling Solutions

- IoT Solution
- Targeted and personalized advertising
- Increased customer loyalty
- Remote monitoring
- Predictive maintenance



AI Stories - HOCHTIEF

- Documentation required for all defects encountered in a project and the steps necessary to remediate the situation
- Implementation of a phone-based system for site managers “Virtual assistant”



AI Stories - Barracuda

- Barracuda provides email and data protection and application, cloud, and network security to more than 220,000 customers worldwide
- “Data Inspector” uses AI to discover sensitive information to make compliance easier



Machine Learning

What is Machine Learning ?

“Machine learning algorithms are pieces of code that help people explore, analyze, and find meaning in complex data sets.”

ML Guiding Principles

Accountability

Reliability &
Safety

Privacy &
Security

Transparency

Inclusiveness

Fairness

ML Techniques

Supervised
Learning

Unsupervised
Learning

Reinforcement
Learning

ML Algorithms

Two Class
Classification

Multiclass
Classification

Anomaly
Detection

Regression

Clustering

Time Series

ML Workloads

Prediction

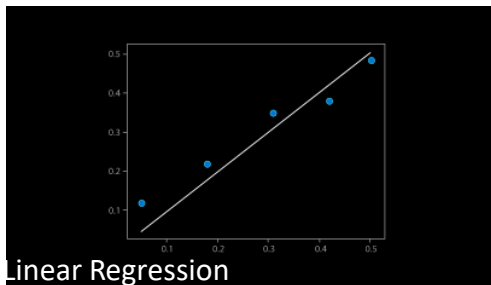
