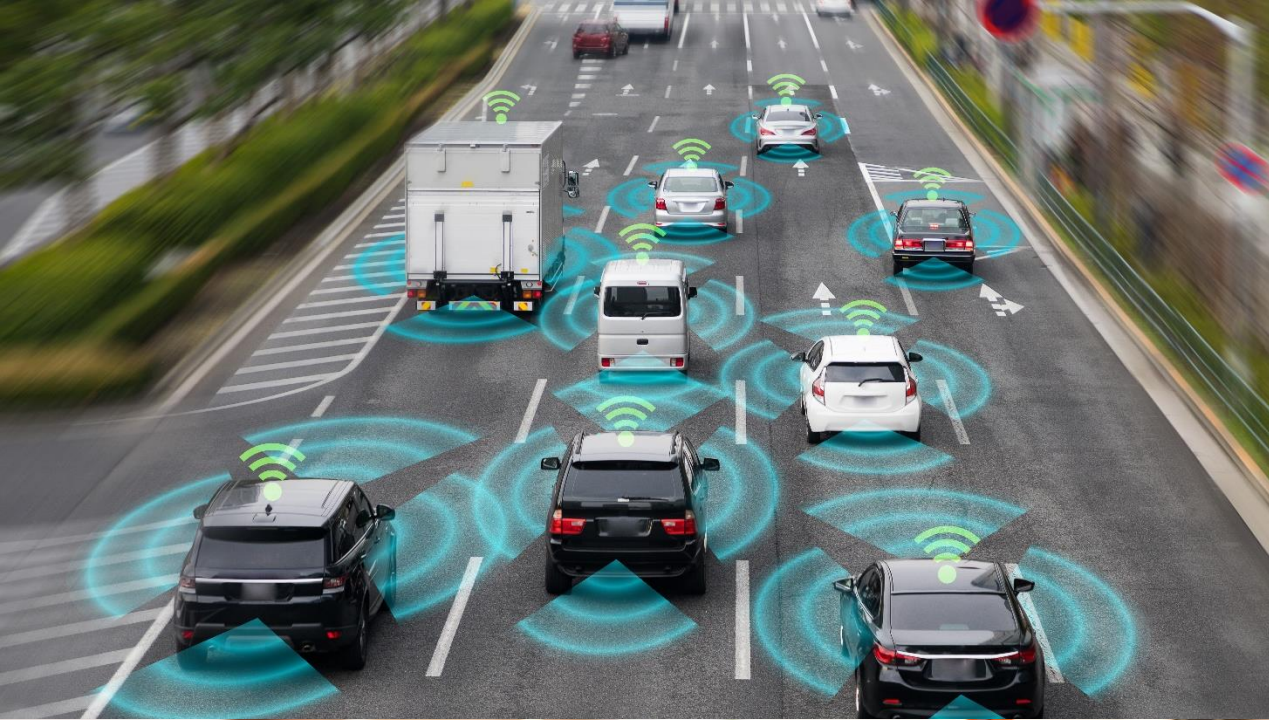


AI for Everything

A Survey of Modern AI Capabilities

Matthew Renze
Renze Consulting



Economic Impacts of AI by 2030

+\$13T GDP
(+16%)

Economic Impacts of AI by 2030

+\$13T GDP
(+16%)

-600M jobs
(-22%)

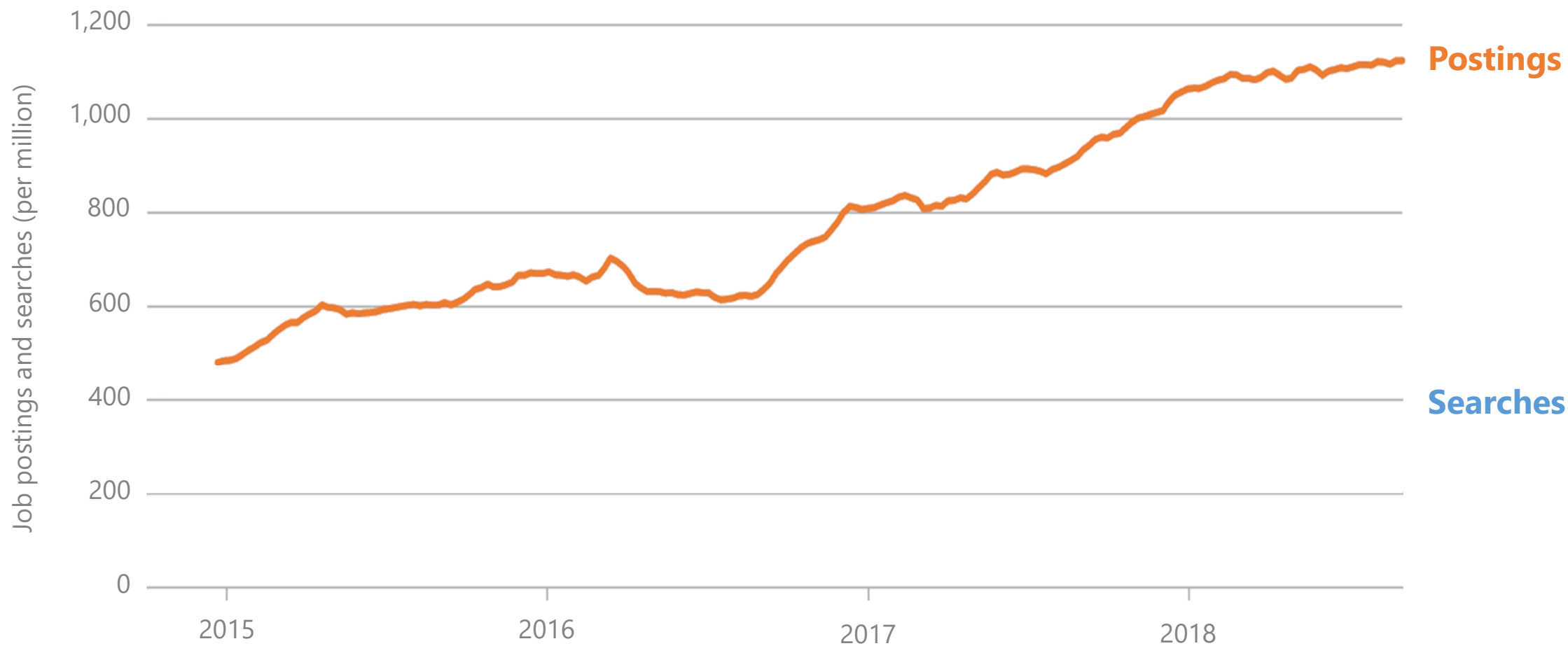
Economic Impacts of AI by 2030

+\$13T GDP
(+16%)

-600M jobs
(-22%)

+700M jobs
(+25%)

AI Job Postings vs. Searches



The Key Questions

What is possible
with modern AI?

The Key Questions

What is possible
with modern AI?

How do I add AI
to my products?

The Key Questions

What is possible
with modern AI?

How do I add AI
to my products?

Will AI provide
us real value?



Purpose

To survey the most popular
modern data-driven AI tools

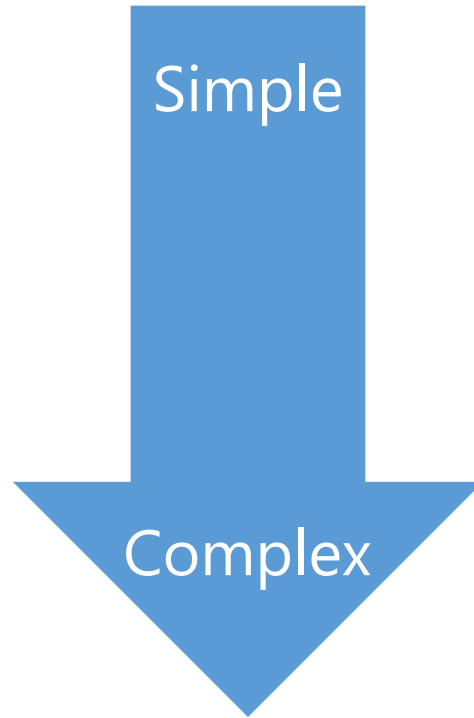
Overview

1. AI for Tables
2. AI for Text
3. AI for Audio
4. AI for Images
5. AI for Video
6. AI for Apps
7. AI for Systems



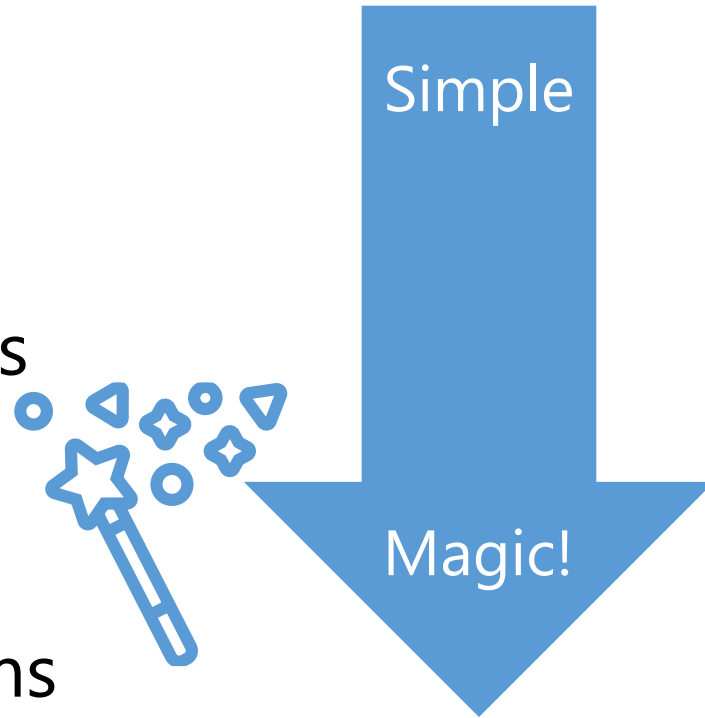
Overview

1. AI for Tables
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Overview

1. AI for Tables
2. AI for Text
3. AI for Audio
4. AI for Images
5. AI for Video
6. AI for Apps
7. AI for Systems



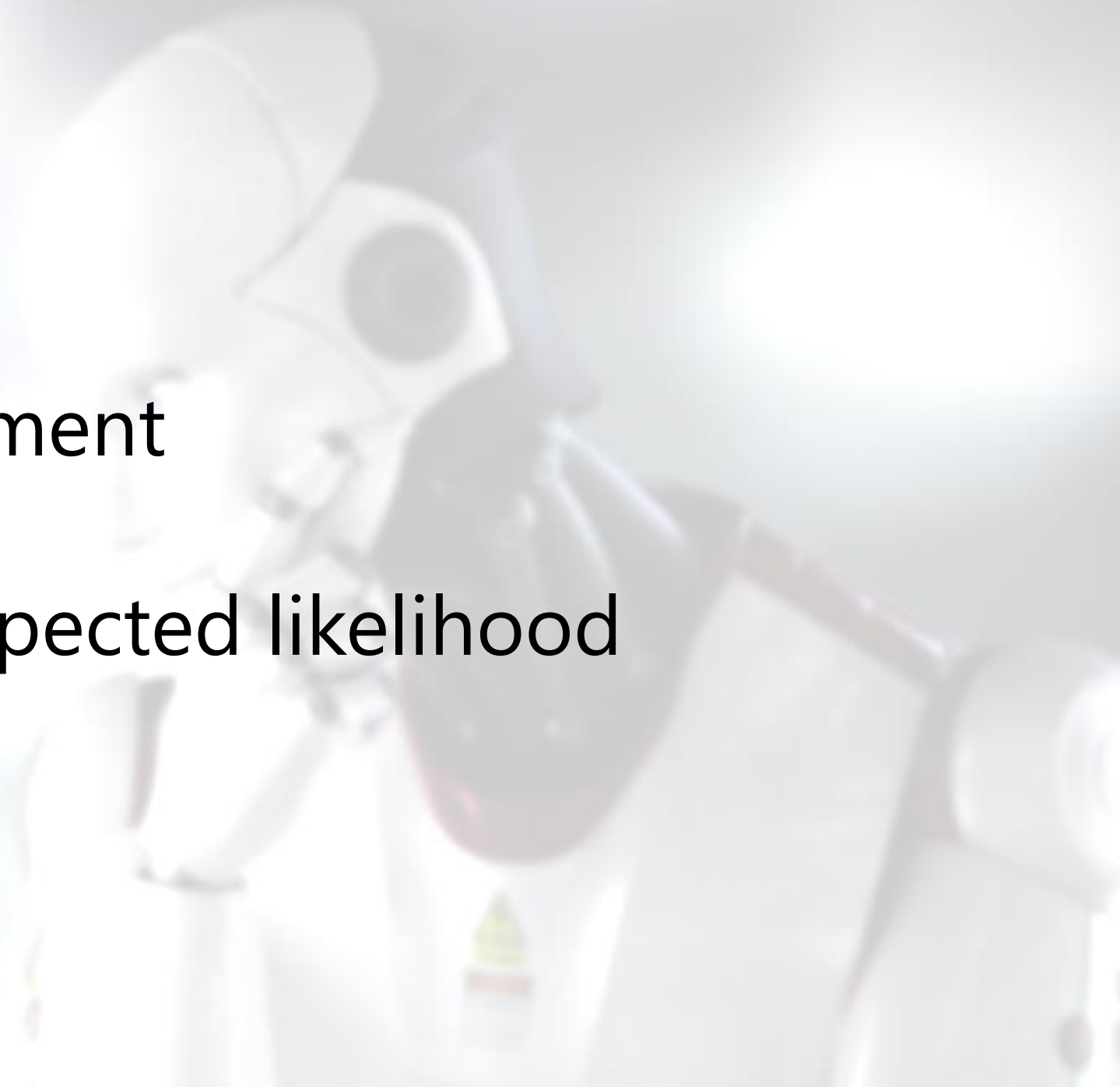


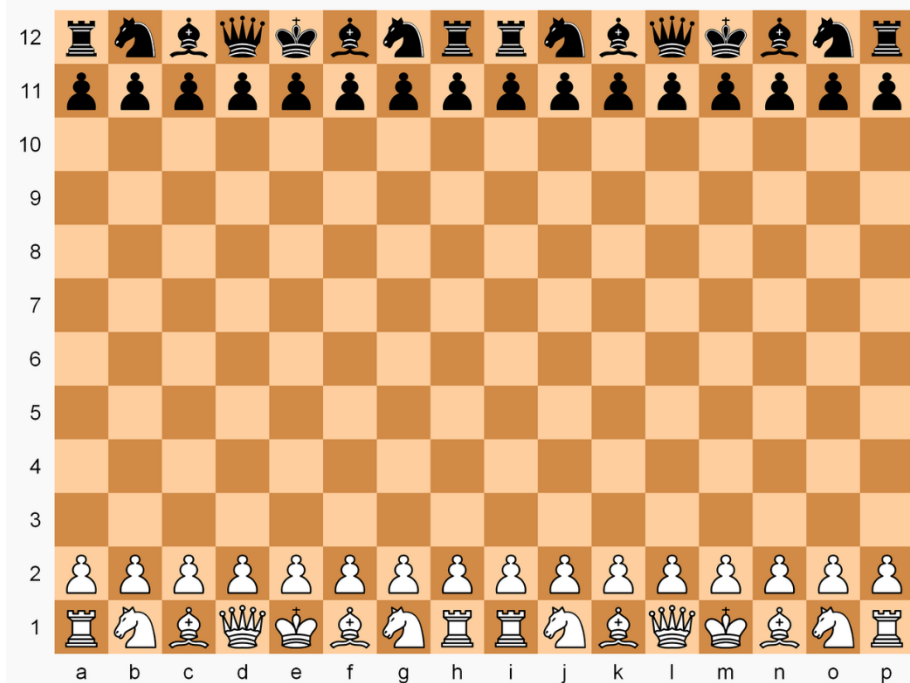


What Is AI?



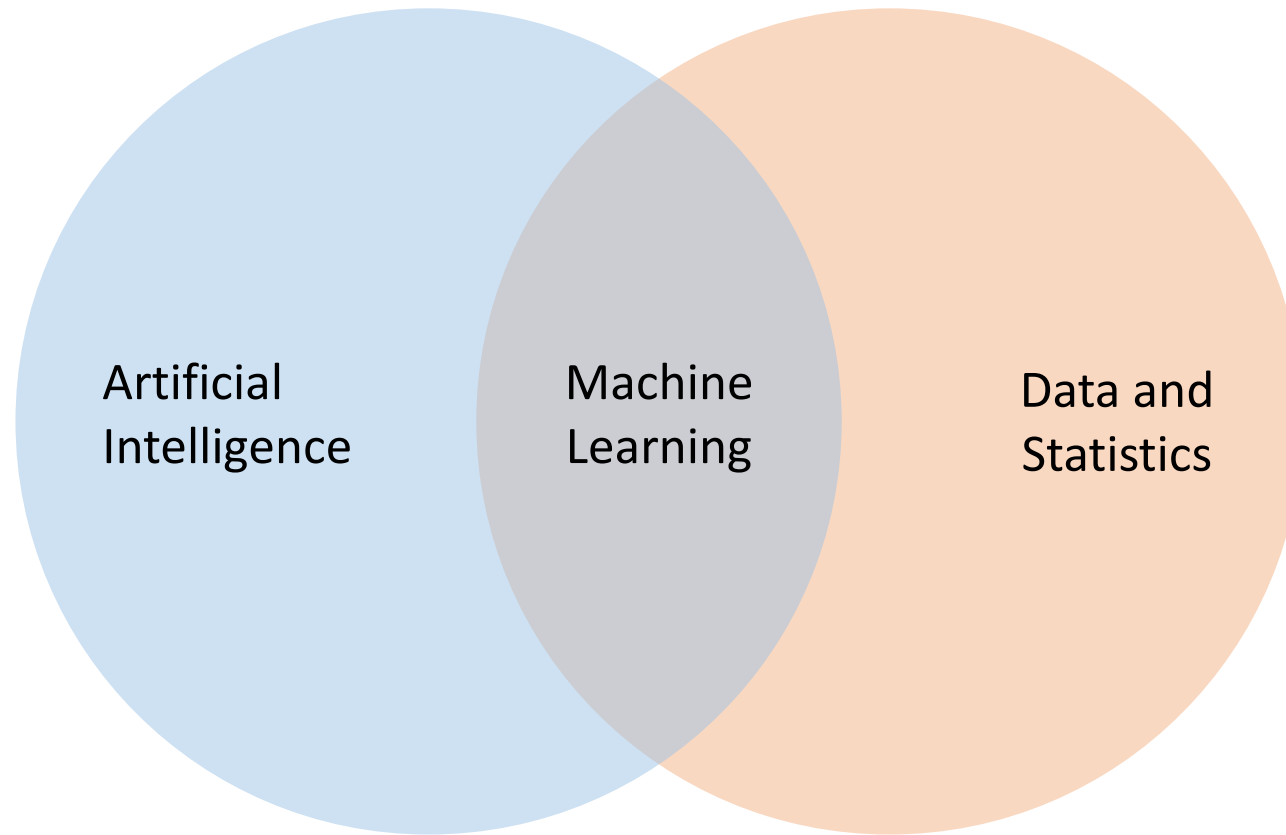
A machine that
perceives its environment
and chooses actions
that maximize the expected likelihood
of achieving a goal



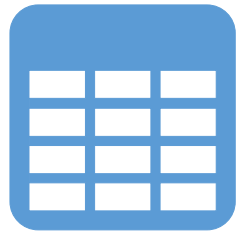


What is machine learning?

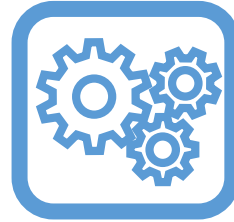
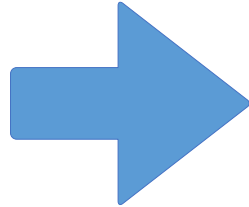
Machine Learning



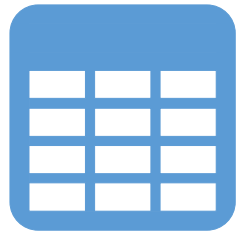
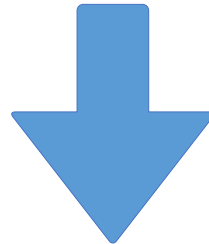
Machine Learning



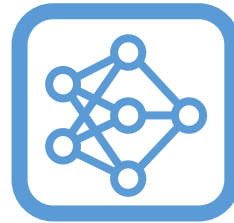
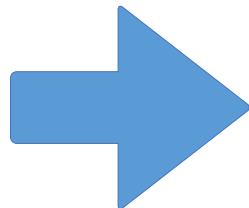
Data



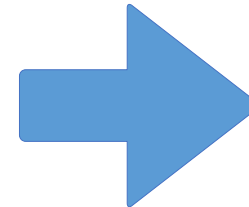
Algorithm



New data

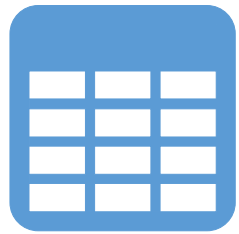


Model

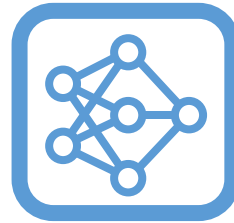
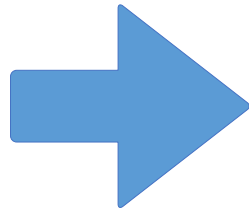


Prediction

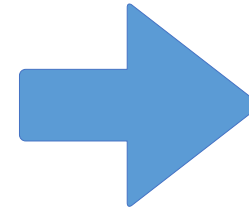
Machine Learning



New data



Model



Prediction

input



$f(x)$



output

Machine Learning



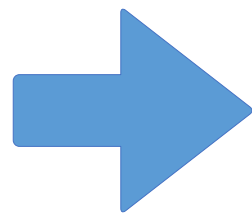
ML Task Types

Analysis

Synthesis

ML Task Types

Analysis



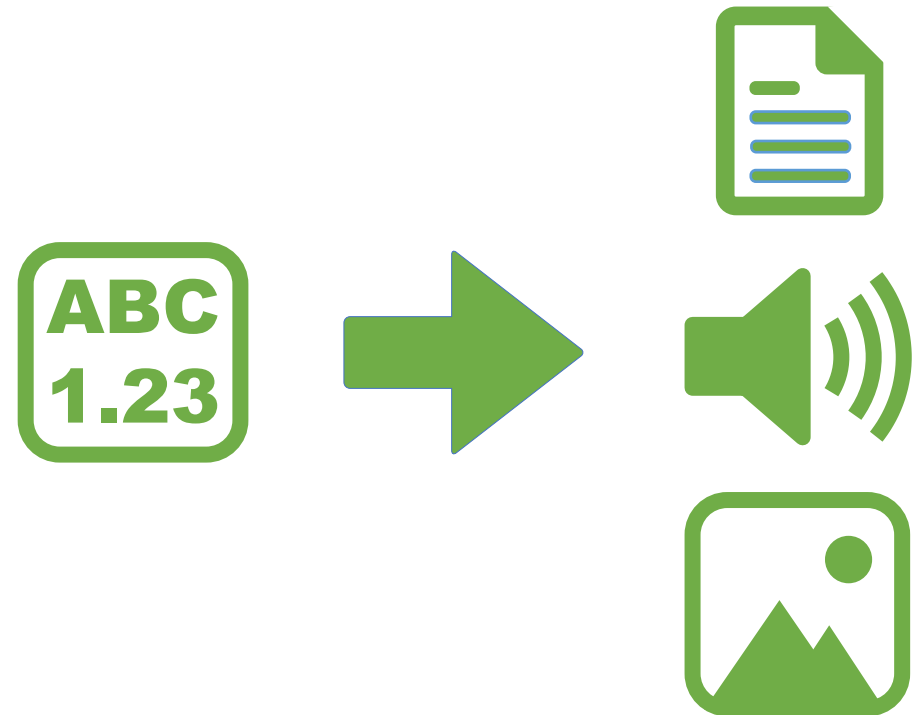
Synthesis

ML Task Types

Analysis



Synthesis

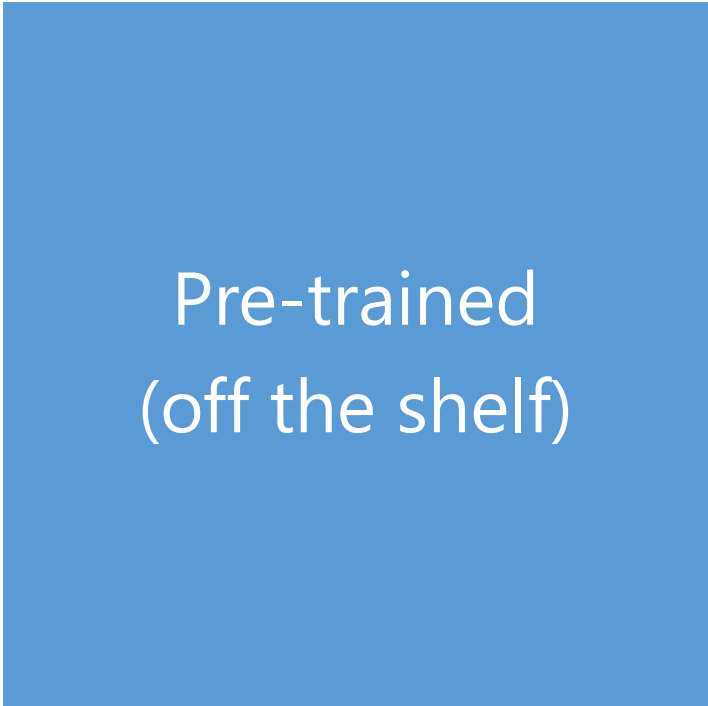


ML Task Types

| | Analysis | Synthesis |
|--------|----------------|-----------------|
| Tables | Table Analysis | Table Synthesis |
| Text | Text Analysis | Text Synthesis |
| Audio | Audio Analysis | Audio Synthesis |
| Images | Image Analysis | Image Synthesis |
| Video | Video Analysis | Video Synthesis |