Forecasting

Anomaly
Detection

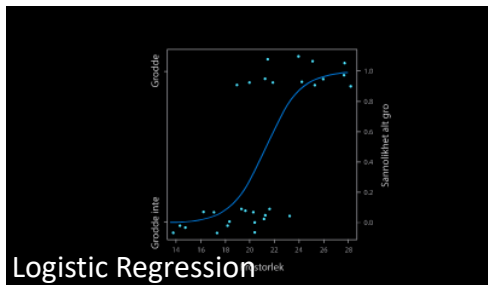
Natural
Language
Processing

Computer
Vision

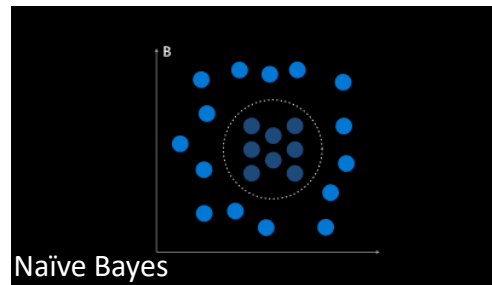
Knowledge
Mining



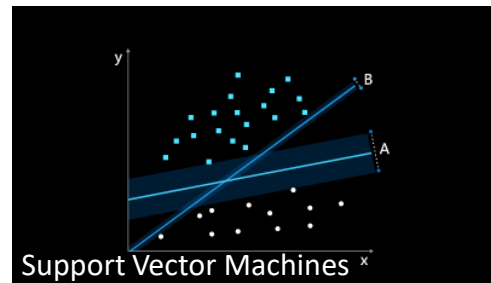
Linear Regression



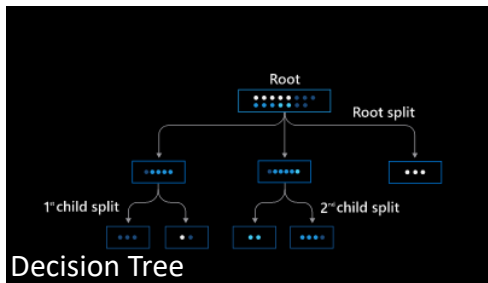
Logistic Regression



Naïve Bayes



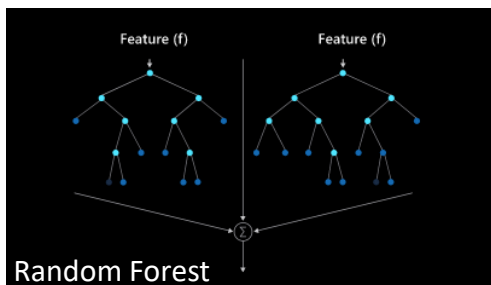
Support Vector Machines



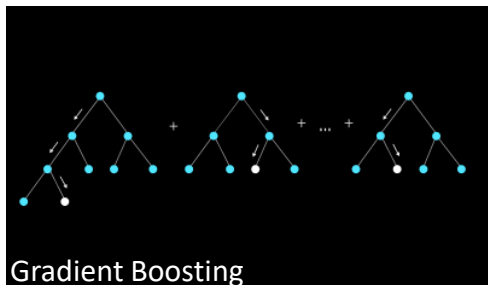
Decision Tree



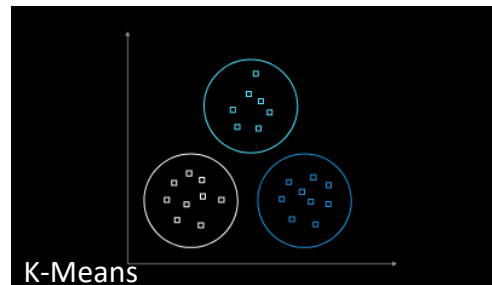
K-Nearest Neighbor



Random Forest

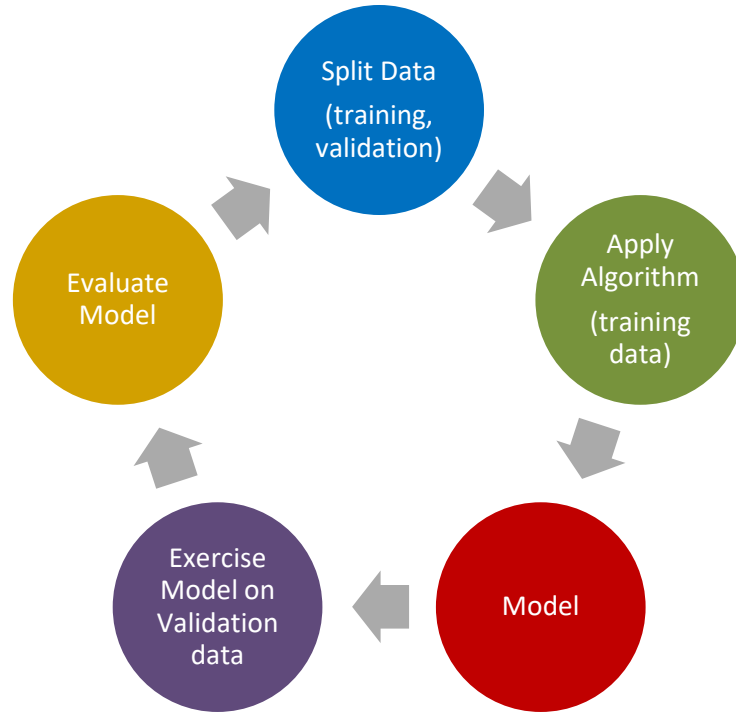


Gradient Boosting



K-Means

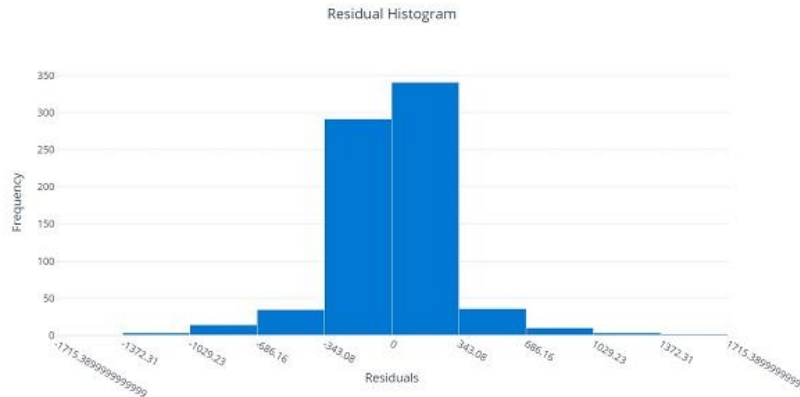
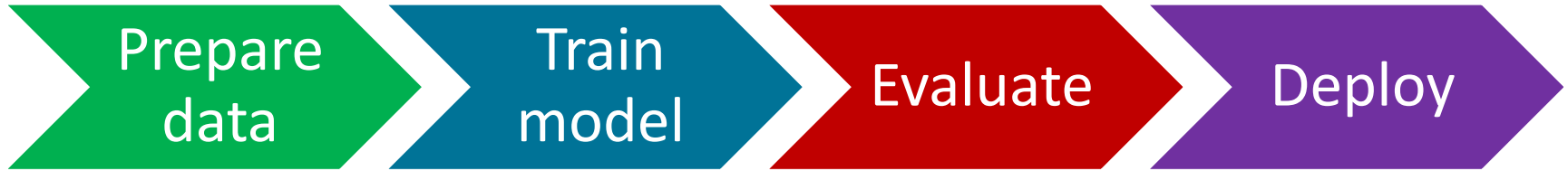
Model training and validation



Azure Machine Learning

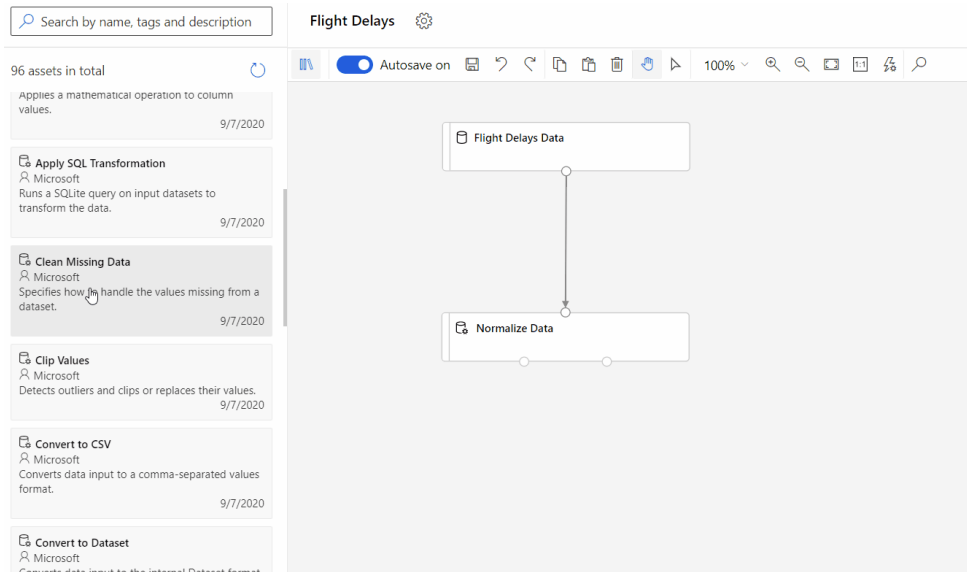
- Automated machine learning
- Azure Machine Learning designer
- Data and compute management
- Pipelines

Automated Machine Learning



Azure Machine Learning Designer

- Evaluates multiple processing techniques and model training algorithms in parallel
- Train models without extensive data science or programming knowledge
- Save time and resources by automating algorithm selection and hyperparameter tuning

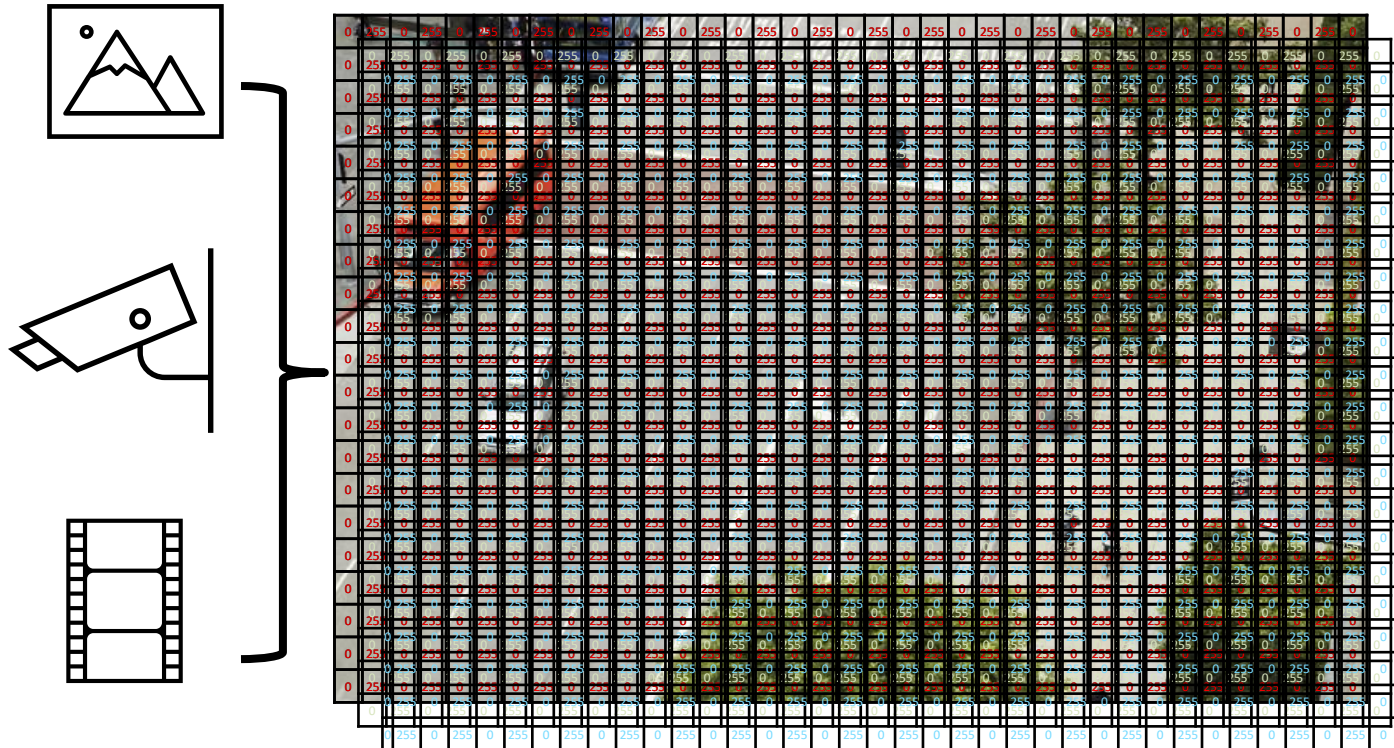


Computer Vision

What is Computer Vision?

“Computer vision is a field of artificial intelligence that enables systems to understand and interpret the content of digital images and videos.”

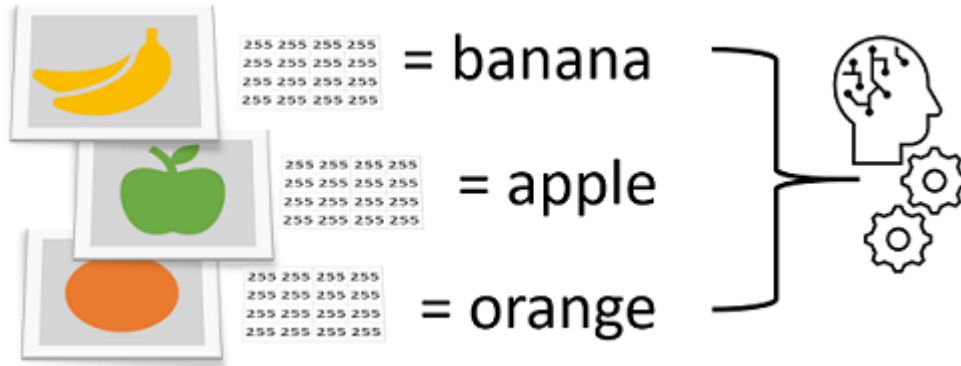
How can a system “see” ?



Applications of Computer Vision

Object Classification

- Image classification is used to determine the main subject of an image



Applications of Computer Vision

Object Detection

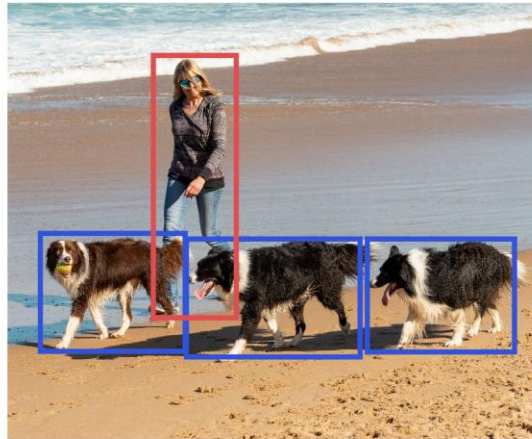
- Object detection builds upon image classification and is used to find individual objects and their locations in an image.