ML Model Types

ML Model Types



Pre-trained
(off the shelf)

ML Model Types

Pre-trained
(off the shelf)

Custom
(do it yourself)

ML Model Types

Pre-trained
(off the shelf)

Augmented
(transfer learning)

Custom
(do it yourself)

ML Model Types

Pre-trained
(off the shelf)

Augmented
(transfer learning)

Custom
(do it yourself)

Easy

Hard



Tables

Tables

| Weather | | |
|----------|-------|--------|
| Date | Temp. | Humid. |
| 1/1/2020 | 20°C | 58% |
| 1/2/2020 | 21°C | 55% |
| 1/3/2020 | 22°C | 53% |

| Sales | | |
|---------|------|--------|
| Product | Qty. | Price |
| Milk | 1 | \$3.00 |
| Bread | 2 | \$2.00 |
| Apple | 3 | \$1.00 |

| Clients | | |
|-------------|-----|---------|
| Name | Age | Country |
| John Doe | 21 | USA |
| Zhang San | 28 | CHN |
| Priya Singh | 39 | IND |

Tabular Data

| Weather | | | |
|----------|-------|----------|---------|
| Date | Temp. | Humidity | Wind |
| 1/1/2020 | 20°C | 58% | 14 km/h |
| 1/2/2020 | 21°C | 55% | 15 km/h |
| 1/3/2020 | 22°C | 53% | 17 km/h |

Tabular Data

| Weather | | | |
|----------|-------|----------|---------|
| Date | Temp. | Humidity | Wind |
| 1/1/2020 | 20°C | 58% | 14 km/h |
| 1/2/2020 | 21°C | 55% | 15 km/h |
| 1/3/2020 | 22°C | 53% | 17 km/h |

Tabular Data

| Weather | | | |
|----------|-------|----------|---------|
| Date | Temp. | Humidity | Wind |
| 1/1/2020 | 20°C | 58% | 14 km/h |
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| 1/3/2020 | 22°C | 53% | 17 km/h |

Types of Tabular Data

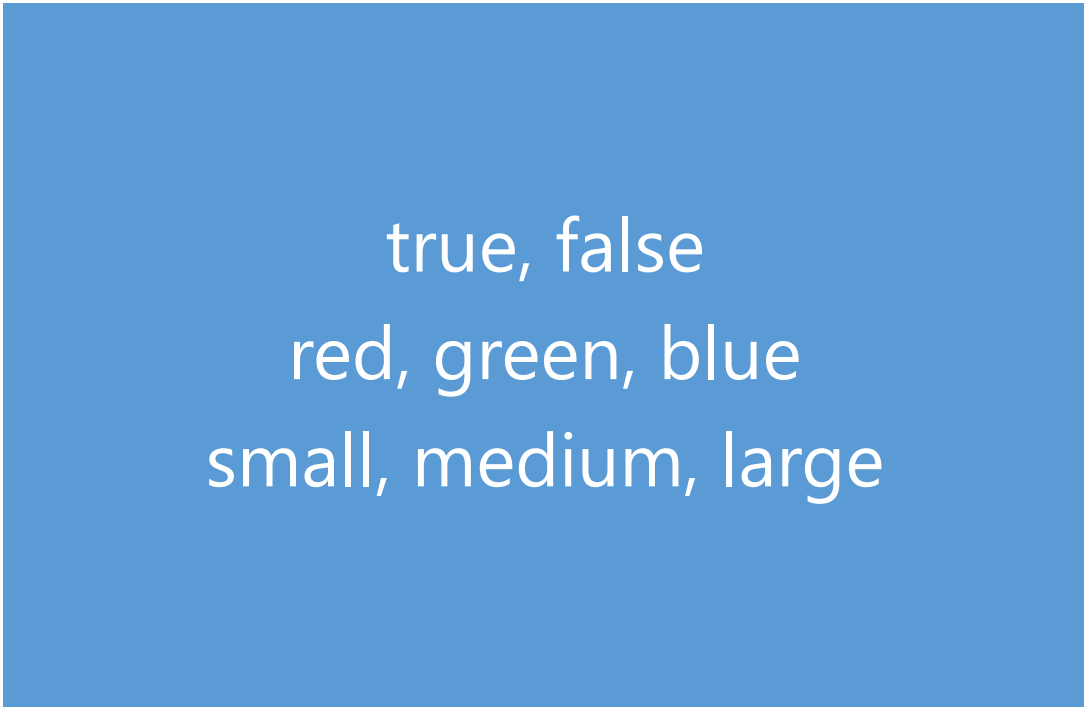
Categorical

Numerical

Types of Tabular Data

Categorical

Numerical



true, false
red, green, blue
small, medium, large

Types of Tabular Data

Categorical

true, false
red, green, blue
small, medium, large

Numerical

1, 2, 3 ...
4.56
 5.97×10^{24}

Data Analysis Tools

Classification

Regression

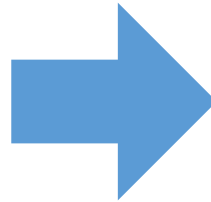
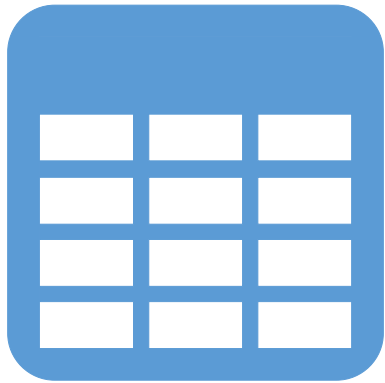
Recommendation

Clustering

Association

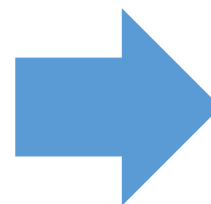
Anomaly
detection

Classification



Classification

| Customers | | |
|-------------|----------|-----------|
| Customer | Income | Late Pays |
| Zhang San | \$99,000 | 0 |
| Priya Singh | \$50,000 | 1 |
| John Doe | \$25,000 | 3 |



| Output | |
|----------|-------|
| Approve? | Score |
| Yes | 90% |
| Yes | 60% |
| No | 80% |

Classification



Loan approval



Fraud detection



Customer Churn

Other Table Analysis Tools

Classification

Regression

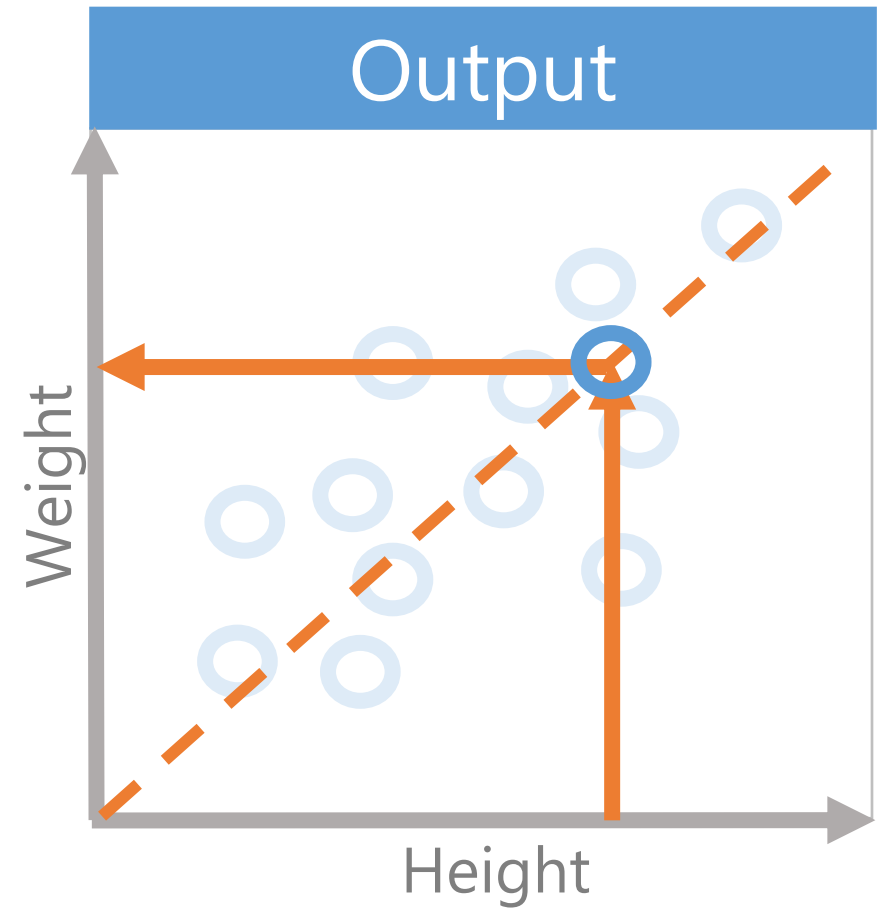
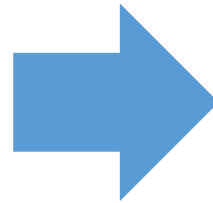
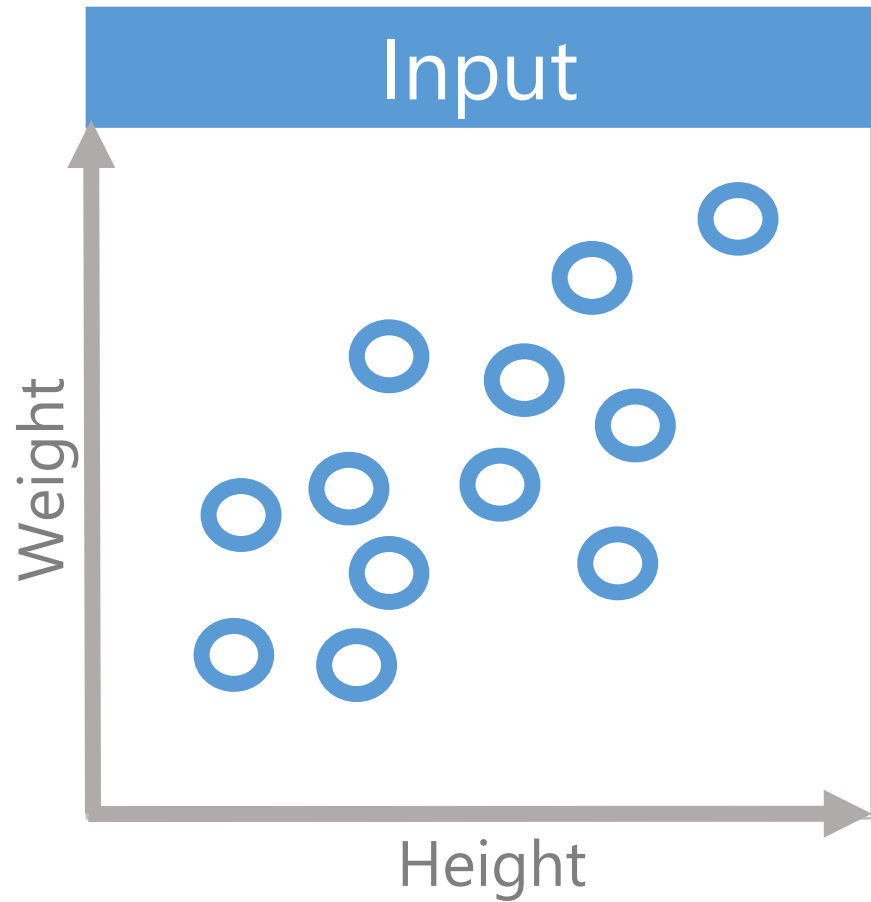
Recommendation

Clustering

Association

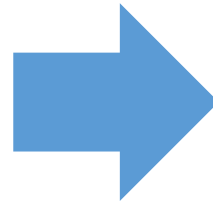
Anomaly
detection

Regression



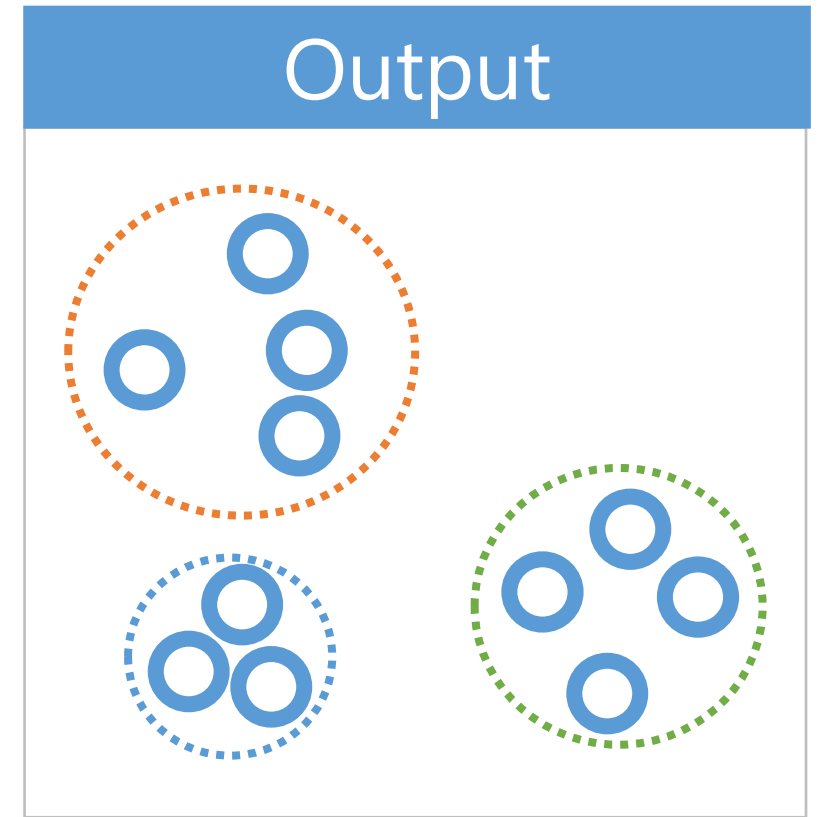
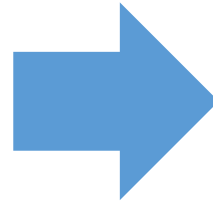
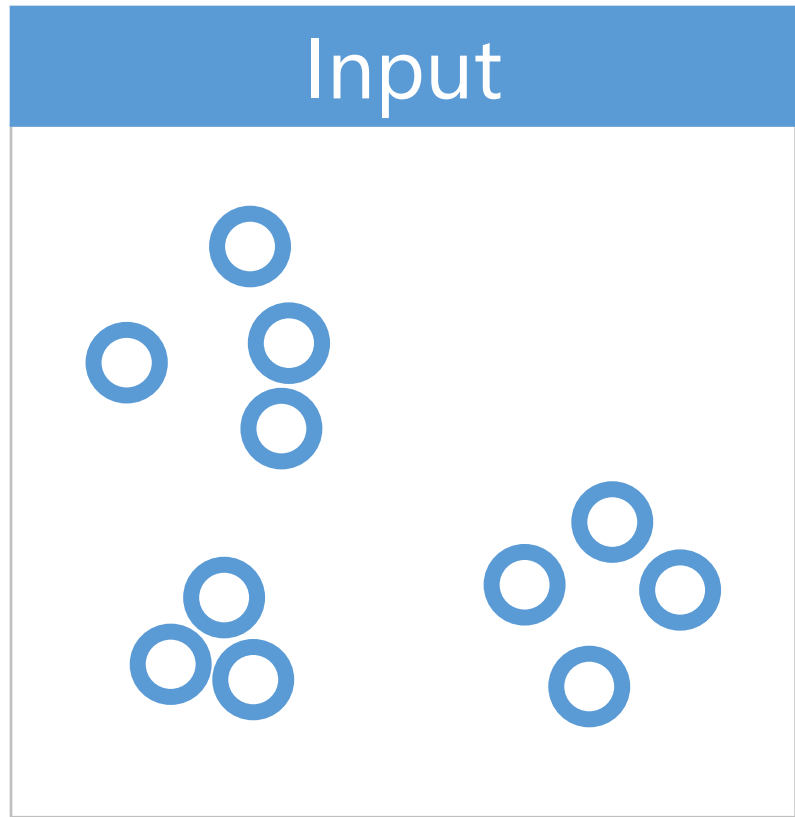
Recommendation

| Purchases | |
|-----------|----------|
| Product | Quantity |
| Chips | 1 |
| Milk | 2 |
| Cheese | 3 |

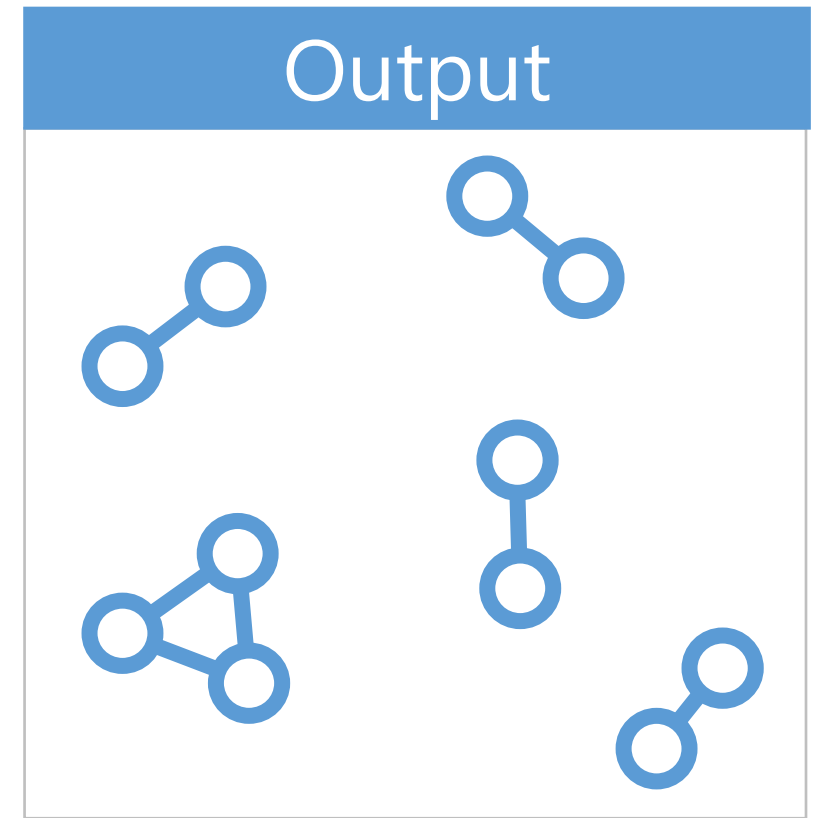
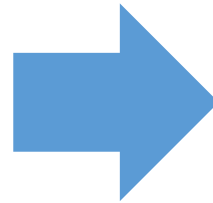
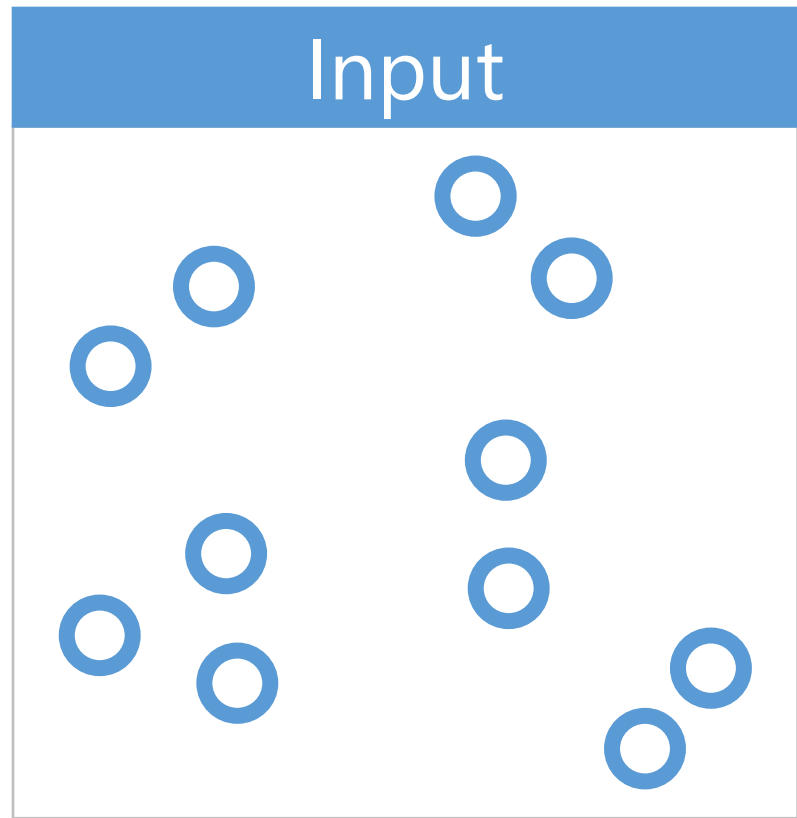


| Output | |
|-----------|-------|
| Recommend | Score |
| Salsa | 70% |
| Cookies | 90% |
| Crackers | 80% |

Clustering



Association



Anomaly Detection

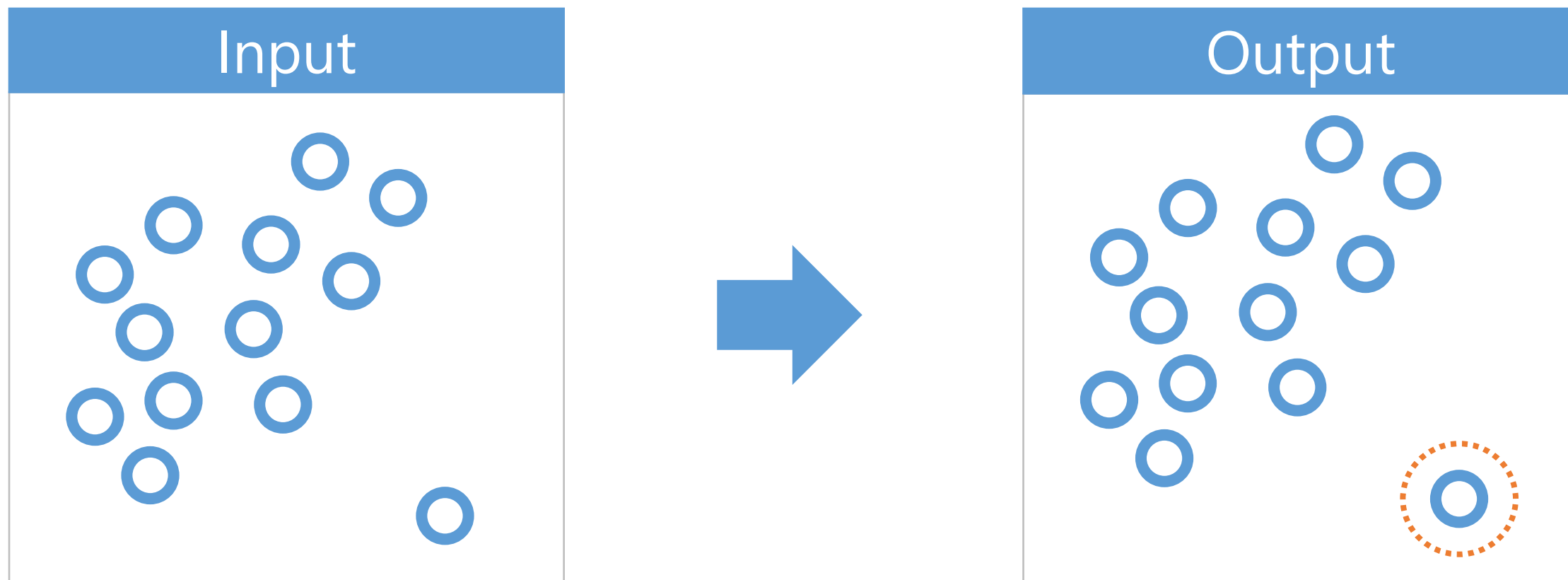


Table Synthesis Tools

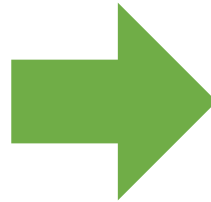
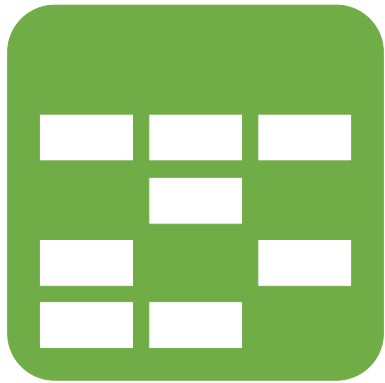


Data
imputation

Data
generation

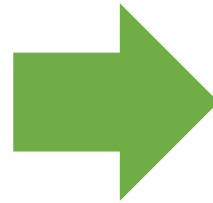
Data
transformation

Imputation



Imputation

| Weather | | |
|----------|--------|--------|
| Date | Temp. | Humid. |
| 1/1/2020 | [null] | 58% |
| [null] | 21°C | 55% |
| 1/3/2020 | 22°C | [null] |



| Weather | | |
|----------|-------|--------|
| Date | Temp. | Humid. |
| 1/1/2020 | 20°C | 58% |
| 1/2/2020 | 21°C | 55% |
| 1/3/2020 | 22°C | 53% |

Table Synthesis Tools

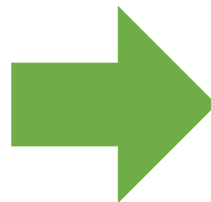
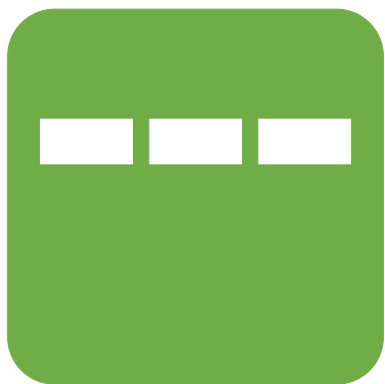


Data
imputation

Data
generation

Data
transformation

Generation



Transformation

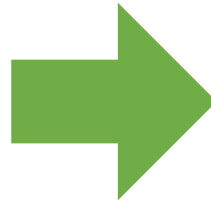
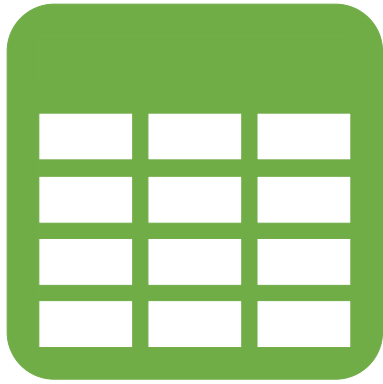


Table Summary

Data Analysis

Classification
Regression
Recommendation

Data Synthesis

Imputation
Generation
Transformation

Text

Text

Book

To be, or not to be,
that is the question:

Whether 'tis nobler
in the mind to suffer

The slings and arrows
of outrageous fortune,
Or to take arms against
a sea of troubles

...