Applications of Computer Vision

Semantic Segmentation

- Classifies individual pixels in an image to the object with which it belongs – providing a Mask/Outline of detected objects.



Object detection

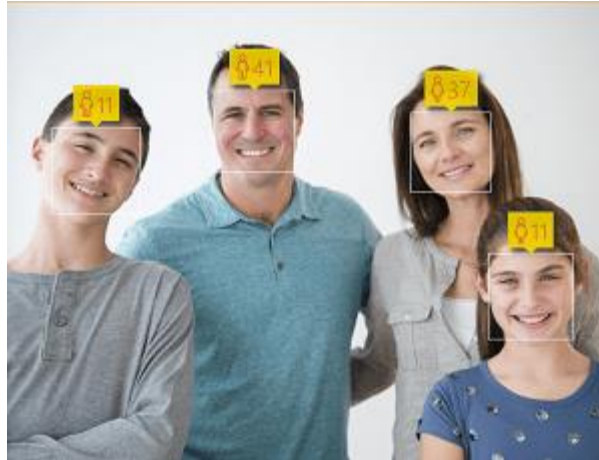


Semantic segmentation

Applications of Computer Vision

Face detection, analysis, and recognition

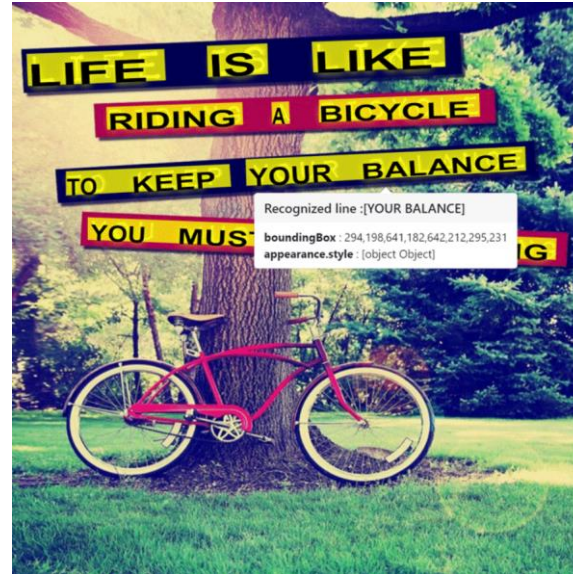
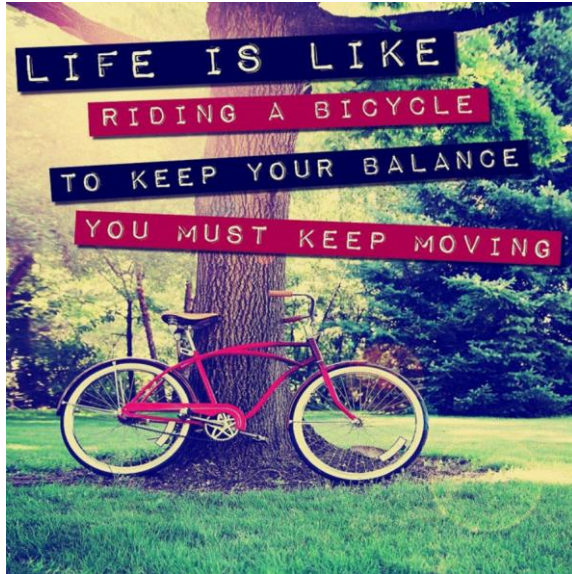
- Specialized form of object detection that identifies faces in an image.



Applications of Computer Vision

Optical Character Recognition (OCR)

- Detects and reads text in images.



Demo



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

[Try another image](#)

Azure Cognitive Services

- **“Cognitive Services” multi-service resource for:**
 - Vision(Computer Vision, Custom Vision, Face)
 - Speech
 - Language (Language Service [Text Analytics, QnA Maker, LUIS], Translator)
 - Decision (Content Moderator)
- **Each is also available as a single service**
- **Consume cognitive services with**
 - Endpoint URI
 - Subscription Key
 - (sometimes API version)

Image Analysis

- **Pre-trained model**
- **Images are required to be:**
 - JPEG, PNG, GIF, or BMP
 - Less than 4MB in size
 - Greater than 50x50 pixels
- **Accessible via the “Analyze Image” API**
- **Customize results by including additional “visualFeatures”**

Image Analysis - Tagging

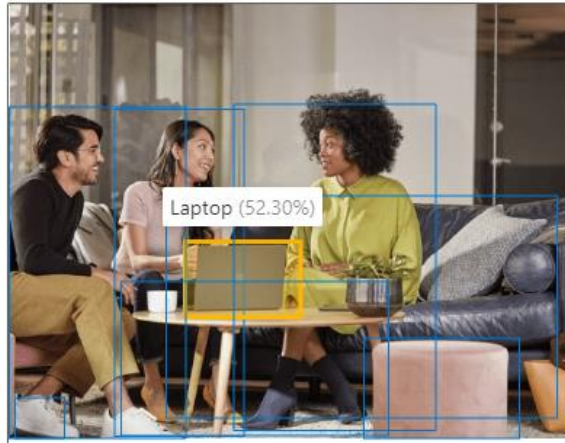
- Model is pre-trained to identify over 10K known objects
 - Living things, scenery, and actions
- Tags include foreground and background elements
- Results include a confidence score
- In visualFeatures include: “Tags”



sport (99.60%)
person (99.56%)
footwear (98.05%)
skating (96.27%)
boardsport (95.58%)
skateboarding equipment (94.43%)
clothing (94.02%)
wall (93.81%)
skateboarding (93.78%)
skateboarder (93.25%)
individual sports (92.80%)
street stunts (90.81%)
balance (90.81%)