Article

The History of AI

The history of AI can be
roughly divided into five
main eras.

Each era can be defined by
either a series of advances
and successes or a new set
of limitations and failures.

...

Email

Dear Mr. Smith,

I'm writing you today to
inform you of a defect I
found in the M-1 Turbo
Encabulator.

On April 1, it began
exhibiting barescent skor
motion.

...

Textual Data

To be, or not to be,
that is the question:

Whether 'tis nobler
in the mind to suffer

The slings and arrows
of outrageous fortune,

Or to take arms against
a sea of troubles ...

Textual Data

To be, or not to be,
that is the question:

Whether 'tis nobler
in the mind to suffer

The slings and arrows
of outrageous fortune,

Or to take arms against
a sea of troubles ...

T o b e , o r n o t ...

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |

Text Analysis Tools

Text
classification

Sentiment
analysis

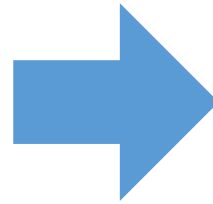
Entity
recognition

Tone
analysis

Language
detection

Syntax
analysis

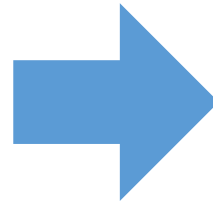
Text Classification



Text Classification

Input

Dear Mr. Smith,
I'm writing you today to
inform you of a defect in
my M1 Turbo Encabulator.
On Apr 1, the parameteric
fan began exhibiting
barescent skor motion ...



Output

| Dept. | Score |
|---------|-------|
| Support | 90% |
| Sales | 50% |
| Billing | 10% |

Text Classification



Document organization



Support tickets



Spam detection

Other Text Analysis Tools

Text
classification

Sentiment
analysis

Entity
recognition

Tone
analysis

Language
detection

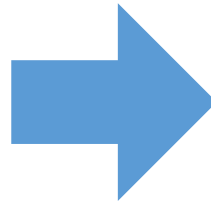
Syntax
analysis

Sentiment Analysis

Input

I love this presentation!

I hate this stupid topic!



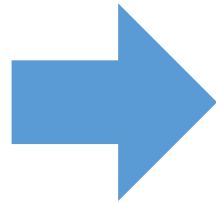
Output

0.9 (positive)

0.1 (negative)

Entity Recognition

| Input |
|--|
| Last week, both Microsoft and Google reported a nominal increase in revenue while Amazon saw a small decrease. |



| Output | | | |
|------------------|-------|-----|-------|
| Entity | Start | End | Score |
| Microsoft | 17 | 26 | 99% |
| Google | 31 | 37 | 95% |
| Amazon (company) | | | 80% |
| Amazon (river) | | | 10% |

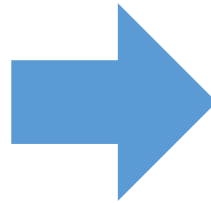
Tone Analysis

Input

Dear Mr. Smith,

I hate your stupid face
and your presentation!

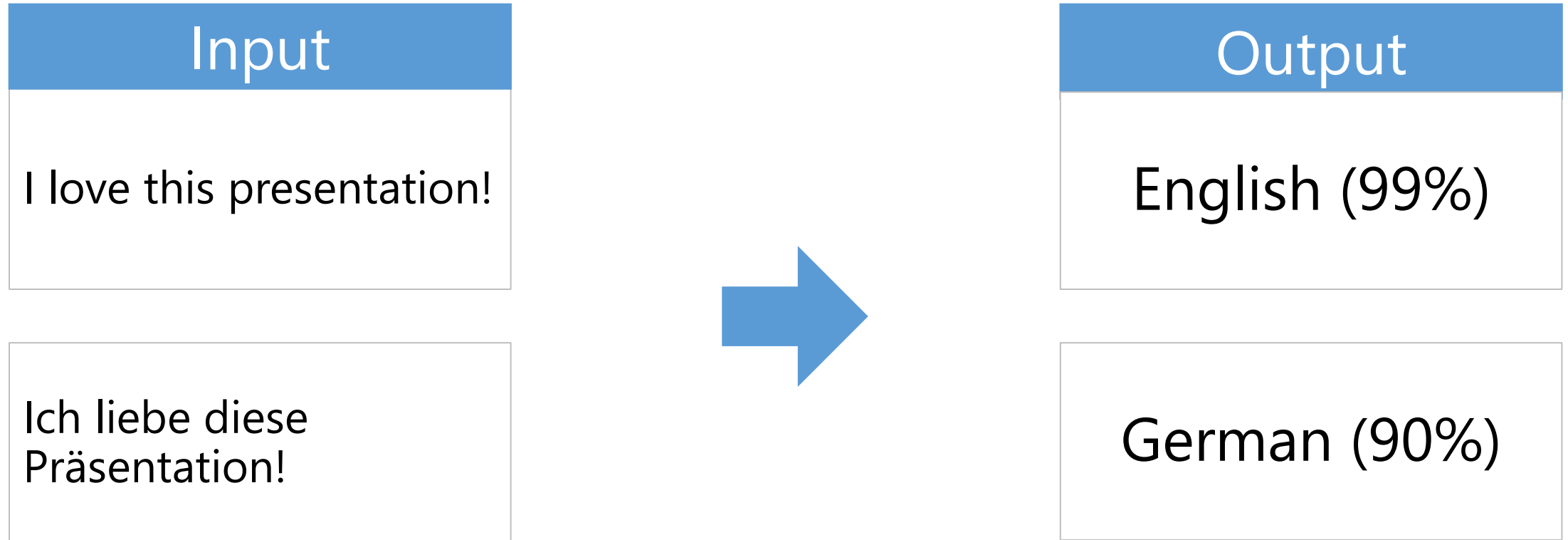
I'm worried your talk has
destroyed me for life! >: (



Output

| Dept. | Score |
|------------|-------|
| Anger | 90% |
| Fear | 60% |
| Analytical | 50% |

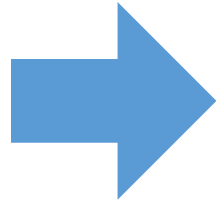
Language Detection



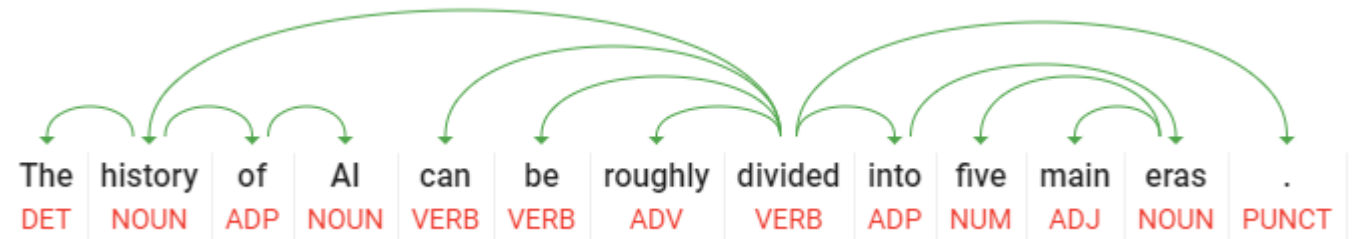
Syntax Analysis

Input

The history of AI
can be roughly
divided into five
main eras.



Output



Text Synthesis Tools

Text
completion

Text
generation

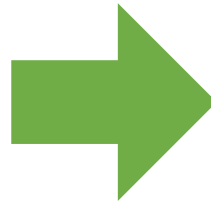
Language
translation

Text
summarization

Language
transliteration

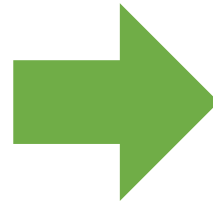
Program
synthesis

Text Completion



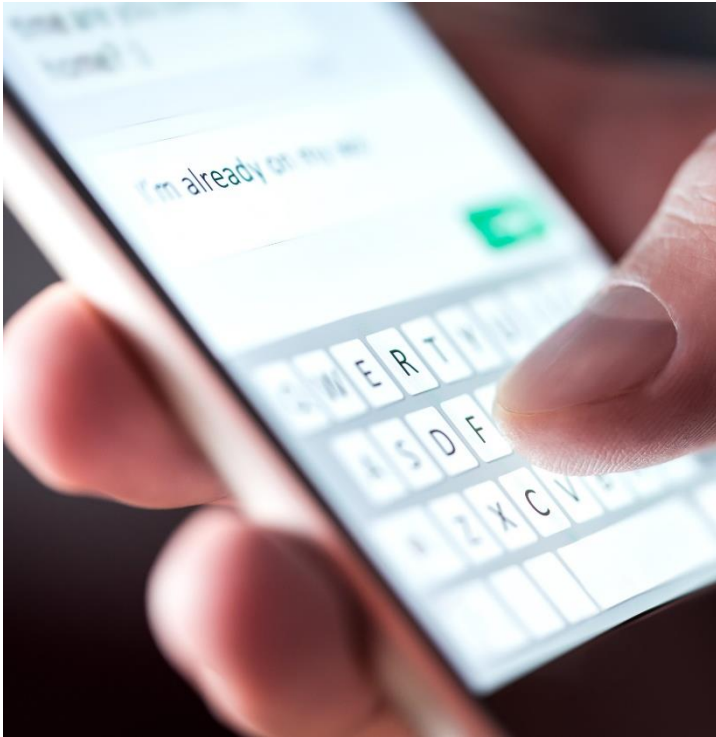
Text Completion

| Input |
|------------------|
| What is your ... |



| Output | |
|----------------|-------|
| Prediction | Score |
| ... name? | 99% |
| ... age? | 80% |
| ... shoe size? | 50% |

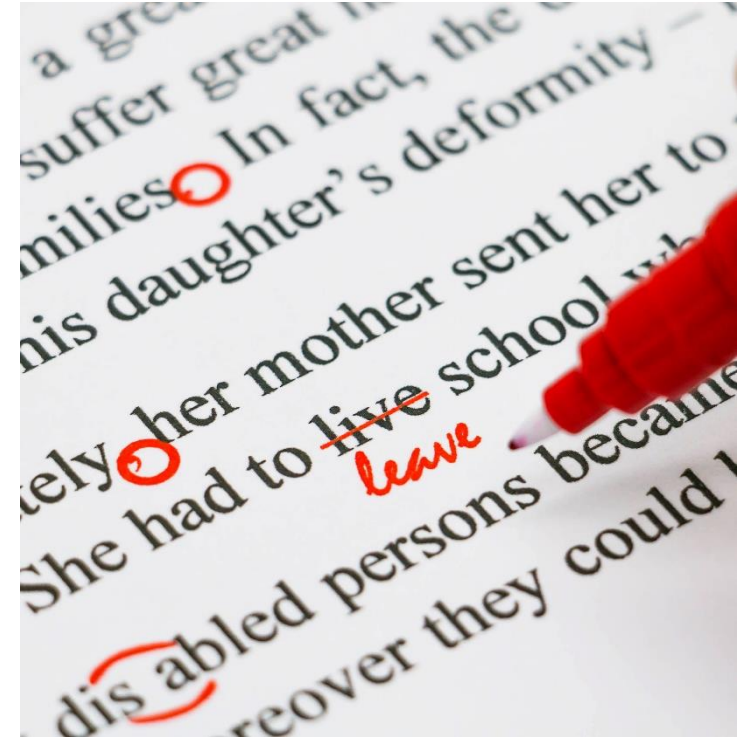
Text Completion



Sentence completion



Transcript correction



Syntax checking

Other Text Synthesis Tools

Text
completion

Text
generation

Language
translation

Text
summarization

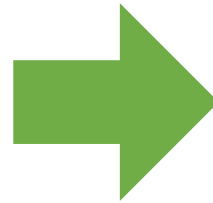
Language
transliteration

Program
synthesis

Text Generation

Input

Thank the OpenAI team for their great work on ChatGPT.



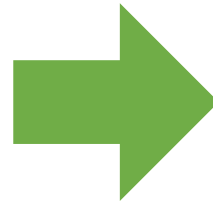
Output

Dear Open AI team,
I'm writing you today
to thank you for your
great work on ChatGPT.
It's an amazing product
and I can't wait to see
what you create next.
Sincerely,
Matthew Renze

Language Translation

Input

Today is a good
day to learn AI!



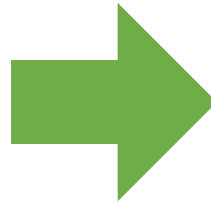
Output

今天是学习人工
智能的好日子！

Text Summarization

Output

Dear Open AI team,
I'm writing you today
to thank you for your
great work on ChatGPT.
It's an amazing product
and I can't wait to see
what you create next.
Sincerely,
Matthew Renze



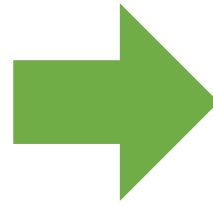
Input

A message thanking
the OpenAI team for
their work on ChatGPT.

Language Transliteration

Input

今天是学习人工
智能的好日子！



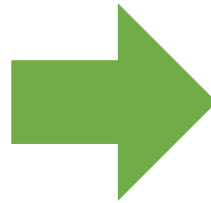
Output

jin tian shi xue
xi ren gong zhi
neng de hao ri zi!

Program Synthesis

Input

Print all items
in a list `m`
that are even.



Output

```
for x in m:  
    if x % 2 == 0:  
        print(x)
```


Text Summary

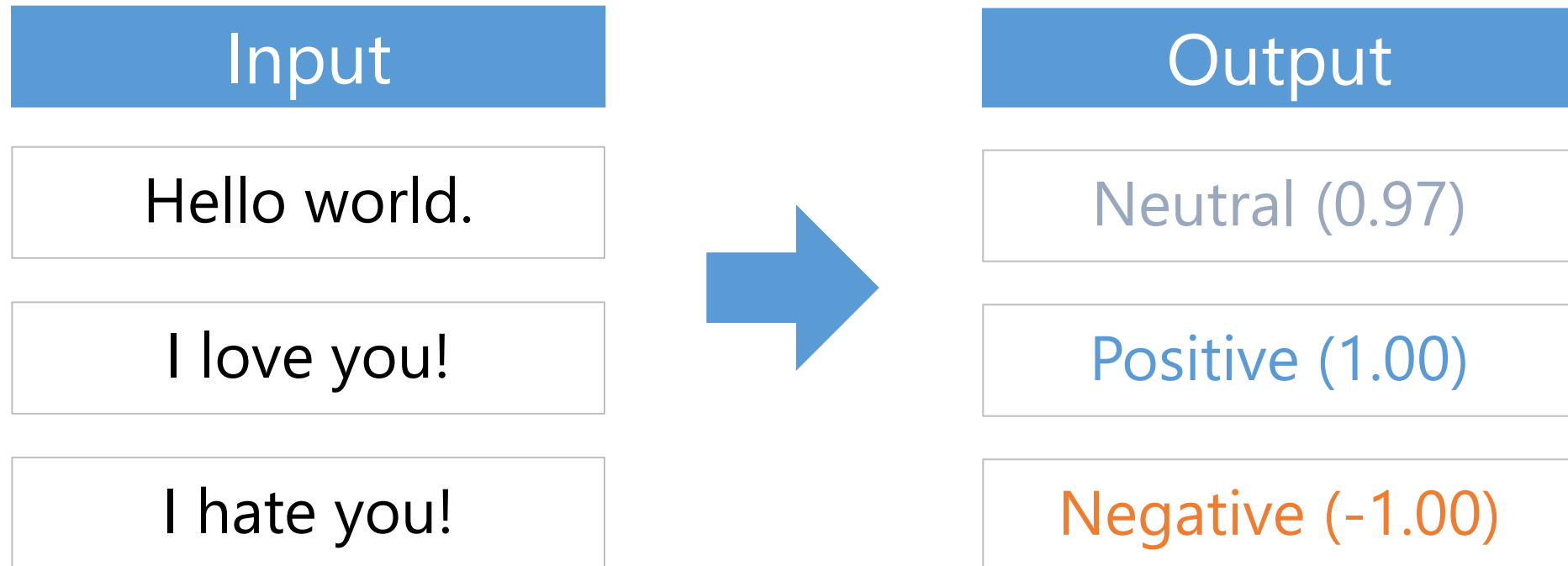
Text Analysis

Text classification
Sentiment analysis
Entity recognition

Text Synthesis

Text completion
Text generation
Language translation

Demo Overview



[Home](#) >

Text-Analytics

Cognitive Services



Search (Ctrl+ /)



Delete



Overview



Activity log



Access control (IAM)



Tags



Diagnose and solve problems

RESOURCE MANAGEMENT



Quick start



Keys and Endpoint



Pricing tier



Networking



Identity



Billing By Subscription



Properties



Locks

Monitoring



Alerts



Metrics

^ Essentials

[JSON View](#)Resource group ([change](#))
[Cognitive-Services](#)Status
ActiveLocation
East USSubscription ([change](#))
[RenzeConsulting](#)Subscription ID
xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxxTags ([change](#))
[Click here to add tags](#)API type
Text AnalyticsPricing tier
FreeEndpoint
<https://text-analytics.cognitiveservices.azure.com/>Manage keys
[Click here to manage keys](#)

Quota info

Free tier Total

5000 Calls

Free tier Remaining

5000 Calls

Free tier Rest period

30.00 Days



Sentiment Analysis with Microsoft Client API

```
# Import libraries
```

```
from azure.core.credentials import AzureKeyCredential
```

```
from azure.ai.textanalytics import TextAnalyticsClient
```

```
# Set the endpoint url
```

```
endpoint_url = "https://text-analytics-1577.cognitiveservices.azure.com/"
```

```
# Set the subscription key
```

```
subscription_key = "[your-azure-subscription-key]"
```

```
# Create the credentials
```

```
credential = AzureKeyCredential(subscription_key)
```

```
# Create a text analytics client
```

```
client = TextAnalyticsClient(  
    endpoint = endpoint_url,  
    credential = credential)
```

```
# Create three text documents
```

```
documents = [
```

Sentiment Analysis with Microsoft Client API

```
# Import libraries
```

```
from azure.core.credentials import AzureKeyCredential
```

```
from azure.ai.textanalytics import TextAnalyticsClient
```

```
# Set the endpoint url
```

```
endpoint_url = "https://text-analytics-1577.cognitiveservices.azure.com/"
```

```
# Set the subscription key
```

```
subscription_key = "[your-azure-subscription-key]"
```

```
# Create the credentials
```

```
credential = AzureKeyCredential(subscription_key)
```

```
# Create a text analytics client
```

```
client = TextAnalyticsClient(  
    endpoint = endpoint_url,  
    credential = credential)
```

```
# Create three text documents
```

```
documents = [
```

```
endpoint = endpoint_url,  
credential = credential)
```

```
# Create three text documents  
documents = [  
    "Hello World",  
    "I love you!",  
    "I hate you!"  
]
```

```
# Analyze the sentiment of the documents  
results = client.analyze_sentiment(  
    documents = documents)
```

```
# Print the results  
for result in results:  
    print(f"Document: {result.sentences[0].text}")  
    print(f" - Sentiment: {result.sentiment}")  
    print(f" - Positive: {result.confidence_scores.positive:.2f}")  
    print(f" - Neutral: {result.confidence_scores.neutral:.2f}")  
    print(f" - Negative: {result.confidence_scores.negative:.2f}")  
    print("")
```


Document: Hello World

- Sentiment: neutral

- Positive: 0.02

- Neutral: 0.97

- Negative: 0.01

Document: I love you!

- Sentiment: positive

- Positive: 1.00

- Neutral: 0.00

- Negative: 0.00

Document: I hate you!