Image Analysis – Detect objects

- Similar to tagging, only it includes a bounding box indicating the coordinates of detected objects
- Informs you if there are multiple instances of the same tag in the image
- In visualFeatures include: “Objects”



footwear (52.50%)
person (76.50%)
Laptop (52.30%)
seating (53.30%)
person (85.60%)
person (72.30%)
seating (67.80%)
table (61.30%)

Image Analysis – Detect brands

- Model is pre-trained with logos of thousands of commercial brands
- In visualFeatures include: “Brands”



JSON

Copy

```
"brands": [  
  {  
    "name": "Microsoft",  
    "rectangle": {  
      "x": 20,  
      "y": 97,  
      "w": 62,  
      "h": 52  
    }  
  }  
]
```

Image Analysis – Categorize image

- Identify and categorize an entire image, using a category taxonomy with parent/child hereditary hierarchies.
- In visualFeatures include: “Categories”



outdoor_mountain

Image Analysis – Categorize image - Categories



Image Analysis – Describe an image

- Generates human-readable captions for images.
- In visualFeatures include: “Description”



```
{
  "description": {
    "tags": ["outdoor", "building", "photo", "city", "white", "black",
    "captions": [
      {
        "text": "a black and white photo of a city",
        "confidence": 0.95301952483304808
      },
      {
        "text": "a black and white photo of a large city",
        "confidence": 0.94085190563213816
      },
      {
        "text": "a large white building in a city",
        "confidence": 0.93108362931954824
      }
    ]
  },
  "requestId": "b20bfc83-fb25-4b8d-a3f8-b2a1f084b159",
  "metadata": {
    "height": 300,
    "width": 239,
    "format": "Jpeg"
  }
}
```


Image Analysis – Detect faces

- A lighter-weight subset of the Face service
- In visualFeatures include: “Faces”



```
{
  "faces": [
    {
      "age": 23,
      "gender": "Female",
      "faceRectangle": {
        "top": 45,
        "left": 194,
        "width": 44,
        "height": 44
      }
    }
  ],
  "requestId": "8439ba87-de65-441b-a0f1-c85913157ecd",
  "metadata": {
    "height": 200,
    "width": 300,
    "format": "Png"
  }
}
```

Image Analysis – Detect image types

- Indicates if an image is clip art or a line drawing

- 0 == Non-clip-art
- 1 == Ambiguous
- 2 == Normal-clip-art
- 3 == Good-clip-art

- In visualFeatures include: “ImageType”



```
{
  "imageType": {
    "clipArtType": 3,
    "lineDrawingType": 0
  },
  "requestId": "88c48d8c-80f3-449f-878f-6947f3b35a27",
  "metadata": {
    "height": 225,
    "width": 300,
    "format": "Jpeg"
  }
}
```

Image Analysis – Detect domain-specific content

- Identify celebrities or landmarks
- In “details” query parameter include: “Celebrities” or “Landmarks”



```
{
  "result": {
    "celebrities": [{
      "faceRectangle": {
        "top": 391,
        "left": 318,
        "width": 184,
        "height": 184
      },
      "name": "Satya Nadella",
      "confidence": 0.99999856948852539
    }]
  },
  "requestId": "8217262a-1a90-4498-a242-68376a4b956b",
  "metadata": {
    "width": 800,
    "height": 1200,
    "format": "Jpeg"
  }
}
```

Image Analysis – Detect color scheme

- Identifies the dominant foreground color, the dominant background color, and the larger set of dominant colors in the image, as well as an accent color returned in hexadecimal
- Possible colors: black, blue, brown, gray, green, orange, pink, purple, red, teal, white, and yellow
- In visualFeatures include: “Color”



```
{  
  "color": {  
    "dominantColorForeground": "Black",  
    "dominantColorBackground": "Black",  
    "dominantColors": ["Black", "White"],  
    "accentColor": "BB6D10",  
    "isBwImg": false  
  },  
  "requestId": "0dc394bf-db50-4871-bdcc-13707d9405ea",  
  "metadata": {  
    "height": 202,  
    "width": 300,  
    "format": "Jpeg"  
  }  
}
```

Image Analysis – Detect adult content

- **In visualFeatures include: “Adult”**
- **Returns boolean values for:**
 - isAdultContent
 - isRacyContent
 - isGoryContent
- **As well as their associated scores:**
 - adultScore
 - racyScore
 - goreScore

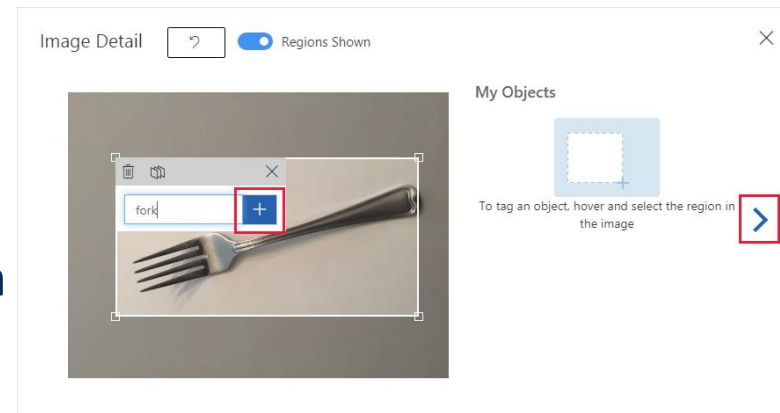
Get Area of Interest / Generate a Thumbnail