- Sentiment: negative

- Positive: 0.00

- Neutral: 0.00

- Negative: 1.00

Sentiment Analysis with Google Cloud AI

```
# Import libraries
import os
from google.cloud import language_v1

# Set an environment variable pointing to the credentials file
os.environ['GOOGLE_APPLICATION_CREDENTIALS'] = "C:/Demos/[your-google-app-credentials-file].json"

# Create a language-service client
client = language_v1.LanguageServiceClient()

# Create the document
document = {
    "type_": "PLAIN_TEXT",
    "language": "en",
    "content": "Hello World. I love you! I hate you!"
}

# Analyze the sentiment of the documents
results = client.analyze_sentiment(
    document = document,
    encoding_type = language_v1.EncodingType.UTF8)

# Print the results
for result in results.sentences :
    print("Text: " + result.text.content)
    print("Score: " + str(result.sentiment.score))
    print("")
```

Sentiment Analysis with Amazon Client API

Import libraries

```
import boto3
```

```
import json
```

Create an AWS client

```
client = boto3.client(  
    aws_access_key_id = "[your-aws-access-key-id]",  
    aws_secret_access_key = "[your-aws-secret-access]",  
    service_name = "comprehend",  
    region_name = "us-west-2")
```

Set the text to be analyzed

```
text = "I love you!"
```

Detect sentiment

```
results = client.detect_sentiment(  
    Text = text,  
    LanguageCode = "en")
```

Print detected sentiment

```
print("Sentiment: " + results["Sentiment"])
```

Get confidence scores

```
scores = results["SentimentScore"]
```

Print confidence scores

```
print("Positive Score: " + str(scores["Positive"]))
```

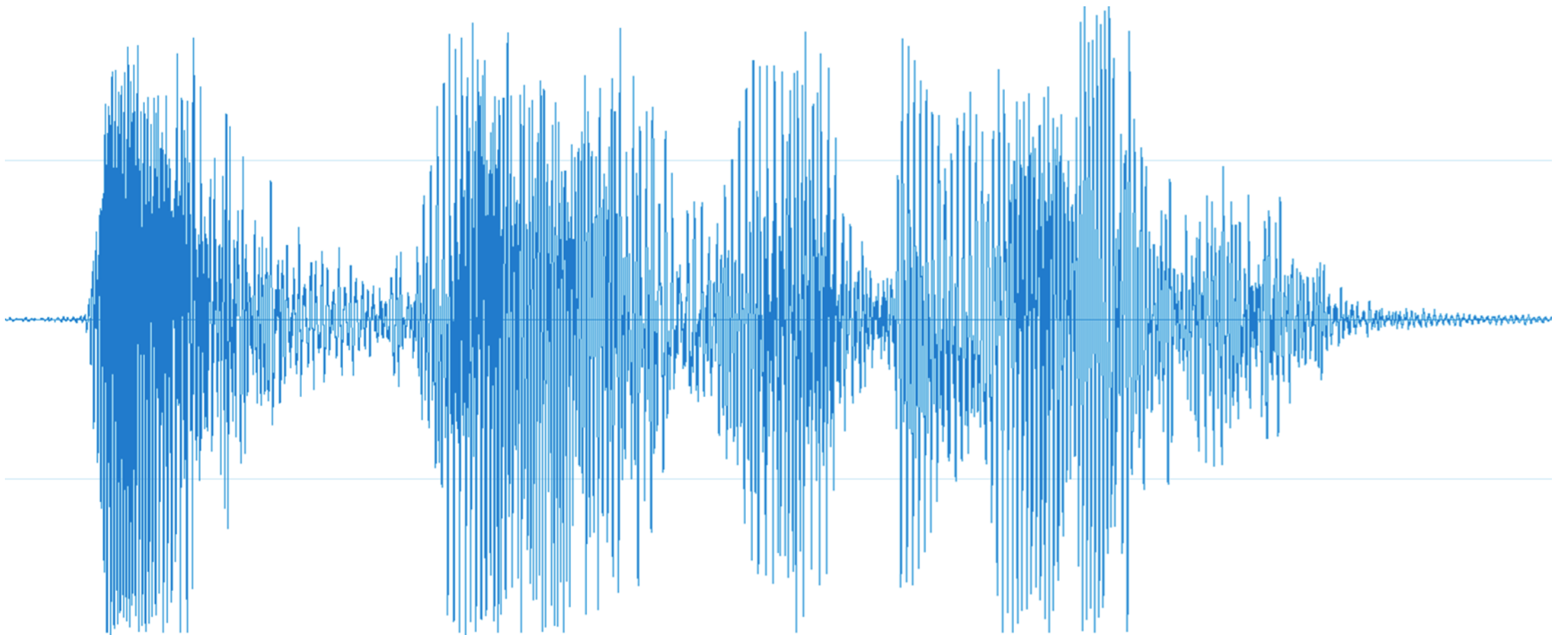
```
print("Negative Score: " + str(scores["Negative"]))
```

```
print("Neutral Score: " + str(scores["Neutral"]))
```

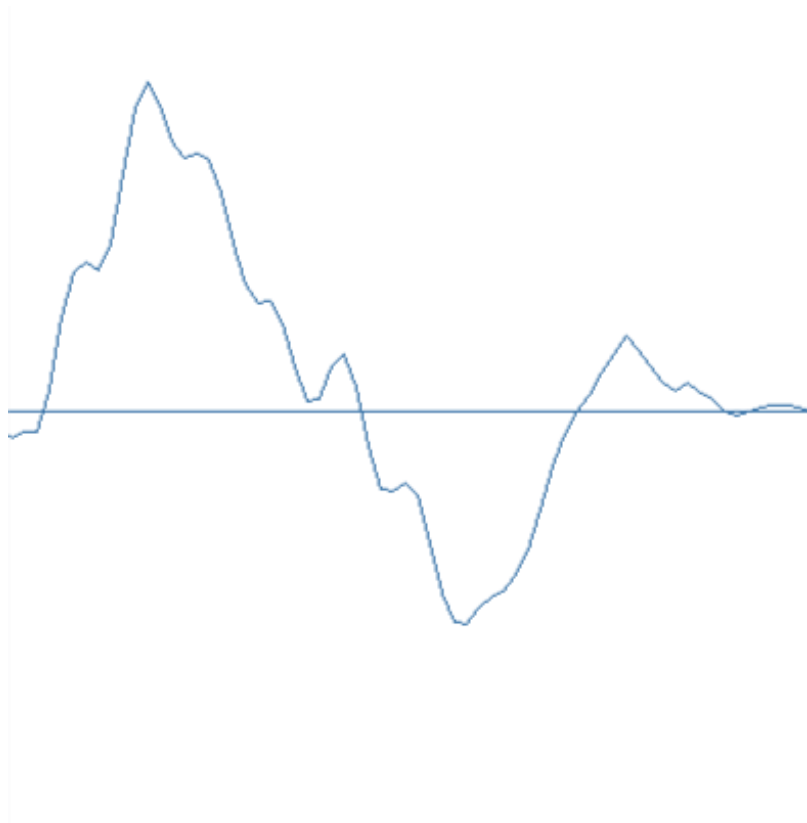
```
print("Mixed Score: " + str(scores["Mixed"]))
```

Audio

Audio



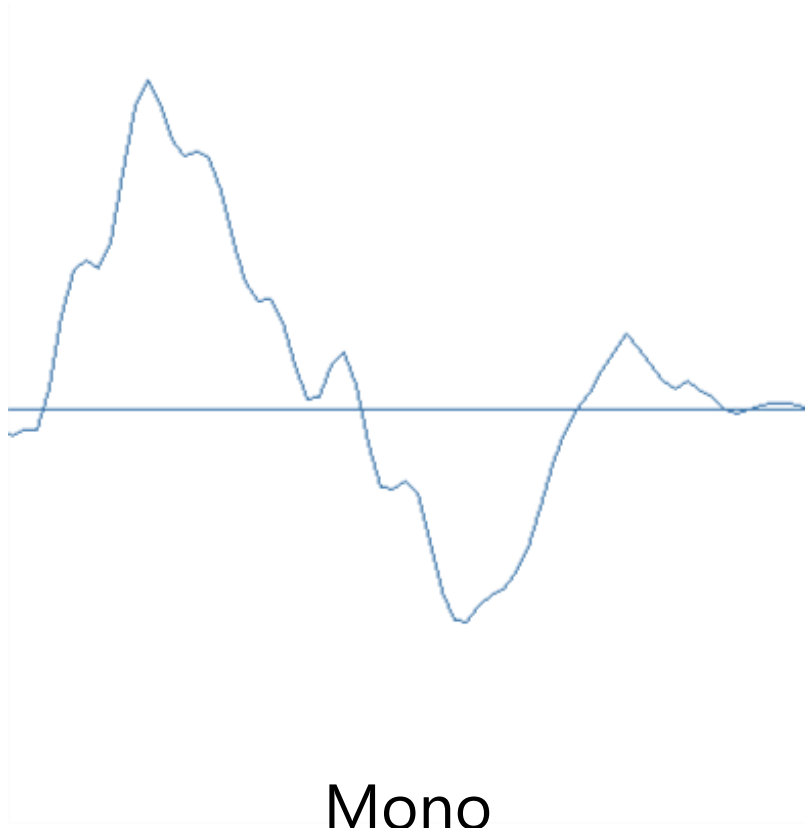
Audio



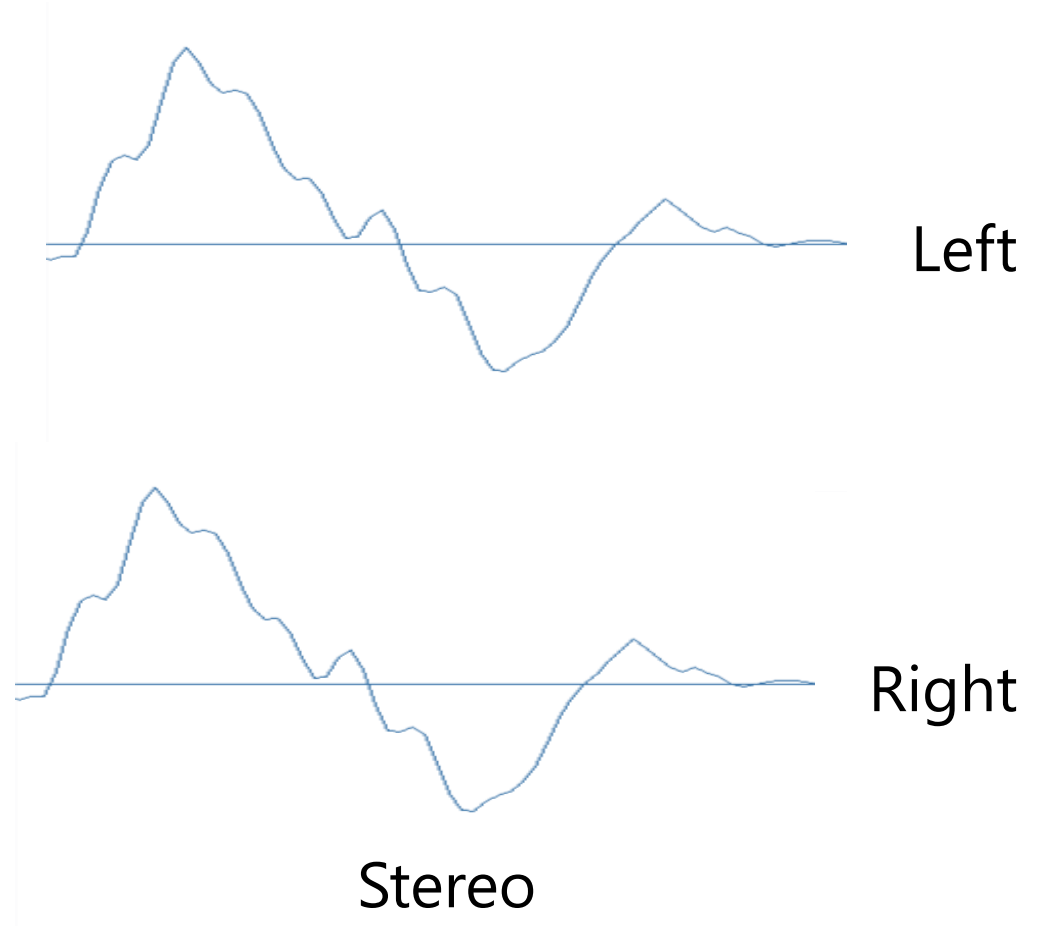
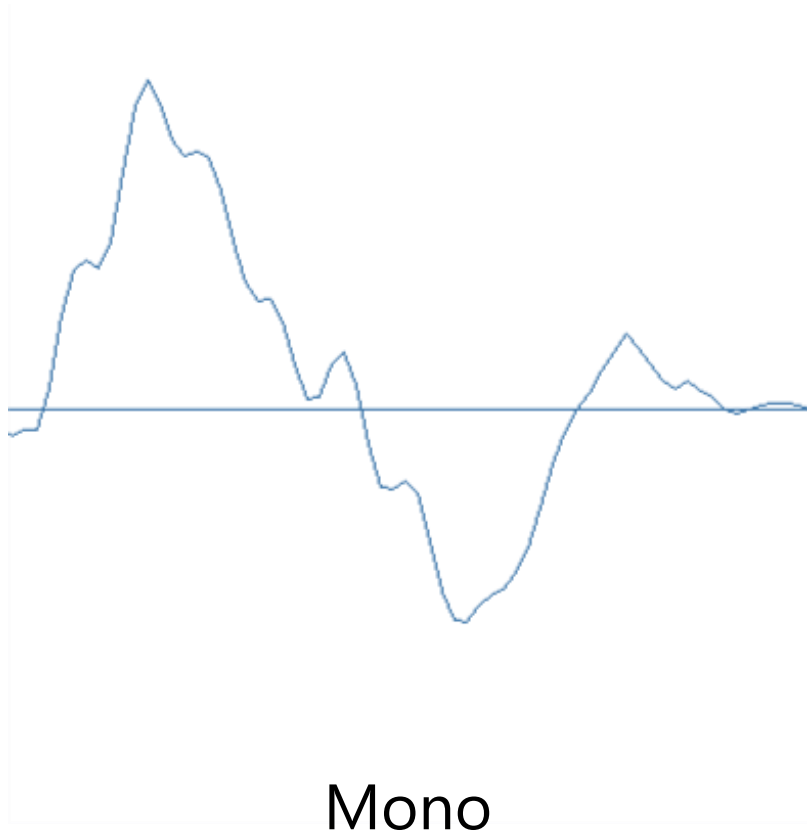
| | | | | | | | | | |
|----|----|---|----|----|----|----|----|----|-----|
| -2 | -1 | 5 | 10 | 15 | 14 | 17 | 25 | 20 | ... |
|----|----|---|----|----|----|----|----|----|-----|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

Audio



Audio



Audio Analysis Tools

Sound
classification

Speaker
recognition

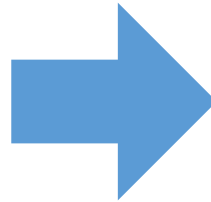
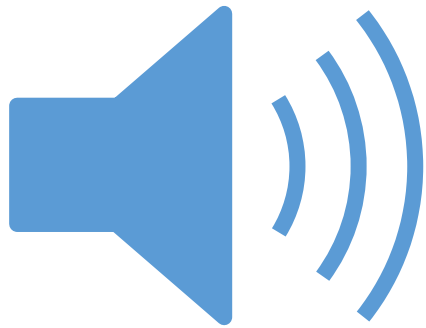
Speech
recognition

Sound
detection

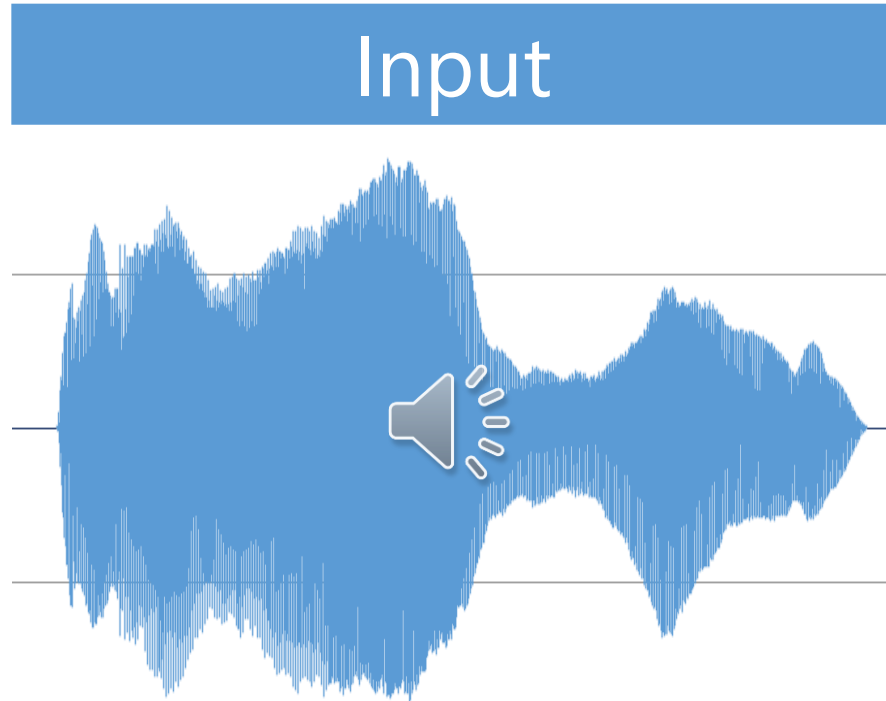
Sound
localization

Song
recognition

Sound Classification



Sound Classification



| Output | |
|------------|-------|
| Prediction | Score |
| Cat | 99% |
| Dog | 50% |
| Bird | 10% |

Sound Classification



Gunshot detection



Predictive maintenance



Wildlife conservation

Other Audio Analysis Tasks

Sound
classification

Speaker
recognition

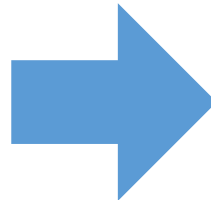
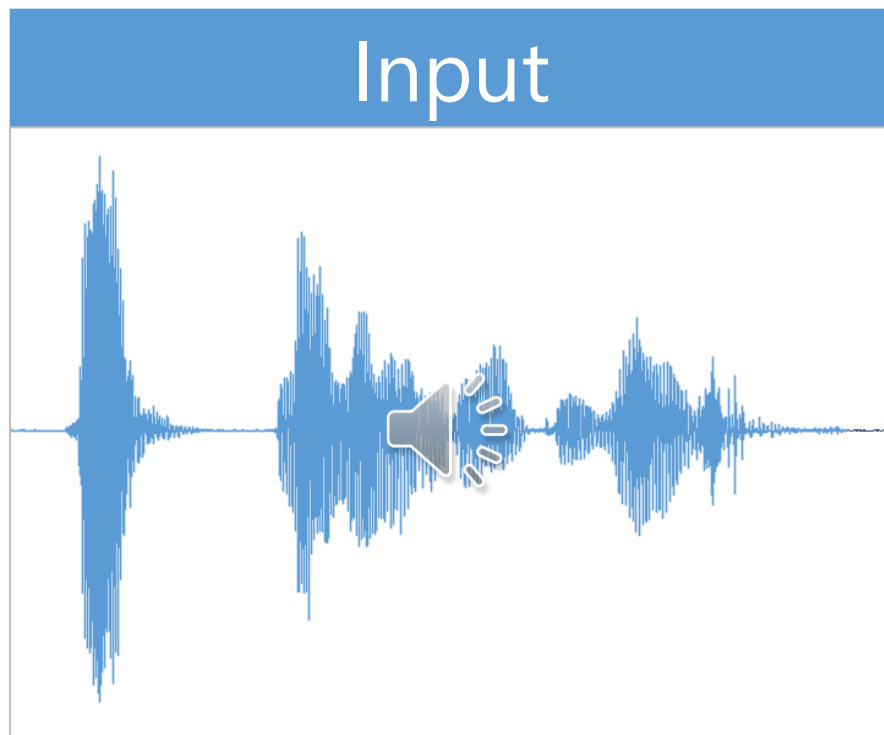
Speech
recognition

Sound
detection

Sound
localization

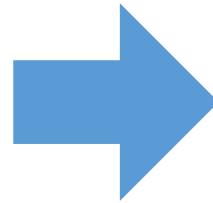
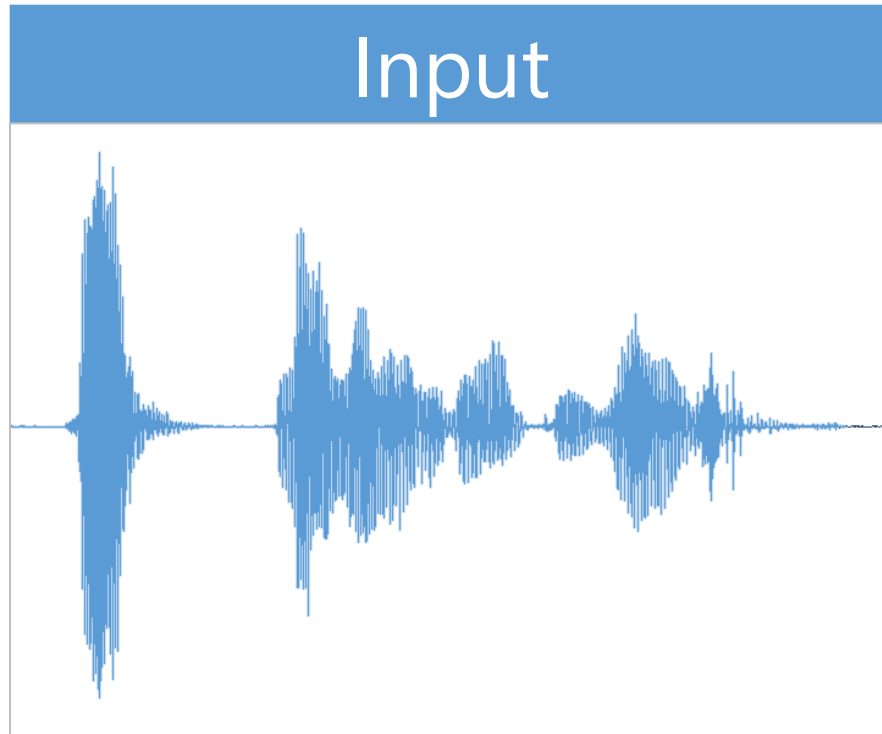
Song
recognition

Speaker Recognition



| Output | |
|---------------|-------|
| Prediction | Score |
| Matthew Renze | 99% |
| Zhang San | 50% |
| Priya Singh | 10% |

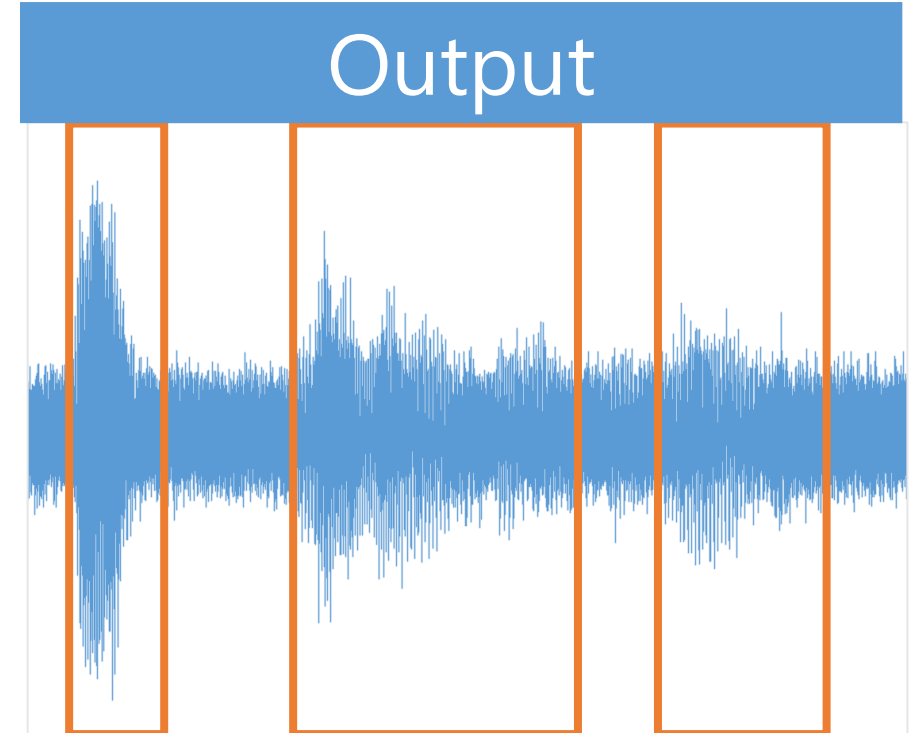
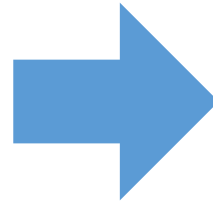
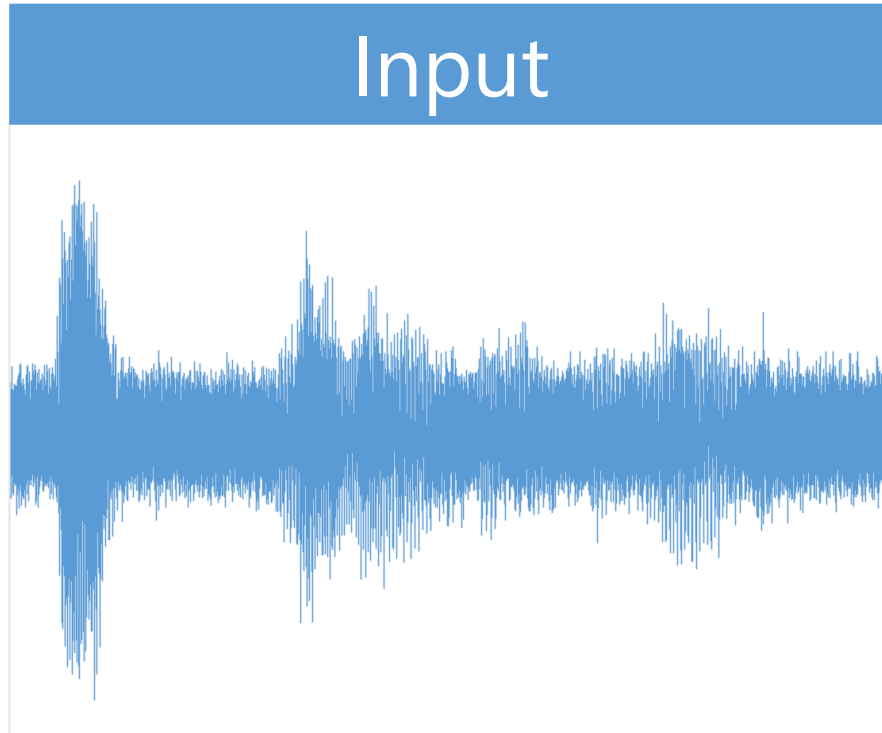
Speech Recognition



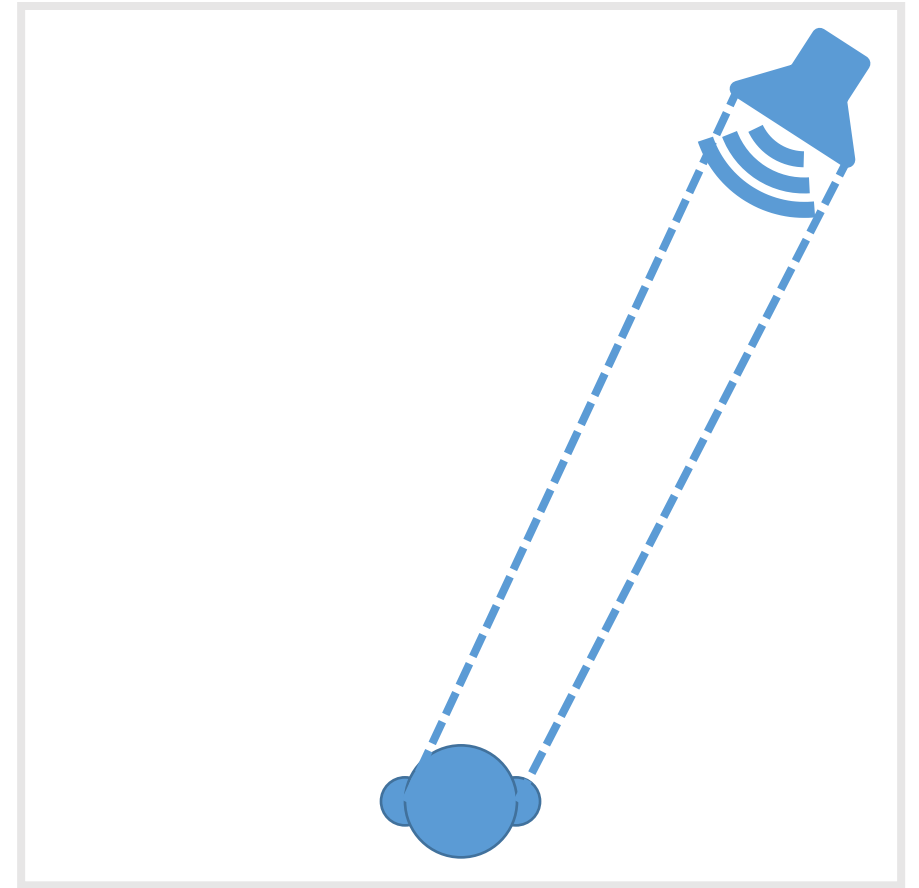
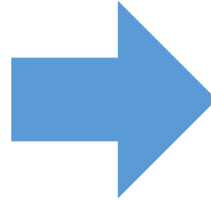
Output

Hi, my name is
Matthew Renze.

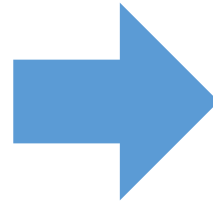
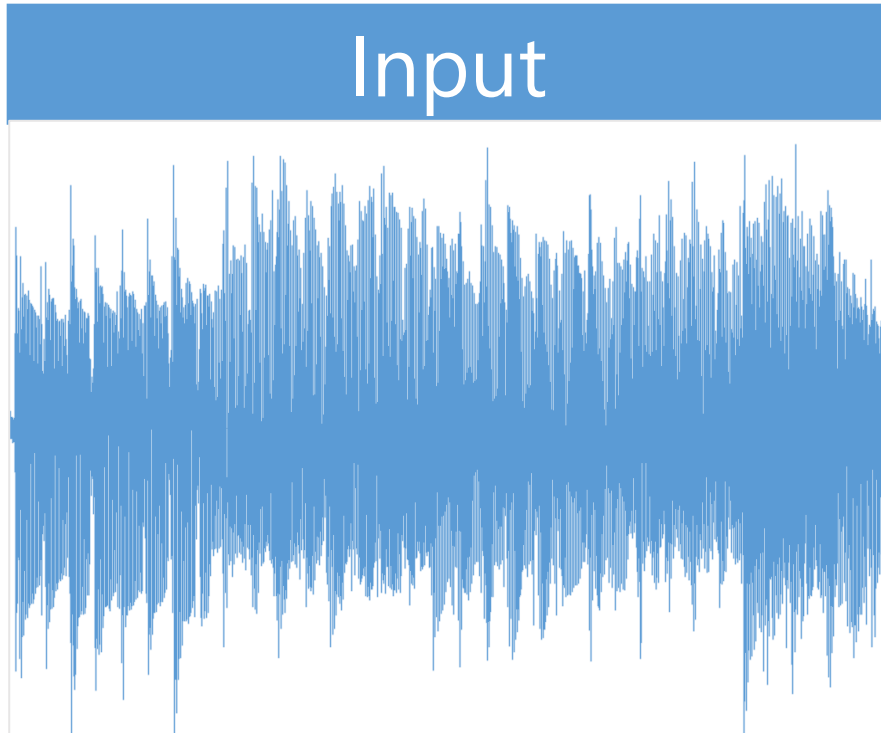
Sound Detection



Sound Localization



Song Recognition



| Output | |
|--------|---------------------|
| Artist | U2 |
| Song | With or Without You |
| Album | The Joshua Tree |
| Year | 1987 |

Audio Synthesis Tasks

Speech
synthesis

Voice
synthesis

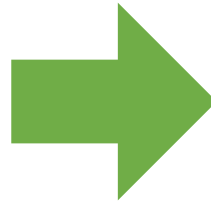
Speech
translation

Sound
generation

Instrument
translation

Music
generation

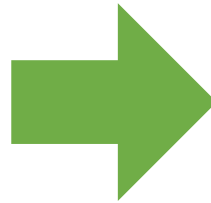
Speech Synthesis



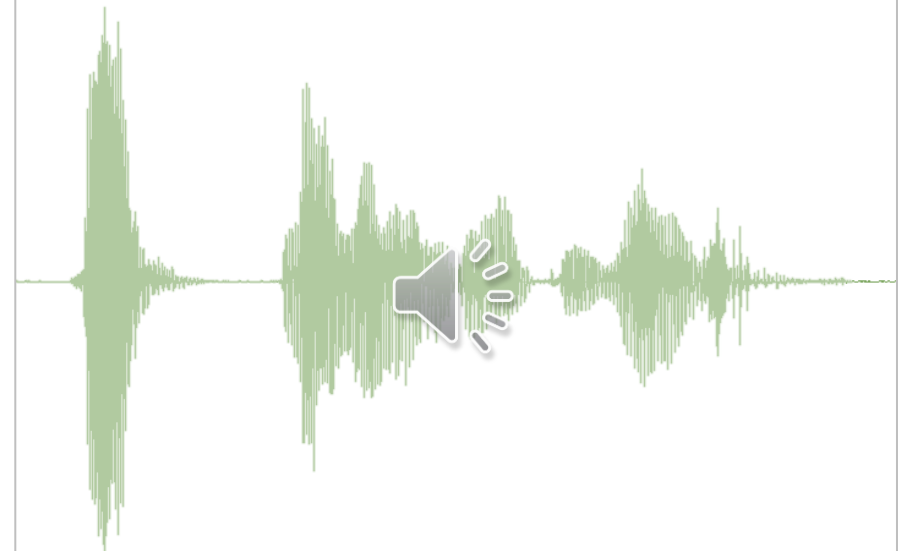
Speech Synthesis

Input

Hi, my name is
Matthew Renze.



Output



Speech Synthesis



Hands-free apps



Document narration



Natural UI

Other Audio Synthesis

Speech
synthesis

Voice
synthesis

Speech
translation


Sound
generation

Instrument
translation

Music
generation

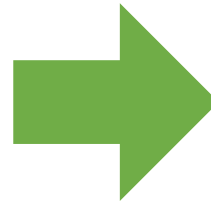
Voice Synthesis

Input

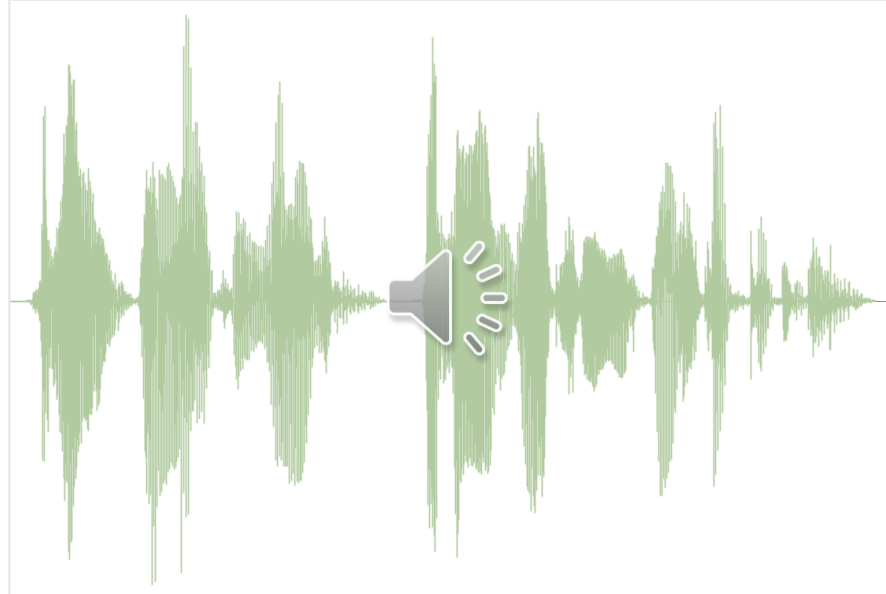


~~Hi, my name is~~ Matthew Renze.

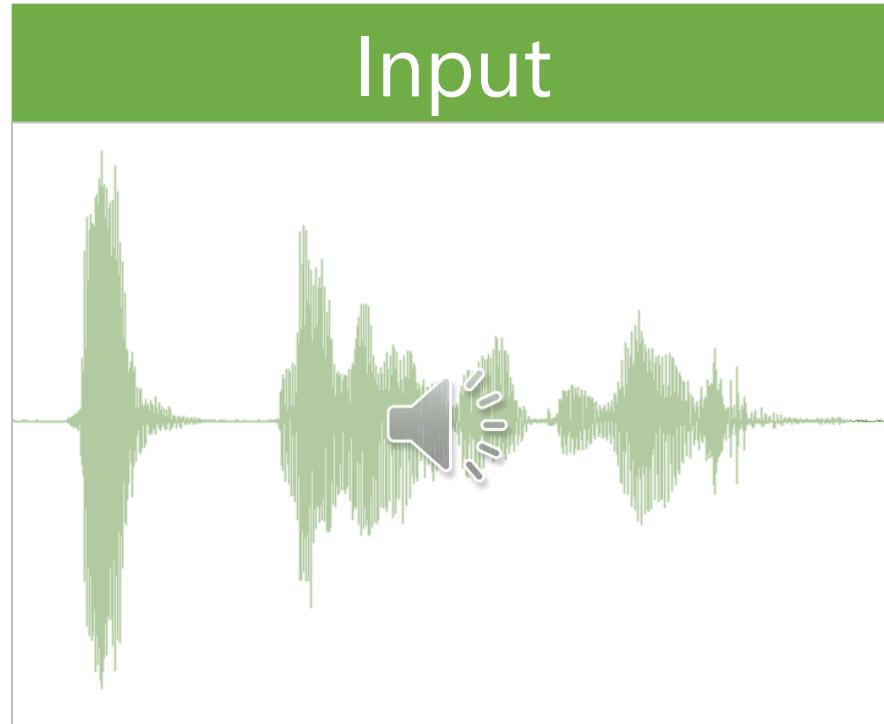
Hello, I'm Matthew Renze.
I'll be your virtual instructor today.



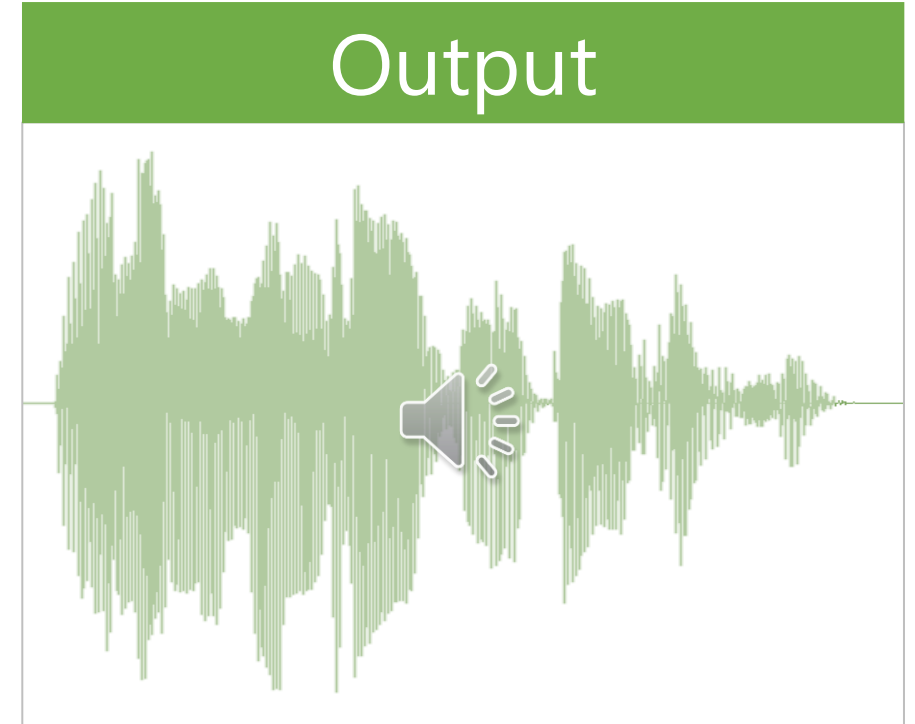
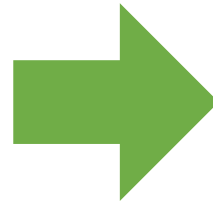
Output



Speech Translation



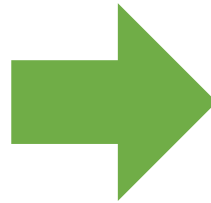
"Hi, my name is Matthew Renze."



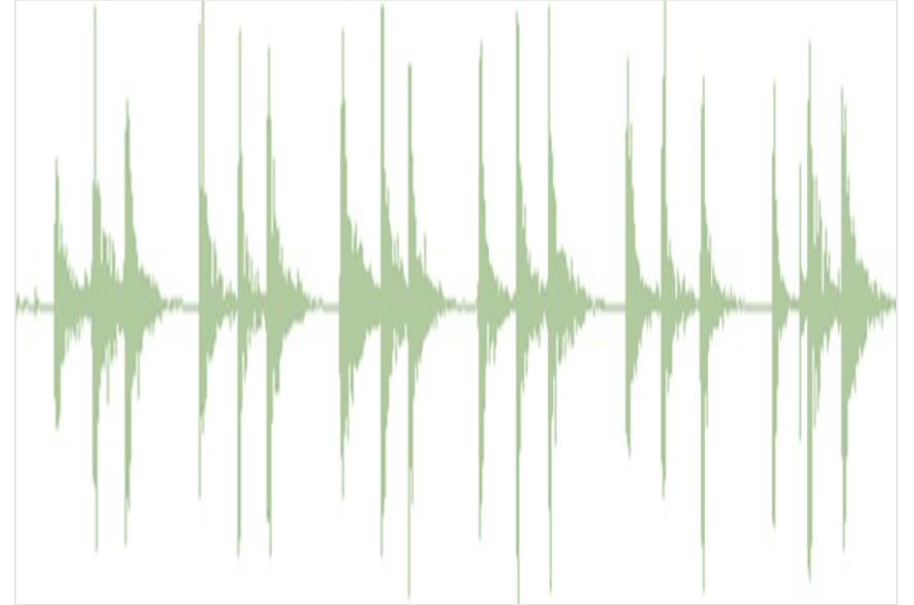
"Hola, mi nombre es Matthew Renze."

Sound Generation

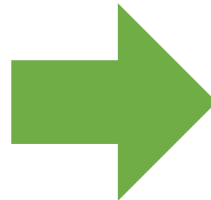
Input



Output

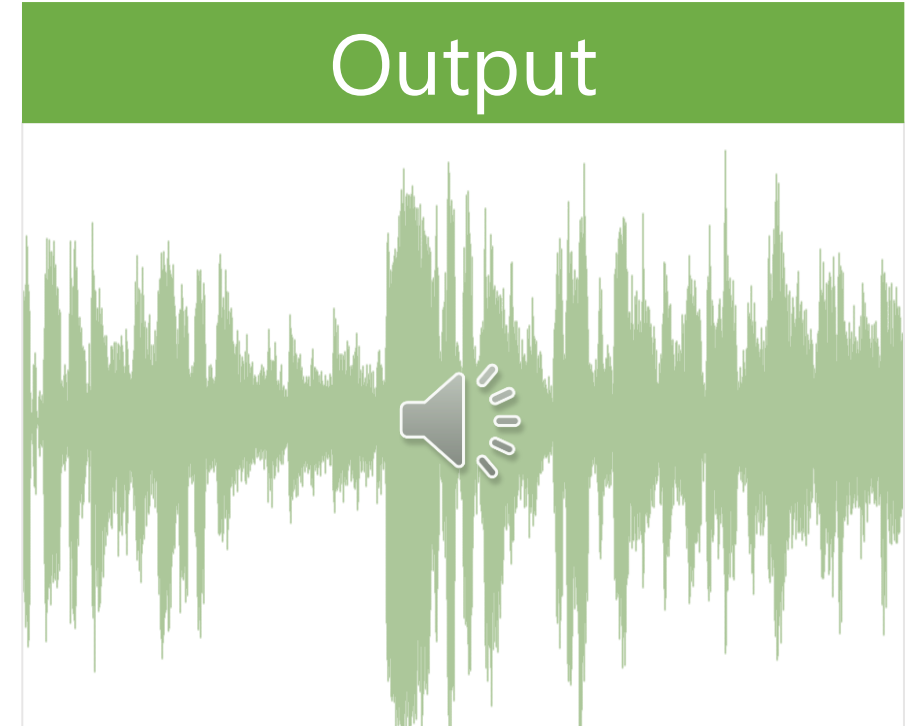
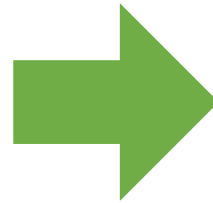


Instrument Translation



Music Generation

| Input | |
|--------|---|
| Genre | Classic Pop |
| Artist | Frank Sinatra |
| Lyrics | It's Christmas time and you know what that means. Oh, it's hot tub time as I ... |



Audio Summary

Audio Analysis

Sound classification
Voice recognition
Speech recognition

Audio Synthesis

Sound generation
Speech synthesis
Speech translation

Images

Images

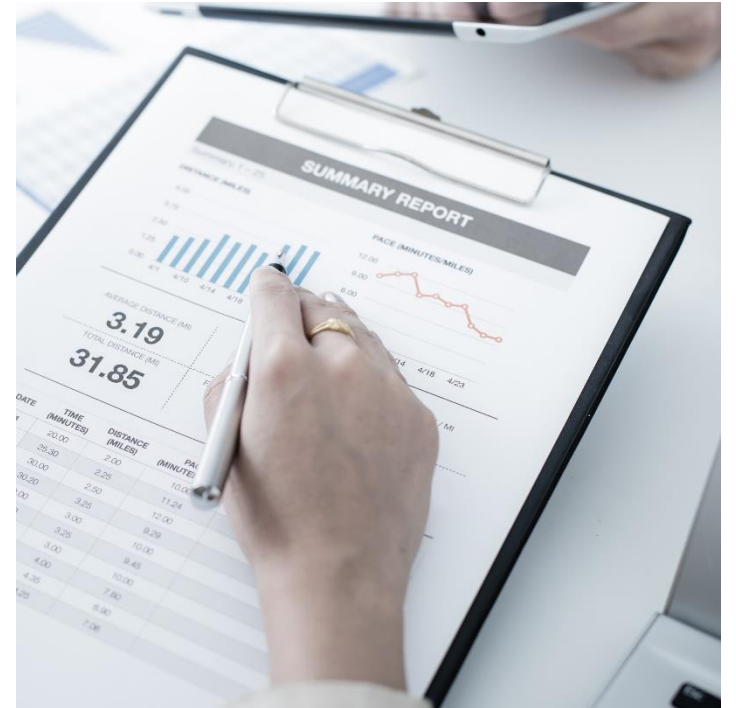


Image Data

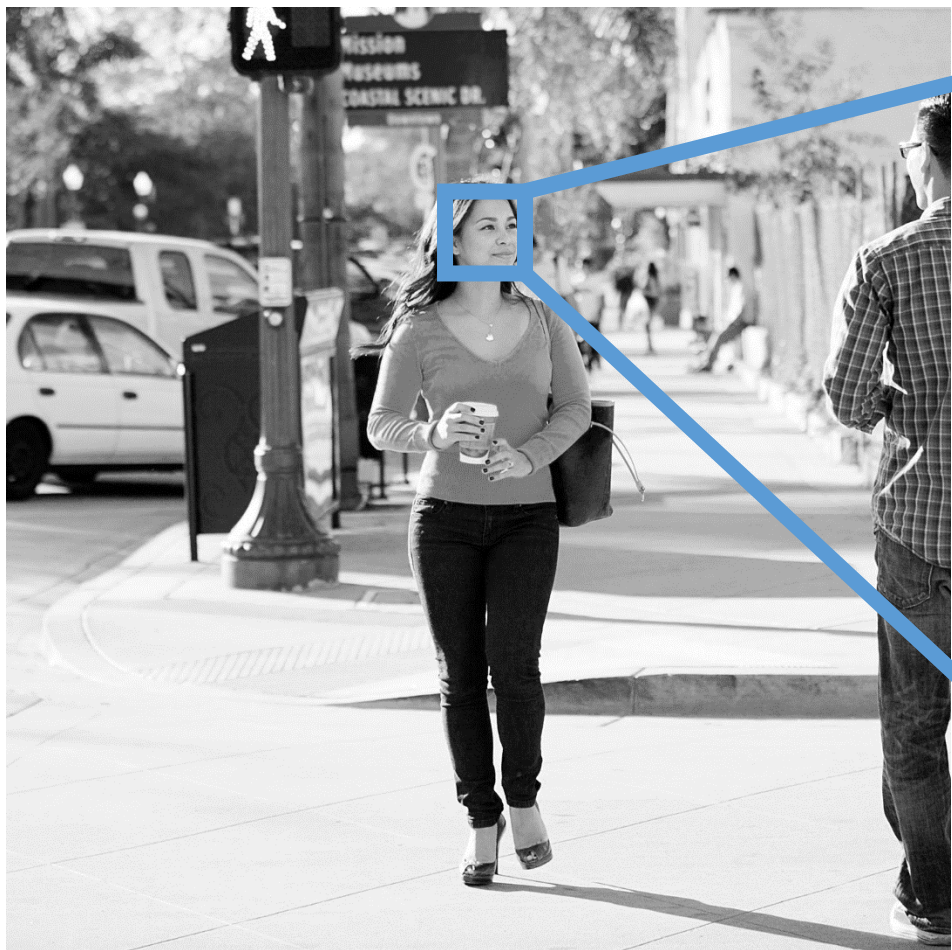
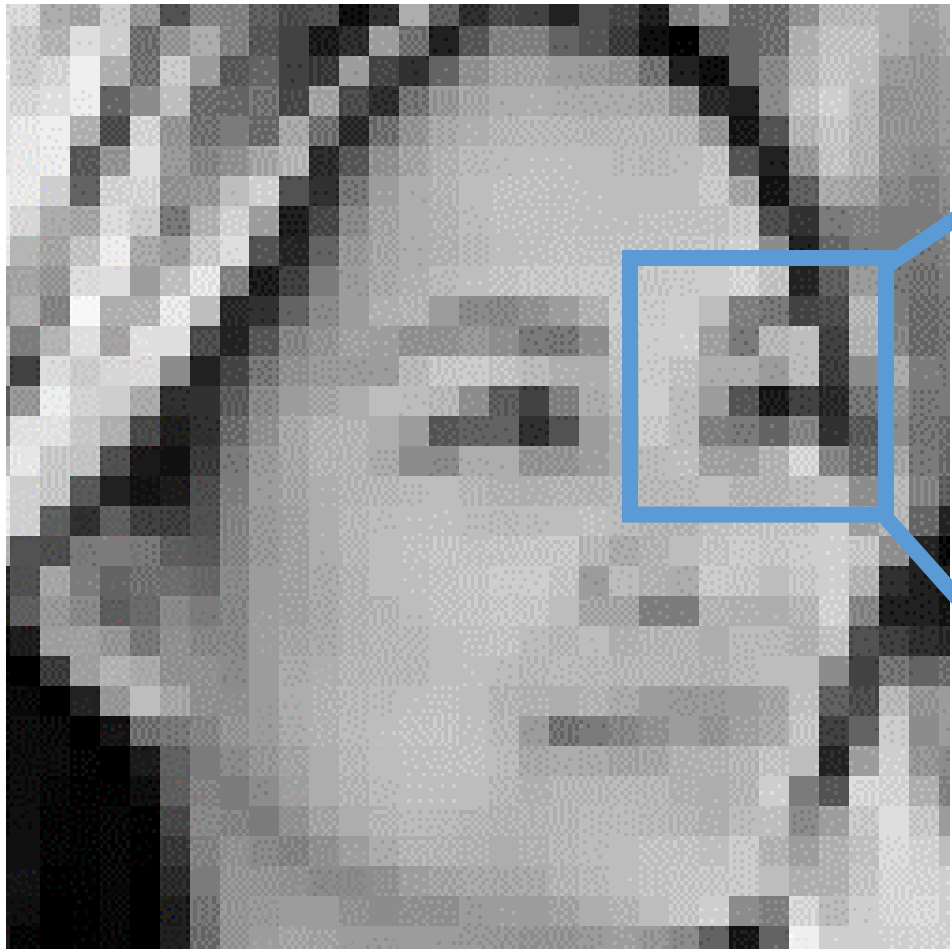