- **“Get Area of Interest” API**
 - Determine the main object of the image
- **“Generate Thumbnail” API**
 - Smart-crop based on the are of interest



Custom Vision Service

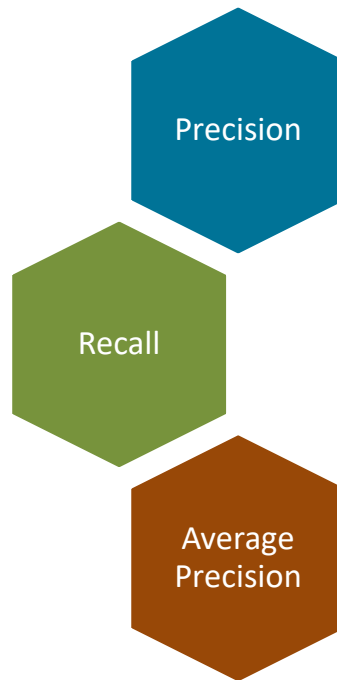
- **Train vision models by uploading and tagging your own images**
 - JPG, PNG, BMP, or GIF
 - Less than 6MB in size (4MB for prediction images)
 - No less than 256px on the shortest edge
 - Min. 15 images per tag
- **<https://www.customvision.ai>**
- **Image classification and object detection**



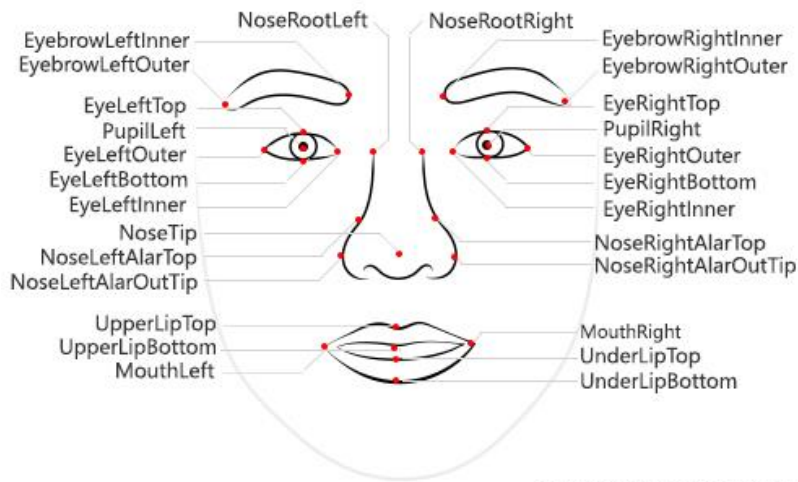
Consuming the Custom Vision Service

- **To consume the custom vision service, you will need:**
 - Project ID
 - Model Name
 - Prediction Endpoint
 - Prediction Key

Evaluating a Custom Vision model



Face Service



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Face detection (Detect API)

- Bounding box

Facial landmark location (Detect API)

- Coordinates of pupils, tip of nose, etc.

Facial attribute analysis (Detect API)

- Used to infer age, emotional state, etc.

Facial comparison (Find Similar API)

- Identify similar faces

Facial recognition (Identify & Verify API)

- Identify returns closest matches (1-many)
- Verify determines if two faces belong to the same person (1-1)

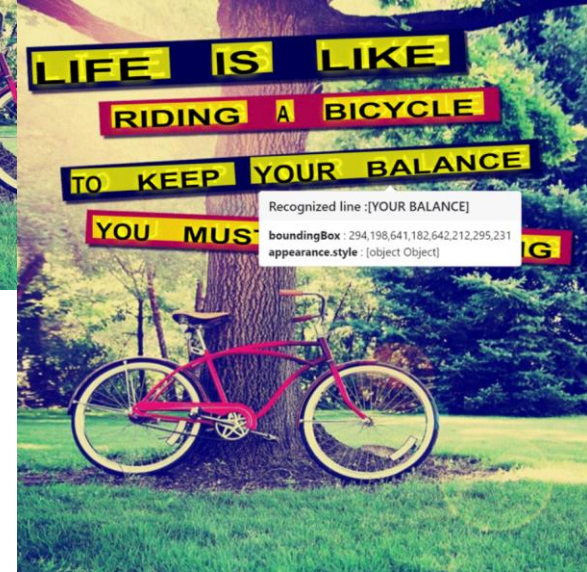
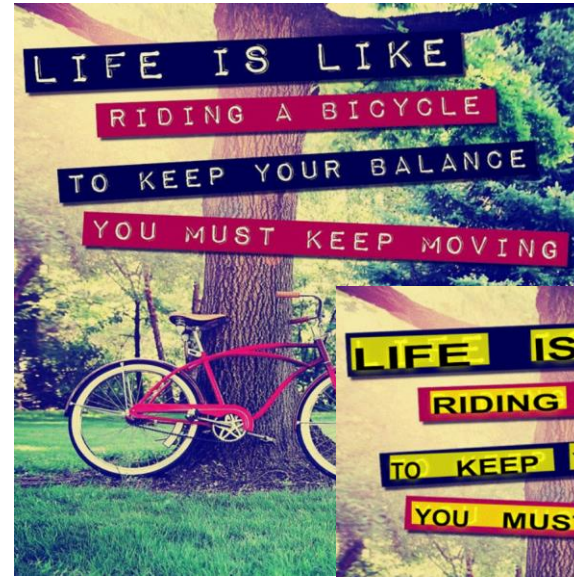
Consuming the Face Service

- **Consume the face service using**
 - key
 - Endpoint
- **Image requirements**
 - JPG, PNG, GIF, BMP
 - 4 MB or smaller
 - Face size range 36x36 to 4096x4096 px