Image Data

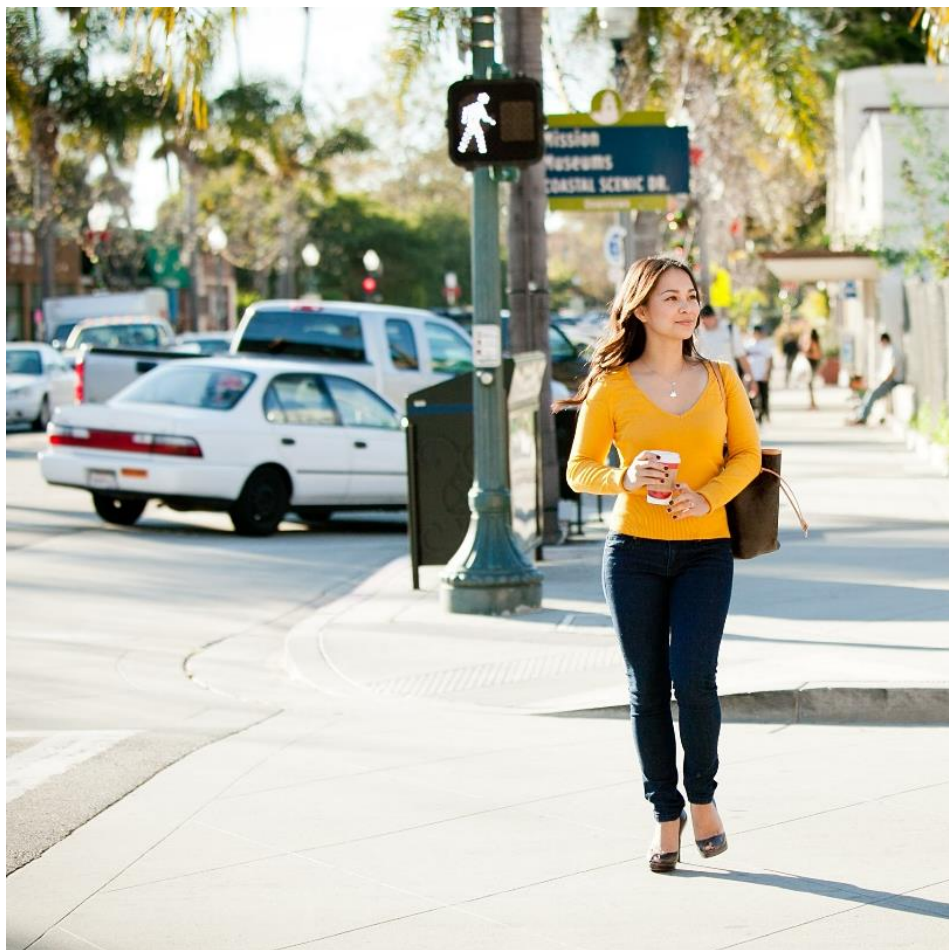


| | | | | | | | |
|----|----|----|----|---|----|---|---|
| 9 | 10 | 10 | 10 | 9 | 2 | 5 | 7 |
| 10 | 10 | 9 | 6 | 6 | 3 | 4 | 9 |
| 10 | 10 | 8 | 6 | 9 | 9 | 3 | 9 |
| 10 | 9 | 8 | 8 | 8 | 9 | 3 | 7 |
| 10 | 9 | 8 | 4 | 1 | 3 | 2 | 6 |
| 9 | 9 | 6 | 6 | 5 | 6 | 2 | 4 |
| 9 | 9 | 8 | 8 | 9 | 10 | 6 | 5 |
| 9 | 9 | 9 | 9 | 9 | 9 | 9 | 7 |

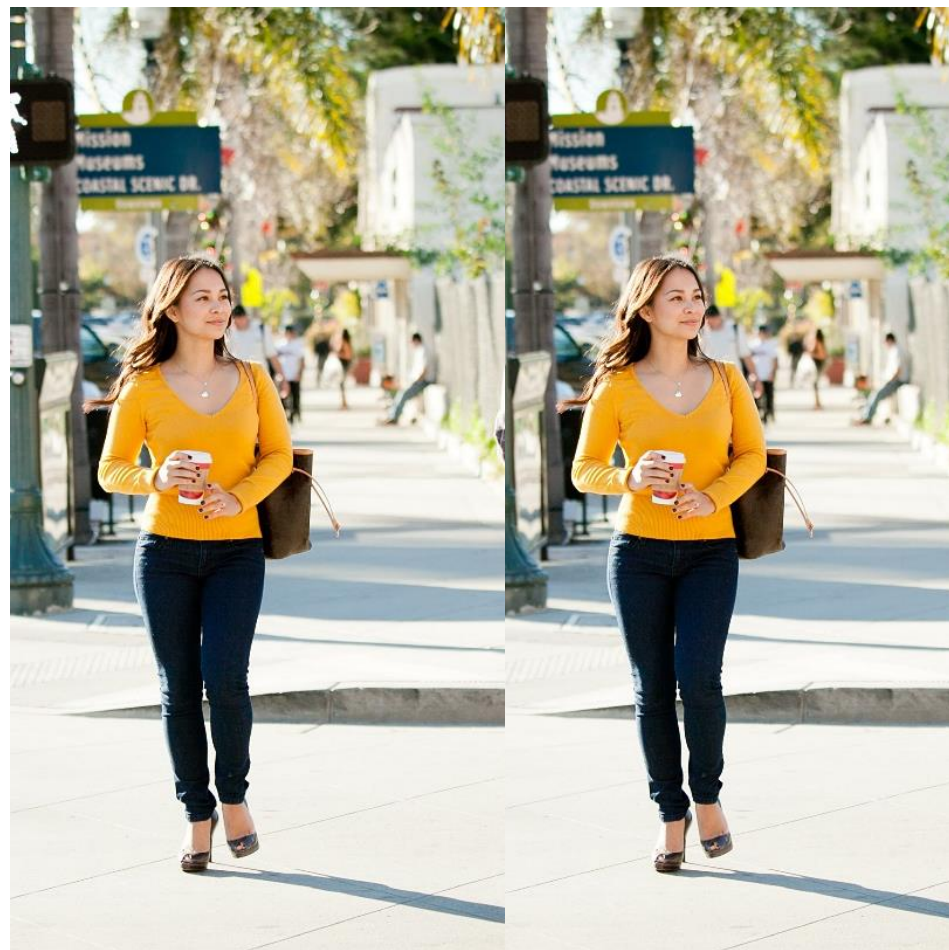
Image Data



Image Data



Mono



Stereo

Image Analysis Tasks

Image
classification

Object
detection

Face
recognition

Image
search

Image
captioning

Image
segmentation

Face
analysis

Body
analysis

Document
analysis

Image Classification

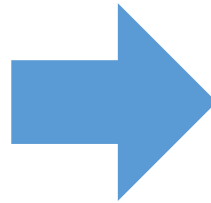
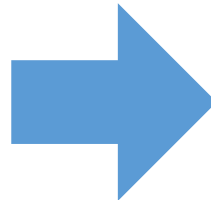
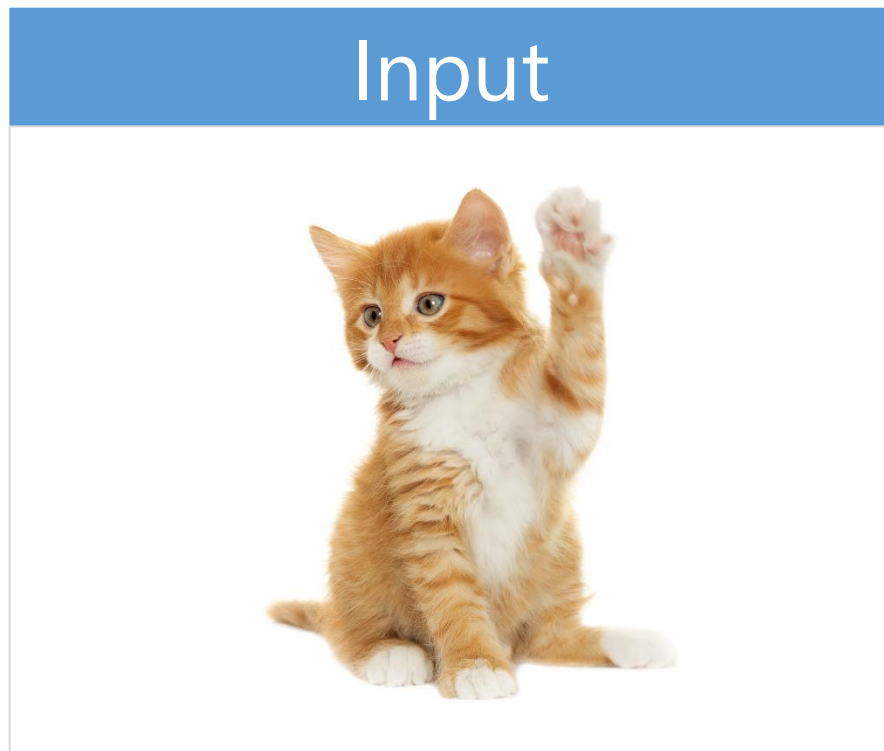


Image Classification

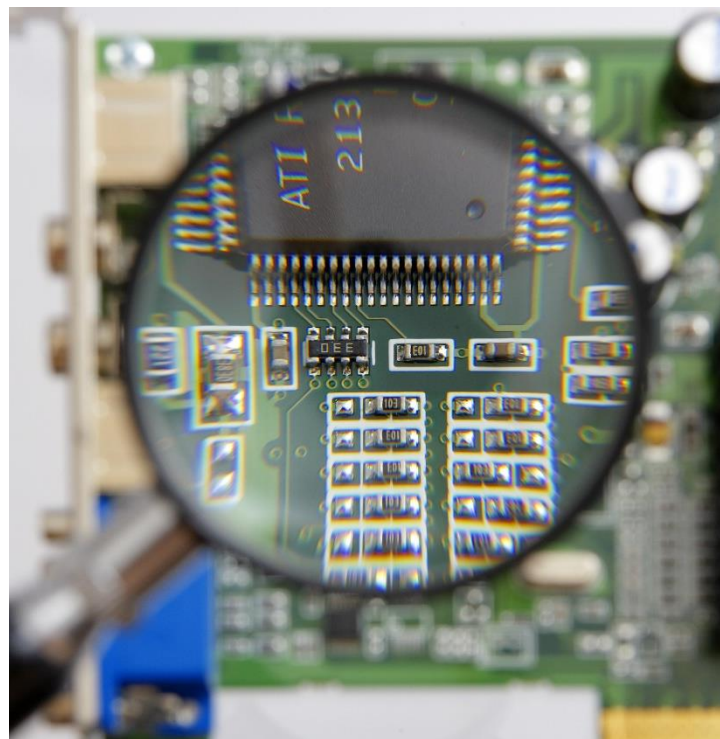


| Output | |
|------------|-------|
| Prediction | Score |
| Cat | 99% |
| Dog | 50% |
| Bird | 10% |

Image Classification



Image tagging



Defect detection



Medical diagnostics

Other Image Analysis Tasks

Image
classification

Object
detection

Face
recognition

Image
search

Image
captioning

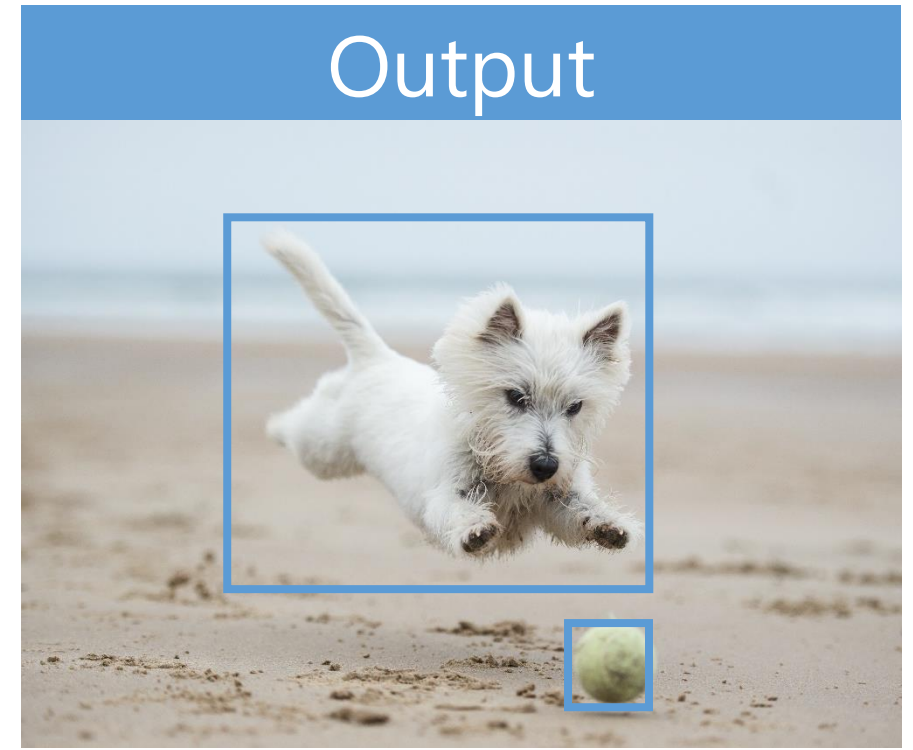
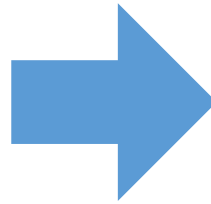
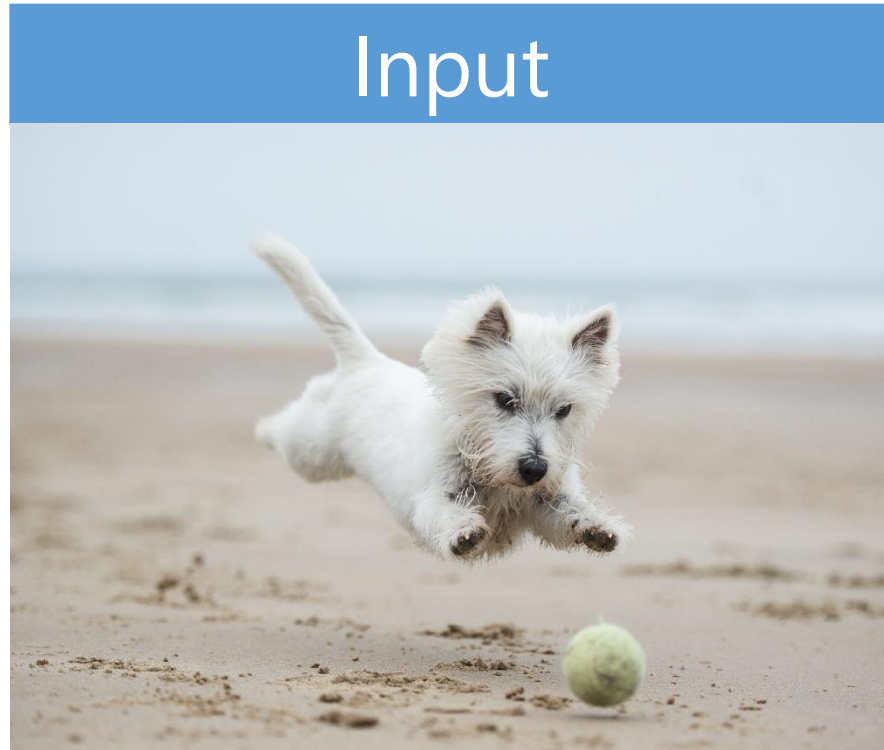
Image
segmentation

Face
analysis

Body
analysis

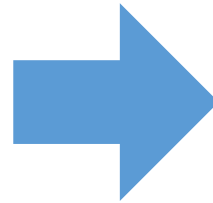
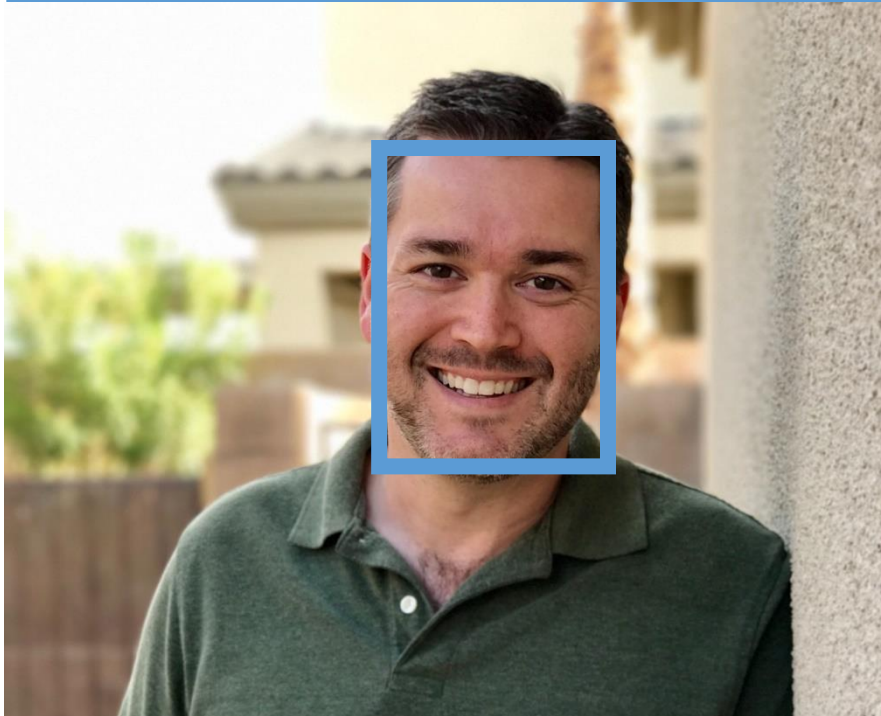
Document
analysis

Object Detection



Face Recognition

Input

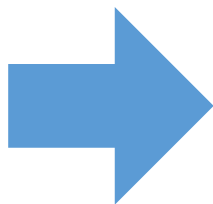


Output

| Prediction | Score |
|---------------|-------|
| Matthew Renze | 99% |
| Zhang San | 50% |
| Priya Singh | 10% |

Reverse Image Search

Input

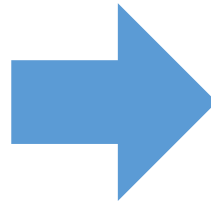


Output



Image Captioning

Input

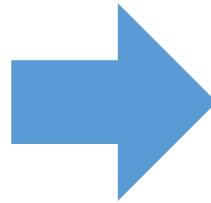


Output

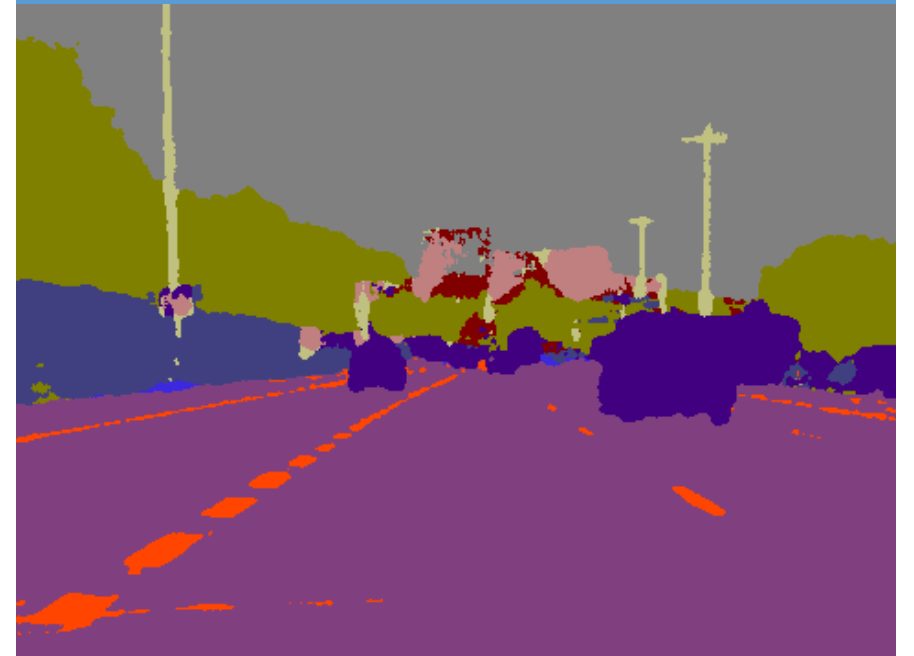
A man in a black shirt
is playing a guitar.

Image Segmentation

Input

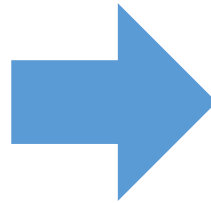
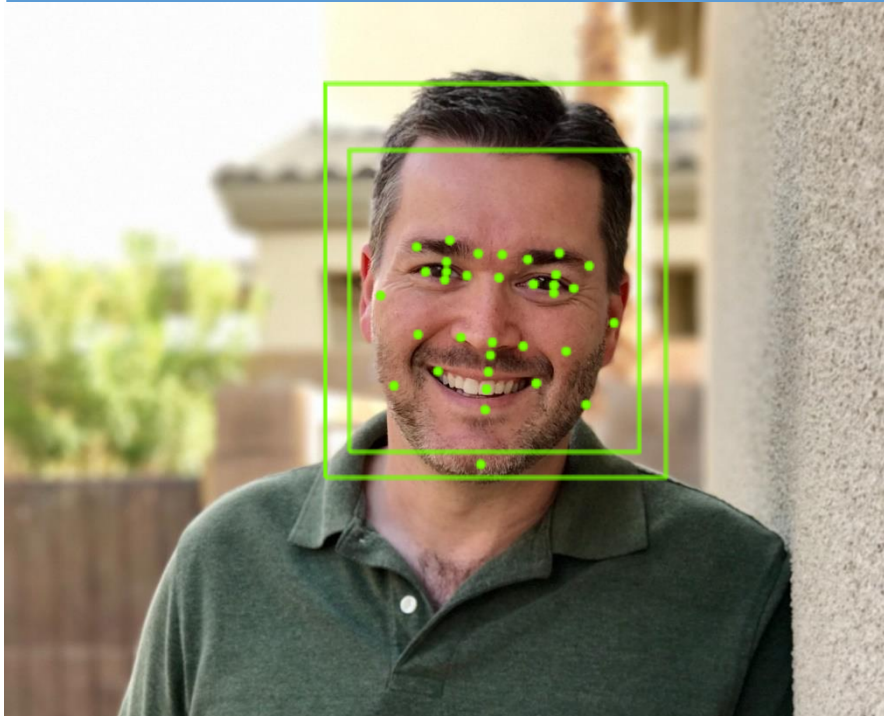


Output



Face Analysis

Input

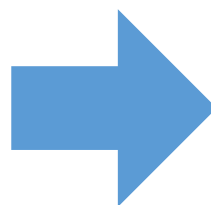
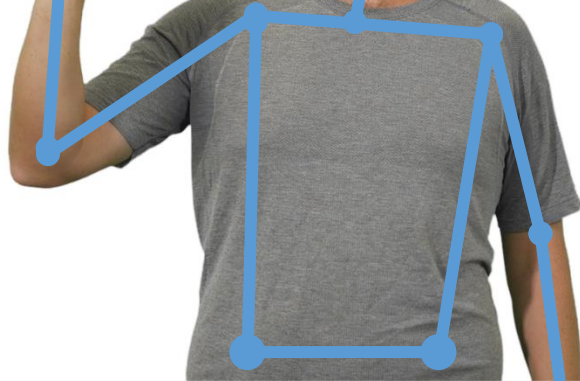


Output

| Output | |
|---------|-------|
| Gender | Male |
| Age | 36 |
| Glasses | No |
| Hair | Brown |
| Emotion | Happy |

Body Analysis

Input



Output

| | |
|---------------|------------|
| Pose | Standing |
| Gesture | Peace Sign |
| Finger Count | 2 |
| Adult Content | No |

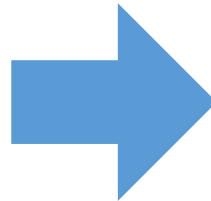
Document Analysis

Input

Store Receipt

| Item | Qty. | Price |
|--------|------|--------|
| Milk | 1 | \$1.00 |
| Chip | 2 | \$2.00 |
| Cheese | 3 | \$3.00 |
| | | <hr/> |
| | | \$6.00 |

X John Smith



Output

Store Receipt

| Item | Qty. | Price |
|--------|------|--------|
| Milk | 1 | \$1.00 |
| Chip | 2 | \$2.00 |
| Cheese | 3 | \$3.00 |

Total: \$6.00

Signature: John Smith

Image Synthesis Tools

Image
completion

Image
generation

Image
style transfer

Image
coloration

Image
super-resolution

Depth-map
estimation

Face
generation

Sketch
generation

Image
interpolation

Image Completion

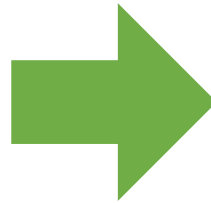
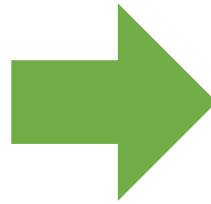


Image Completion

Input



Output



Image Completion



Object removal

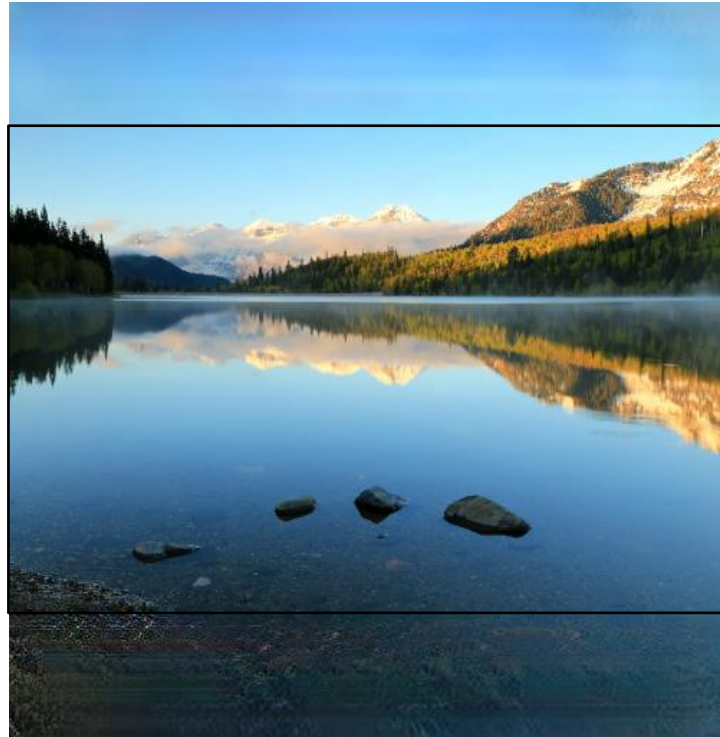


Image expansion



Image restoration

Other Image Synthesis Tasks

Image
completion

Image
generation

Image
style transfer

Image
coloration

Image
super-resolution

Depth-map
estimation

Face
generation

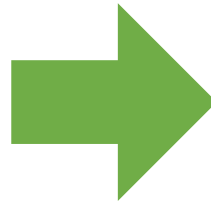
Sketch
generation

Image
interpolation

Image Generation

Input

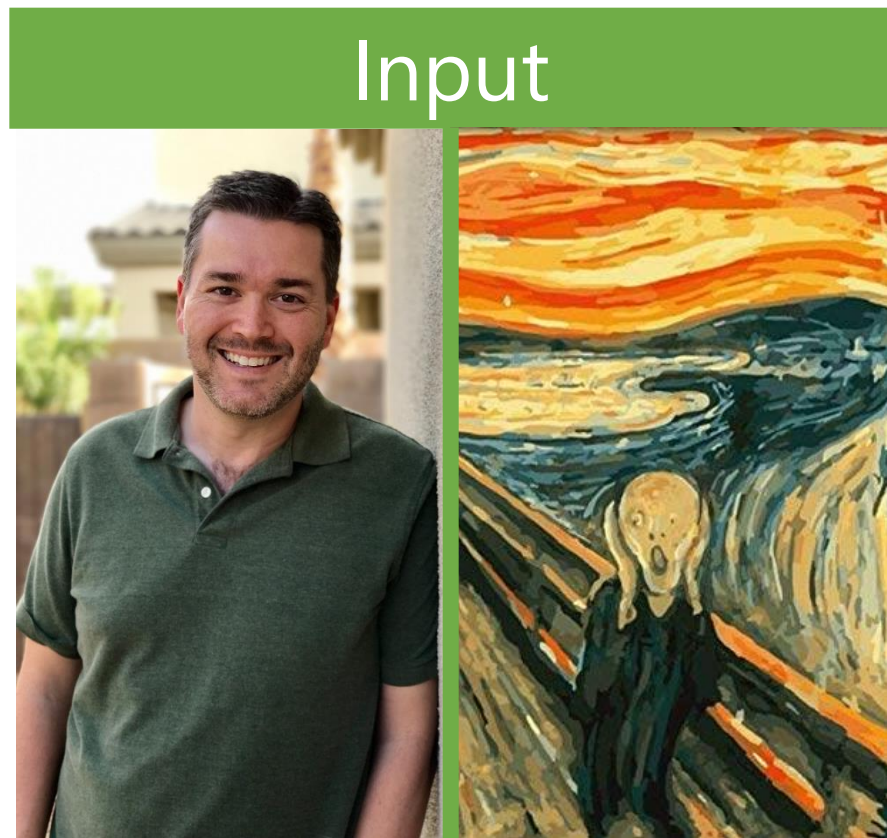
A photograph of
an astronaut riding
a horse on the moon.



Output



Image Style Transfer



Source image

Style image

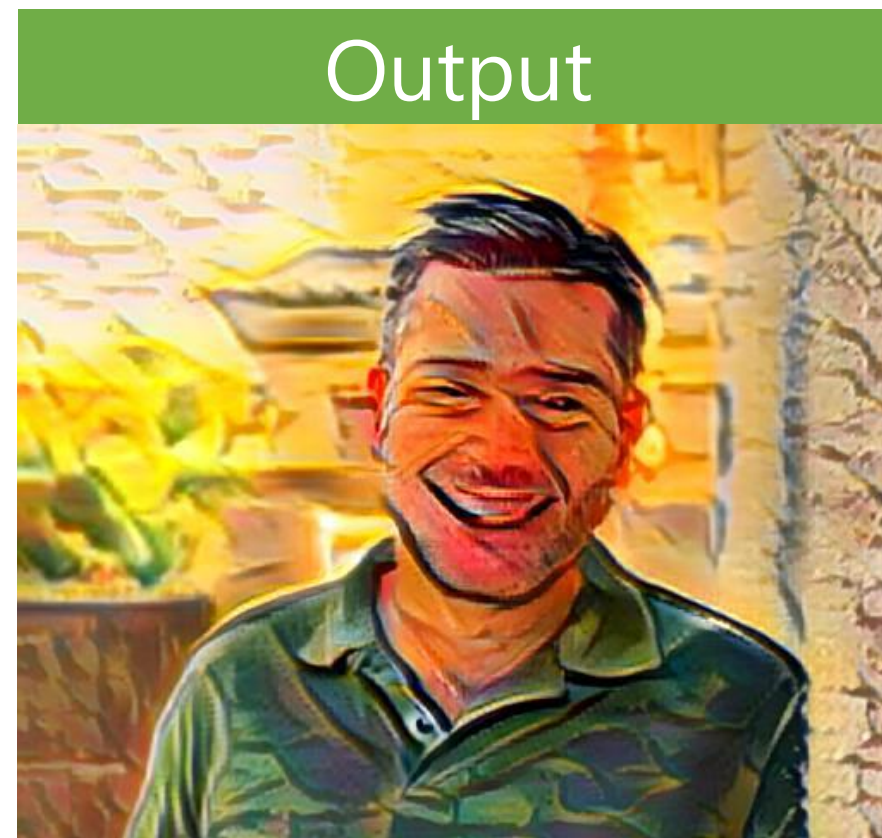
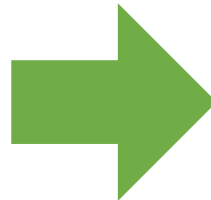
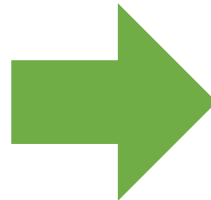
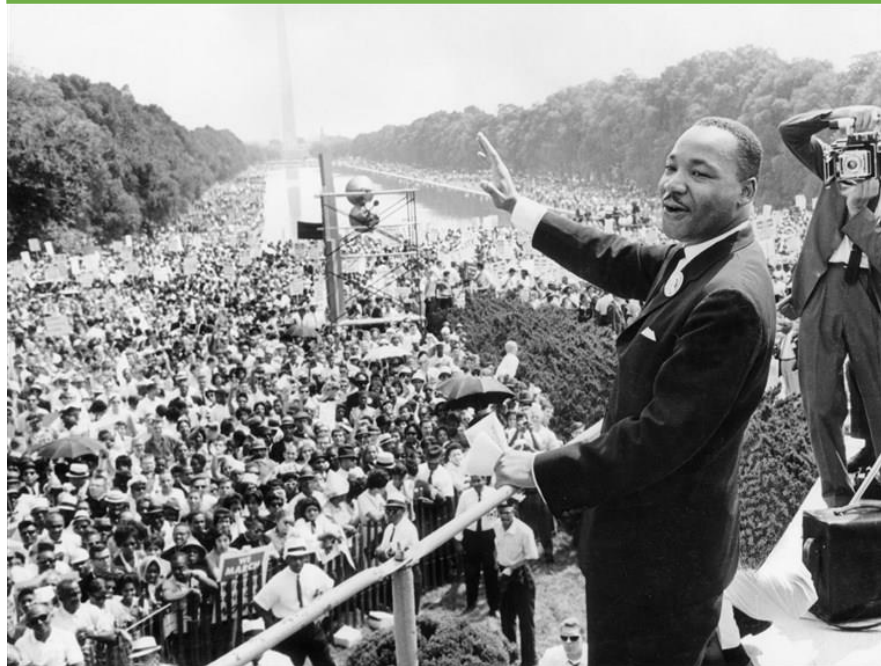


Image Colorization

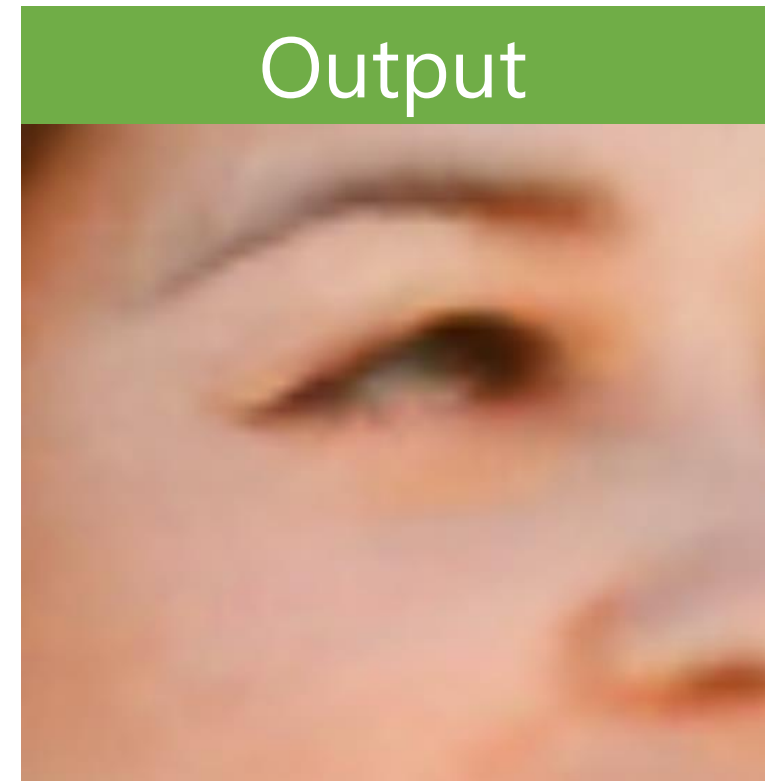
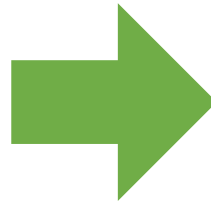
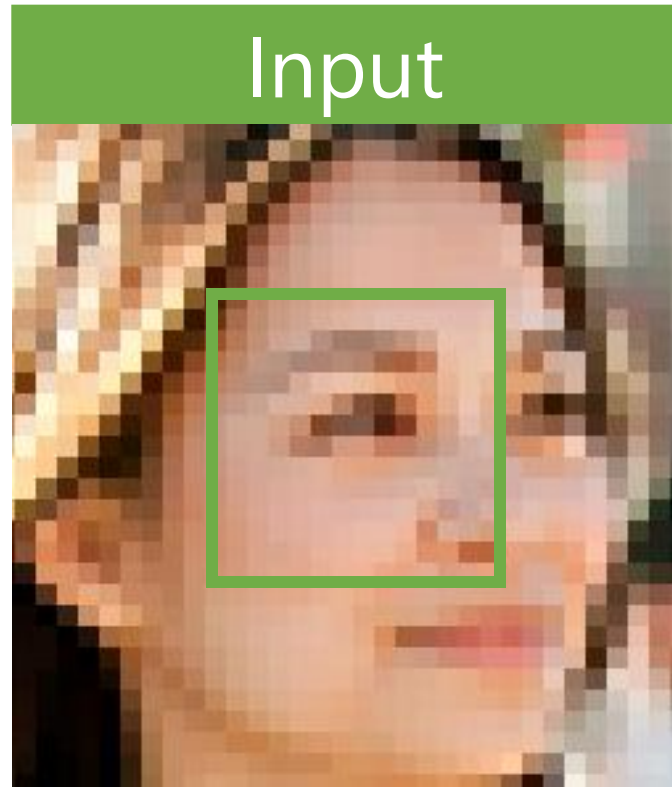
Input



Output



Image Super-Resolution



Depth-Map Estimation

Input

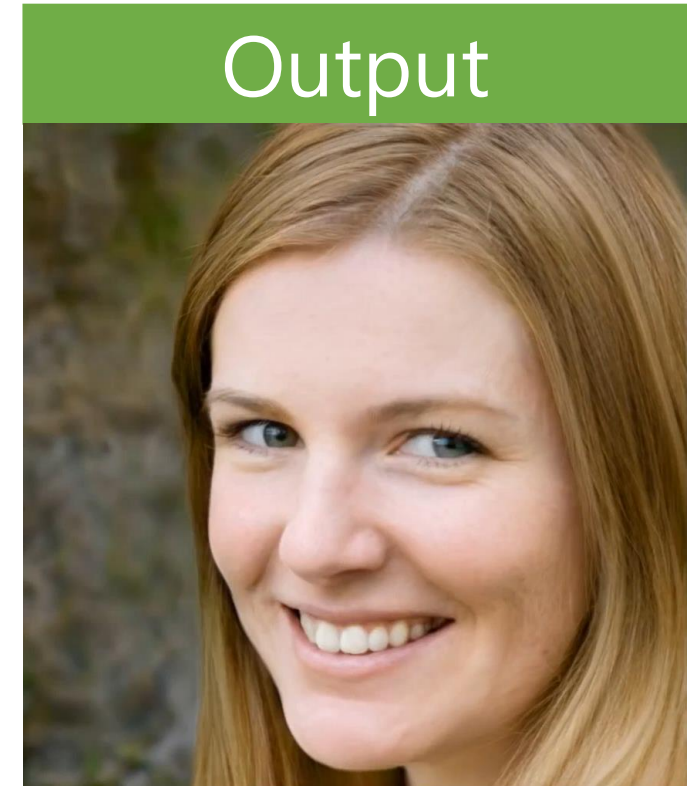
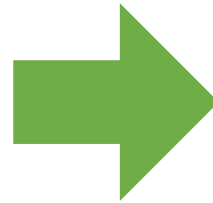


Output



Face Generation

| Input | |
|---------|--------|
| Gender | Female |
| Age | 33 |
| Glasses | No |
| Hair | Blonde |
| Emotion | Happy |



Sketch Generation

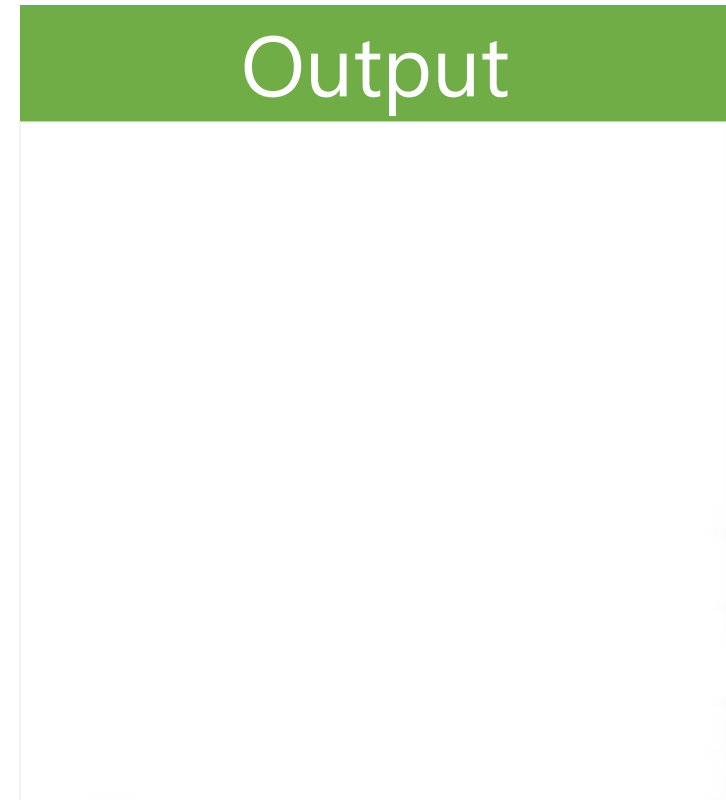
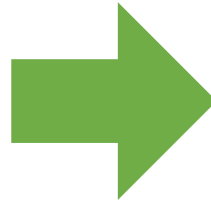
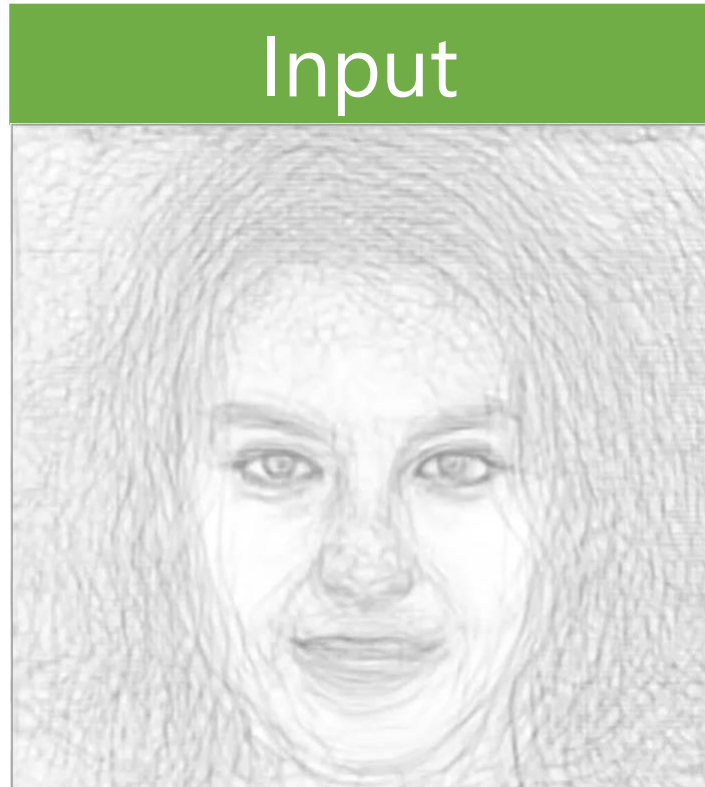


Image Interpolation



Image Summary

Image Analysis

Image classification
Object detection
Face recognition

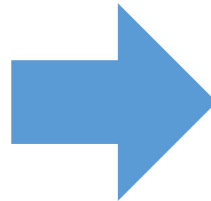
Image Synthesis

Image completion
Image generation
Image style transfer

Face Detection Demo

Demo Overview


Input



Output



Home >



Face

Cognitive Services

Search (Ctrl+ /)

Overview

- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

RESOURCE MANAGEMENT

- Quick start
- Keys and Endpoint
- Pricing tier
- Networking
- Identity
- Billing By Subscription

Properties

Locks

Monitoring

Alerts

Metrics

Delete

Essentials

JSON View

Resource group [\(change\)](#)
[Cognitive-Services](#)

Status
Active

Location
East US

Subscription [\(change\)](#)
[RenzeConsulting](#)

Subscription ID

Tags [\(change\)](#)
[Click here to add tags](#)

API type
Face

Pricing tier
Free

Endpoint
<https://face.cognitiveservices.azure.com/>

Manage keys
[Click here to manage keys](#)

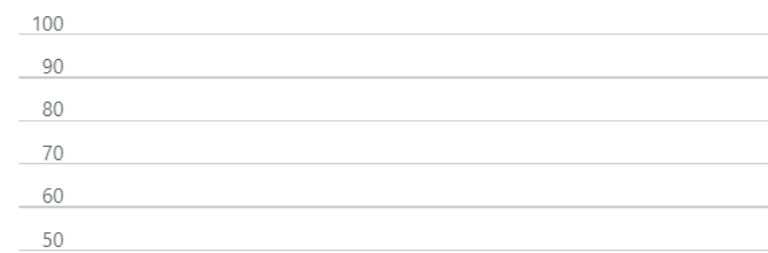
Show data for the last

15 minutes 1 hour 1 day 1 week 30 days

Requests



Errors



```
# Face Detection with Microsoft REST API
```

```
# Import dependencies
```

```
import os
```

```
import json
```

```
import requests
```

```
# Set the endpoint URL
```

```
url = "https://eastus.api.cognitive.microsoft.com/face/v1.0/detect"
```

```
# Set the subscription key
```

```
subscription_key = "[your-subscription-key]"
```

```
# Set the headers
```

```
headers = {
```

```
    "Ocp-Apim-Subscription-Key": subscription_key,
```

```
    "Content-Type": "application/octet-stream" }
```

```
# Set the file path to the image file
```

```
image_file_path = "C:/Demos/4 - Face Detection/Input.jpg"
```

```
# Open the image file for binary reading
image_file = open(
    file = image_file_path,
    mode = "rb")
```

```
# Read the image data
image_data = image_file.read()
```

```
# Post the request to the API
response = requests.post(
    url = url,
    headers = headers,
    data = image_data)
```

```
# Format the JSON response
formatted_json = json.dumps(
    obj = response.json(),
    indent = 4)
```