OCR

■ OCR API

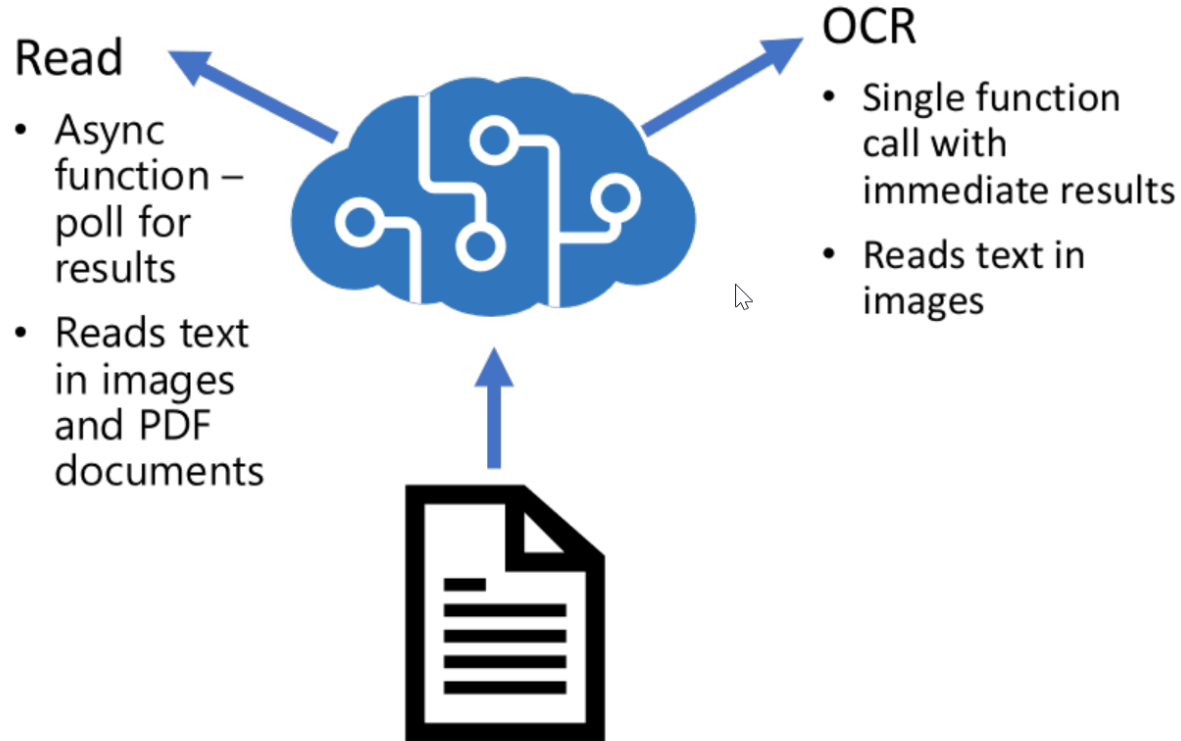
- Meant for quick extraction of small amounts of text from images
- Operates synchronously
- Returns
 - Regions (location in the image)
 - Lines of text
 - Words in each line of text



(OCR) Read API

- Extracts text from images and PDF documents
- Greater accuracy than OCR API
- Can extract handwritten text (English only)
- Asynchronous

OCR vs Read API



Form Recognizer

- **Automated processing of data**
 - Hand-filled/digital scan or image
- **Pre-built models available for**
 - Receipts
 - W-2
 - ID Document
 - Business Card
 - Invoice
 - General document
 - Read*

* Some features currently in preview

Applied AI | Form Recognizer Studio - Preview

Form Recognizer Studio > Layout

Layout Service resource: cs-play-2

+ Add

layout.png

layout-checklist.jpg

layout-report.png

Analyze API version: 2022-01-30-preview

Booking Confirmation - ORIGINAL

Order reference: 3456623
Your reference: 2334566
BLIND: EUR4234
Summary: 45472

Booking date: 05-Dec-2018
Contract No: 334566

Opt. A Opt. B

Export: Comment

Export empty pick up depot(s)

97 Morris Lane
Sterling Heights, MI 48310

Loc	By	Due	ETA
119 Queen Street Hoboken, NJ 07030	cause science slow	09-Dec-2018 19:00	09-Dec-2020 11:00
9 Ketch Harbour Ave. Vincentown, NJ	tone late spoken	12-Dec-2018 10:00	19-Dec-2020

Deadline	Location	Date/Time (local)	Required action
Table	Harleysville (PA)	08-Dec-2019 13:00	Nobody loves a pig wearing lipstick.
Flight	Harleysville (PA)	08-Dec-2019	Two more days and all his problems would be solved.
Round	Harleysville (PA)	09-Dec-2019	
Accent	Harleysville (PA)	10-Dec-2019	
Monkey	Harleysville (PA)	11-Dec-2019	
Route	Harleysville	11-Dec-2019	Remember don't miss out

1 of 1

Content Result Code

Python

```
1 """
2 This code sample shows Prebuilt Layout opera
3 The async versions of the samples require Py
4
5 To learn more, please visit the documentatio
6 https://docs.microsoft.com/en-us/azure/appl
7
8
9 from azure.core.credentials import AzureKeyC
10 from azure.ai.formrecognizer import Document
11
12 endpoint = "YOUR_FORM_RECOGNIZER_ENDPOINT"
13 key = "YOUR_FORM_RECOGNIZER_SUBSCRIPTION_KEY"
14
15 formurl = "https://raw.githubusercontent.com
16
17 document_analysis_client = DocumentAnalysisC
18 endpoint=endpoint, credential=AzureKeyCr
19 )
20
21 poller = document_analysis_client.begin_anal
22 result = poller.result()
23
24 for idx, style in enumerate(result.styles):
25     print(
26         "Document contains {} content".format
27         "handwritten" if style.is_handwritt
28     )
29
30 for page in result.pages:
31     for line_idx, line in enumerate(page.lin
```

Form Recognizer – Layout API

- Another pre-built model
 - Introspects form, identifies tables, labels, and input automatically

The screenshot displays the Azure Form Recognizer interface. On the left, a scanned document from 'Liberty's Delightful Sinful Bakery & Café' is shown. The document includes contact information, a booking confirmation, and a table of shipping schedules. A red arrow points from the 'Shipping' table in the document to the corresponding 'words' array in the JSON output on the right. The JSON output is a detailed representation of the document's structure, including page information, bounding boxes, and the content of each element.

API version: 2021-09-30-preview

Result Code

JSON

```
1 {
2   "apiVersion": "2021-09-30-preview",
3   "modelId": "prebuilt-layout",
4   "stringIndexType": "textElements",
5   "content": "Liberty's Delightful Sinful Bakery
6   \"pages\": [
7     {
8       \"pageNumber\": 1,
9       \"angle\": 0,
10      \"width\": 909,
11      \"height\": 1177,
12      \"unit\": \"pixel\",
13      \"words\": [
14        {
15          \"content\": \"Liberty's\",
16          \"boundingBox\": [
17            47,
18            51,
19            113,
20            51,
21            114,
22            69,
23            48,
24            69
25          ],
26          \"confidence\": 0.993,
27          \"span\": {
```


Form Recognizer – Custom model

- Interpret specific forms or documents
- Train with as few as 5 documents
- Requirements
 - JPG, PNG, BMP, TIFF, PDF
 - Less than 2K pages (free max 2 pages)
 - PDF Max 17x17"
 - Total size of training data 500 pages or less
 - Unsupervised
 - Data must have keys and values
 - Keys need to be above or to the left of values
 - PDF can't be password protected/locked

Custom form models

Custom form models work well when the target documents share a common visual layout. Training only takes a few minutes, and more than 100 languages are supported.

Form **W-9**
Rev. October 2019
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification
Go to www.irs.gov/FormW9 for instructions and the latest information.

Give Form to the requester. Do not send to the IRS.

1. Name (see instructions on your income tax return). Name is required on this line; do not leave this line blank.

JAMIE DOE

2. Business (non-employee) entity name, if different from above

ARCHER INC.

3. Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only one of the following seven boxes.

☒ Individual sole proprietor or single-member LLC ☐ S Corporation ☐ C Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (LLC, S corporation, C corporation, Partnership, etc.) in the box below for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner for tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions)

4. Exemption codes apply only to certain entities, not individuals; see instructions on page 5.

Exempt payee code (if any) **0**

Exemption from FATCA reporting code (if any) **0**

5. Address (number, street, and apt. or suite no.) See instructions.

101 WEST ADDRESS

6. City, state, and ZIP code

SEATTLE WA 98108

7. Taxpayer's name and address (optional)

JAMIE DOE

NLP – Natural language Processing

What is NLP?

“Natural Language Processing is the definition of how well a computer is able to process large amount of natural data.”

NLP Techniques

Key Phrase Extraction

Entity Recognition

Sentiment Analysis

Translation

Speech
Recognition/Synthesis

Semantic language
modeling

NLP in Azure

Service	Capabilities
Language	Language detection Key phrase extraction Entity detection Sentiment analysis Question answering Conversational language understanding
Speech	Text to speech Speech to text Speech translation
Translator	Text translation
Azure Bot Service	Platform for conversational AI

Key Phrases Demo

Languages Demo

Sentiments Demo

Entity Recognition Demo

Translator Demo

Speech To Text Demo

Text To Speech Demo

Question Answering

- A knowledgebase consists of question and answer pairs
- Import from csv, tsv, URL (FAQ), chit-chat
- Question Answer Pairs include:
 - All the alternate forms of the question
 - Metadata tags used to filter answer choices during the search
 - Follow-up prompts to continue the search refinement

Conversational Language Understanding (or the service formerly known as LUIS)

INTENTS

ENTITIES

Prebuilt
Domains

Utterances

Publishing
The Model

Testing The
Endpoints

What is Conversational AI?

“Conversational AI provides a way for systems (bots/agent/virtual assistants) to communicate clearly, naturally, and effectively through speech or text”

Applications of Conversational AI

Voice calls

Messaging
services

Online chat

Email

Social media

Collaborative
workplace
tools

How to make a bot successful

- Is the bot discoverable?
- Is the bot intuitive and easy to use?
- Is the bot available on devices and platforms that users care about?
- Can users solve their problems with minimal use and bot interaction?
- Does the bot solve the user issues better than alternative experiences?

Responsible AI Guidelines for Bots

- 1) Articulate the purpose of your bot and take special care if your bot will support consequential use cases.
- 2) Be transparent about the fact that you use bots as part of your product or service.
- 3) Ensure a seamless hand-off to a human where the human-bot exchange leads to interactions that exceed the bot's competence.
- 4) Design your bot so that it respects relevant cultural norms and guards against misuse.
- 5) Ensure your bot is reliable.
- 6) Ensure your bot treats people fairly.
- 7) Ensure your bot respects user privacy.
- 8) Ensure your bot handles data securely.
- 9) Ensure your bot is accessible.
- 10) Accept responsibility for your bot operation and how it affects people.

Demo



Session Survey

- Your feedback is very important to us
- Please take a moment to complete the session survey found in the mobile app
- Use the QR code or search for “Converge360 Events” in your app store
- Find this session on the Agenda tab
- Click “Session Evaluation”
- Thank you!