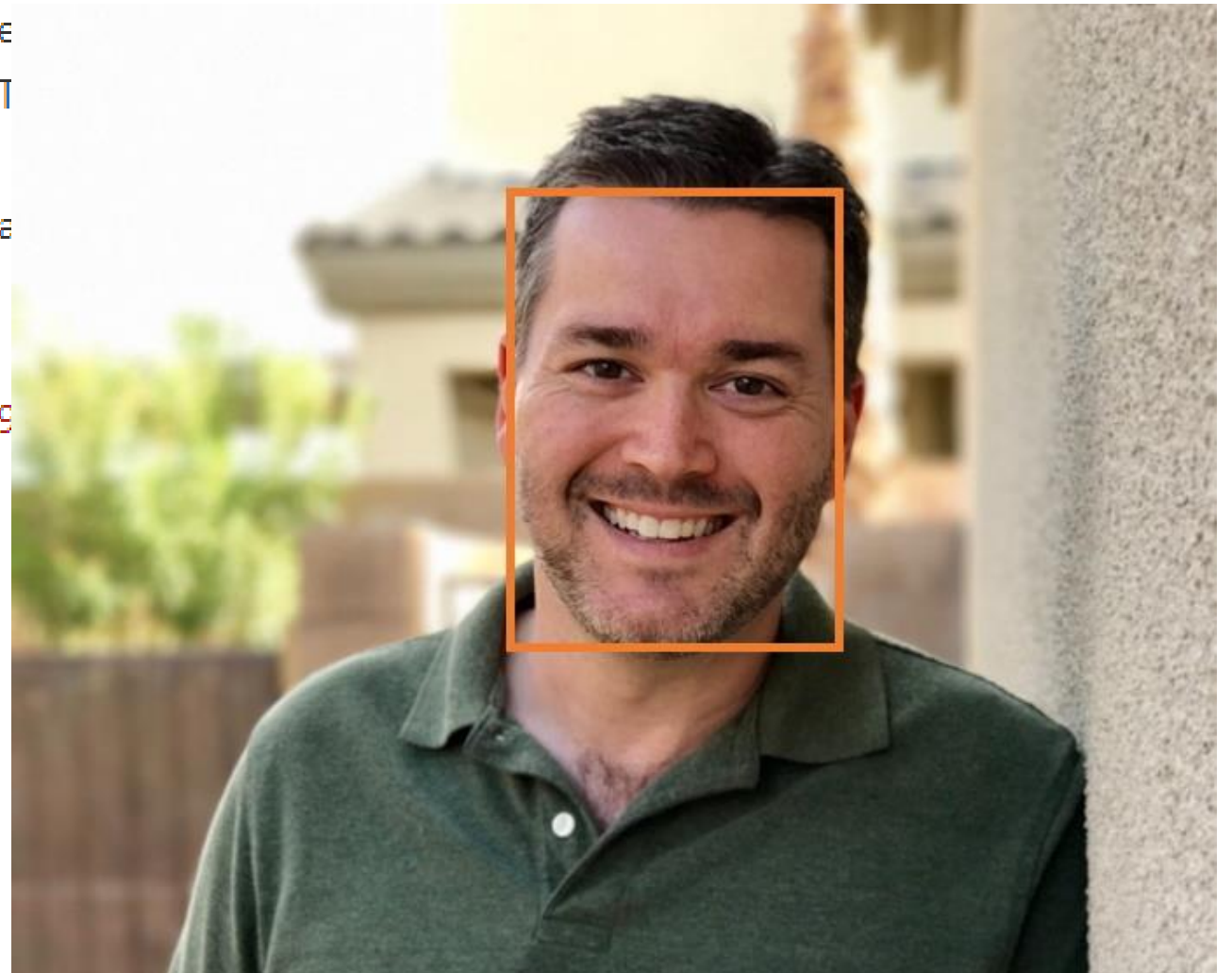
```
# Print the formatted json
print(formatted_json)
```

apim-request-id: 0d9f22dc-3c8a-4408-bc2c-21a6b0e0e4e9
x-envoy-upstream-service-time: 1102
Strict-Transport-Security: max-age=31536000; includeSubDomains; preload
x-content-type-options: nosniff
CSP-Billing-Usage: CognitiveServices.Face.Transaction=1
Date: Wed, 18 May 2022 12:23:26 GMT
Content-Length: 115
Content-Type: application/json; charset=utf-8

```
[{  
  "faceId": "19ed54ee-6b85-4aab-b89b-7b19123e0d06",  
  "faceRectangle": {  
    "top": 105,  
    "left": 283,  
    "width": 193,  
    "height": 265  
  }  
}]
```

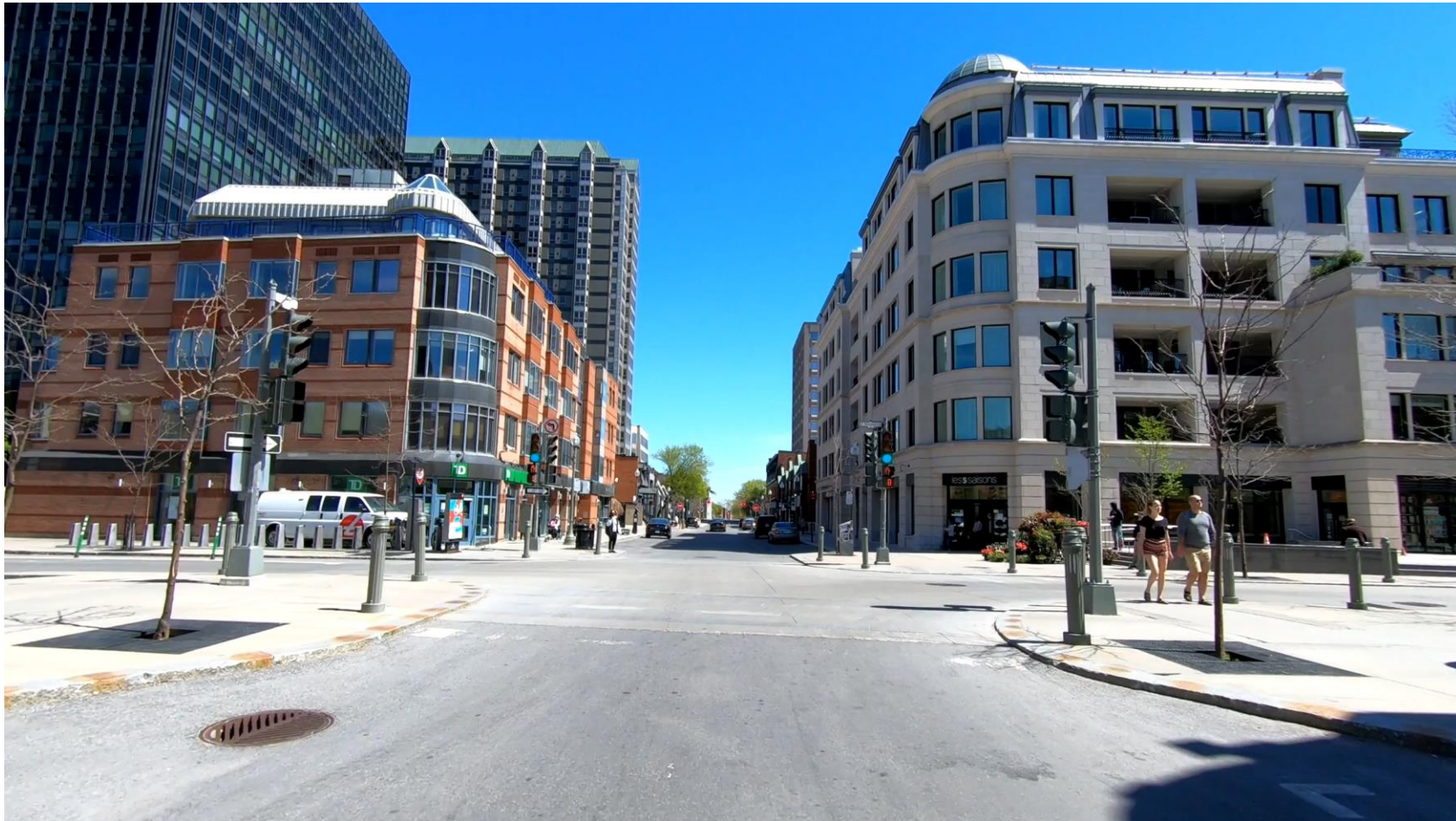
```
apim-request-id: 0d9f22dc-3c8a-4408-bc2c-21a6b0e0e4e9
x-envoy-upstream-service-time: 1102
Strict-Transport-Security: max-age=31536000; includeSubDomains; preload
x-content-type-options: nosniff
CSP-Billing-Usage: CognitiveService
Date: Wed, 18 May 2022 12:23:26 GMT
Content-Length: 115
Content-Type: application/json; cha
```

```
[{
  "faceId": "19ed54ee-6b85-4aab-b89
  "faceRectangle": {
    "top": 105,
    "left": 283,
    "width": 193,
    "height": 265
  }
}]
```



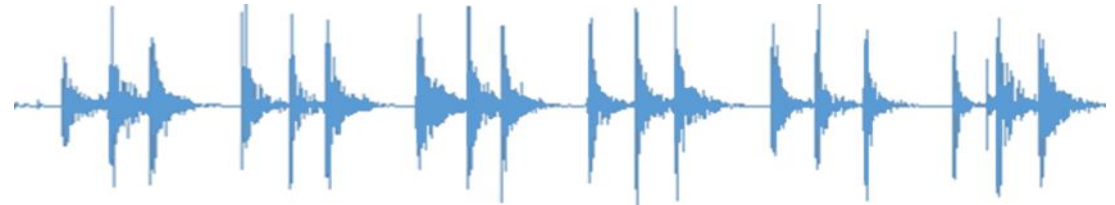
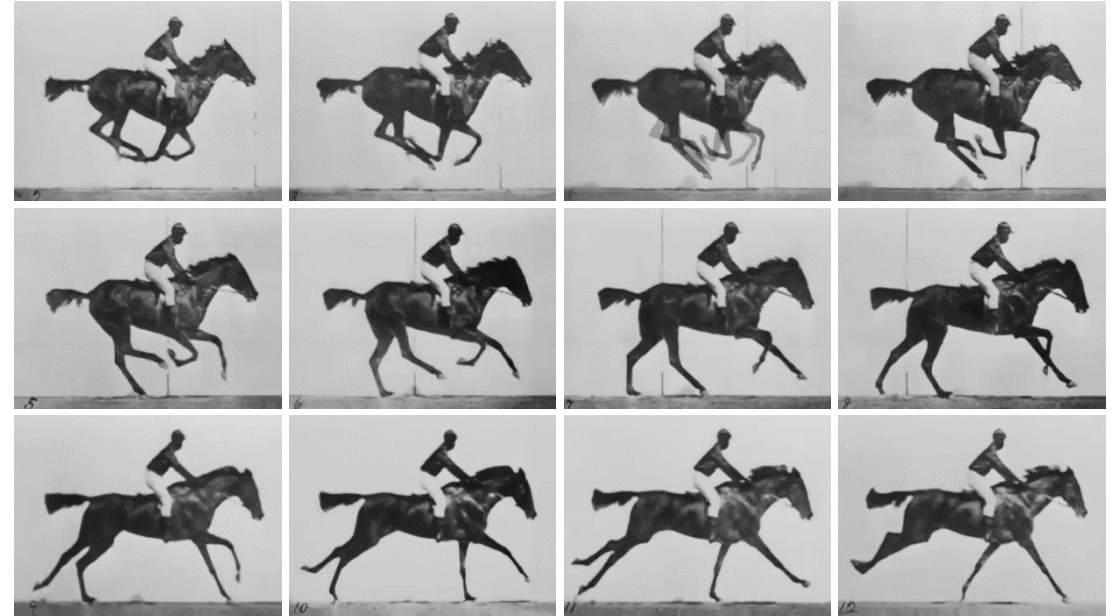
Video

Video



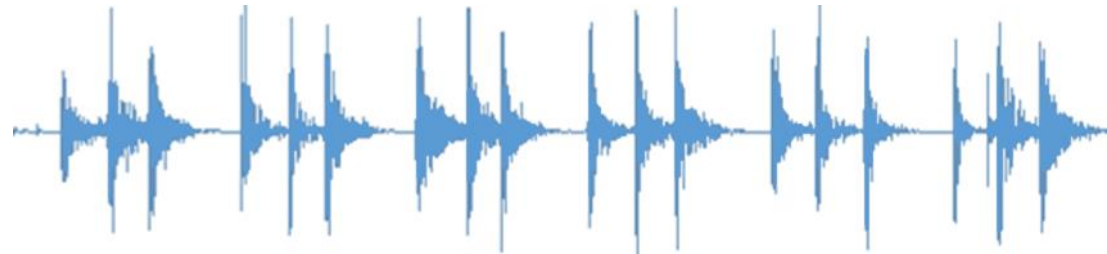
Video by German Korb from Pexels

Video

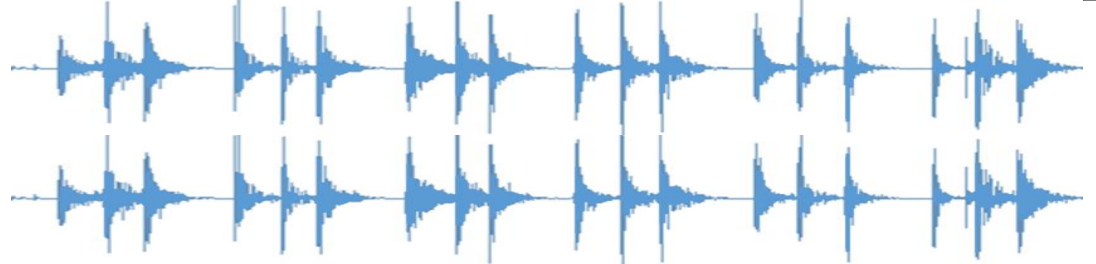
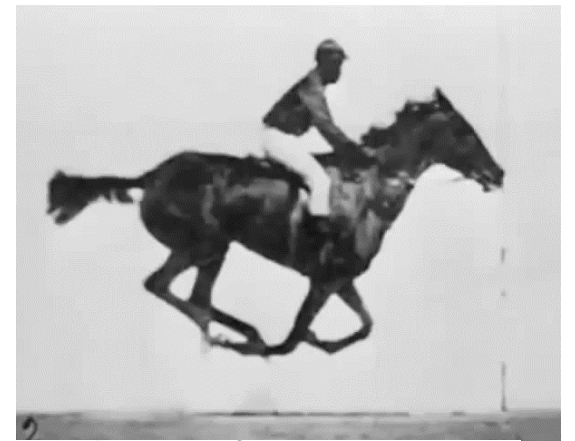
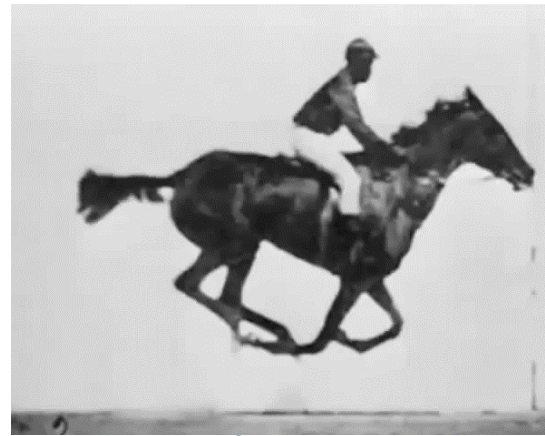


Video

Mono



Stereo



Includes All Previous A/V Tasks

Audio Tasks

Sound classification
Voice recognition
Speech recognition

Image Tasks

Image classification
Object detection
Face recognition

Video Analysis Tools

Motion
detection

Object
tracking

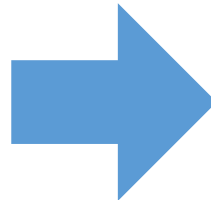
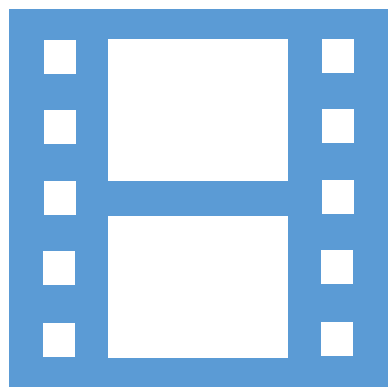
Action
recognition

Optical
flow

Gait
recognition

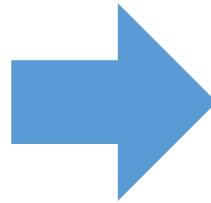
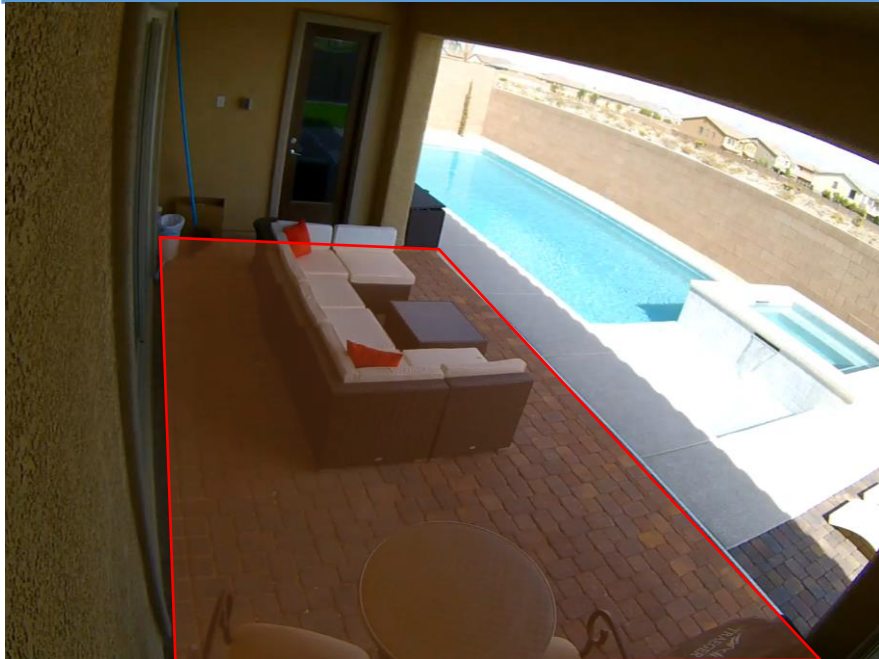
Lip
reading

Motion Detection



Motion Detection

Input



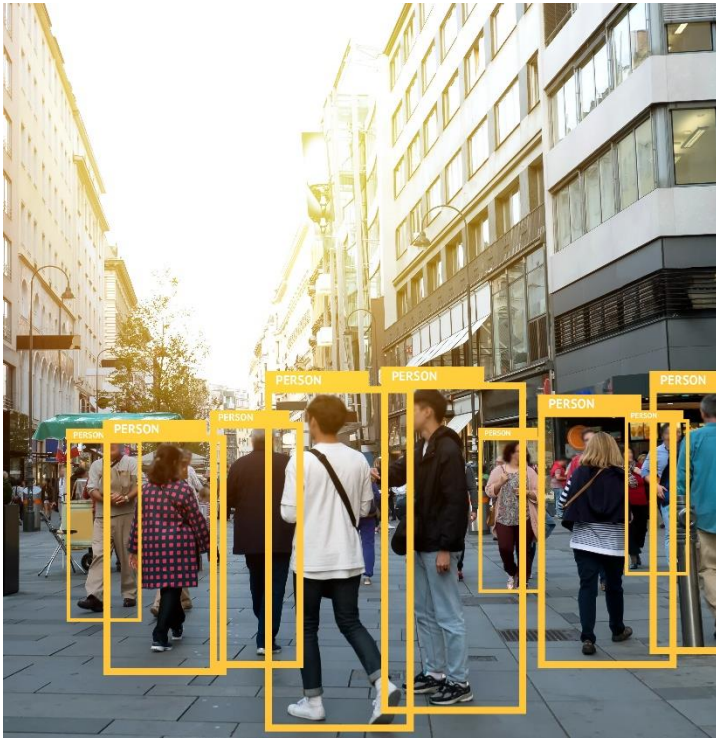
Output

No Motion

100%

Motion

Motion Detection



Video surveillance



Wildlife monitoring



Collaborative robotics

Other Video Analysis

Motion
detection

Object
tracking

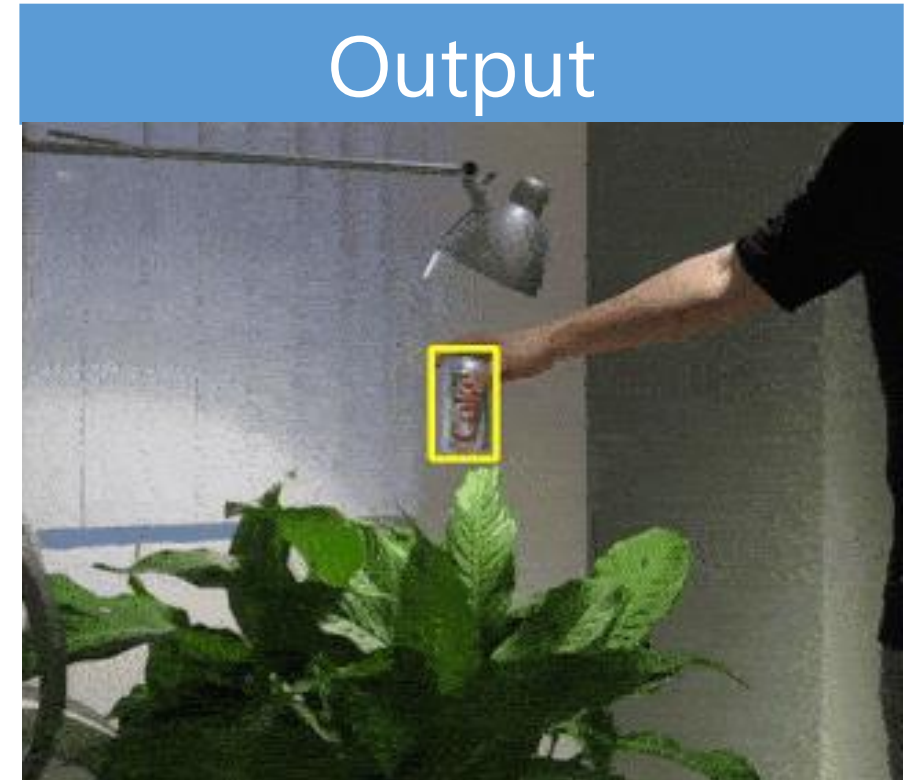
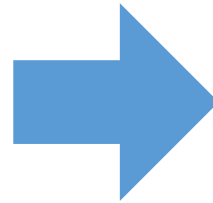
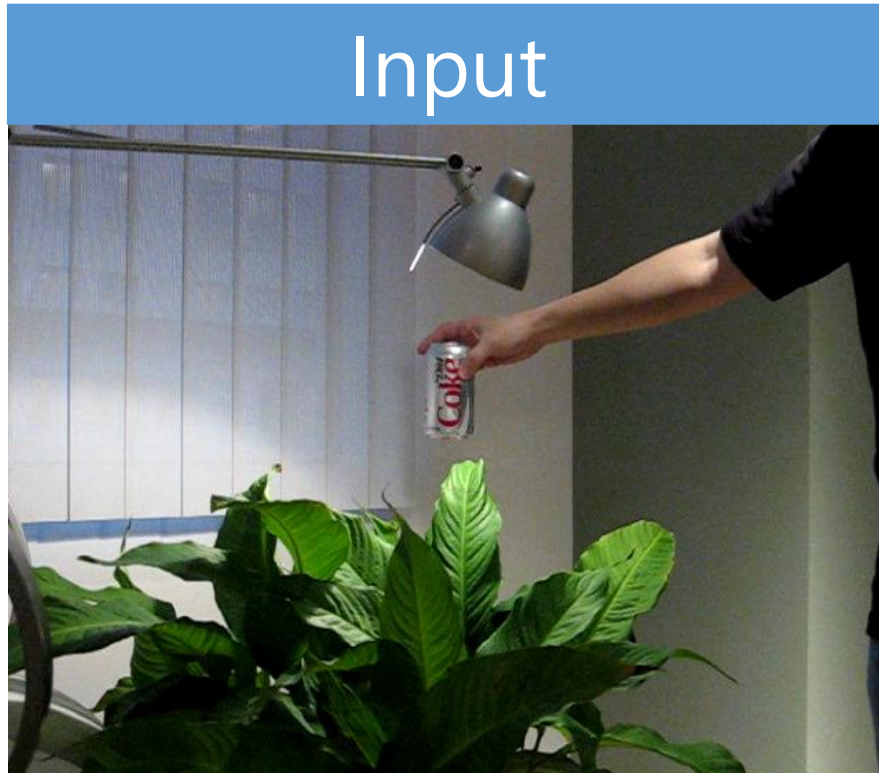
Action
recognition

Optical
flow

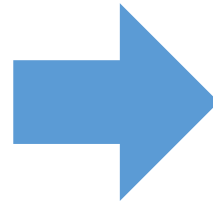
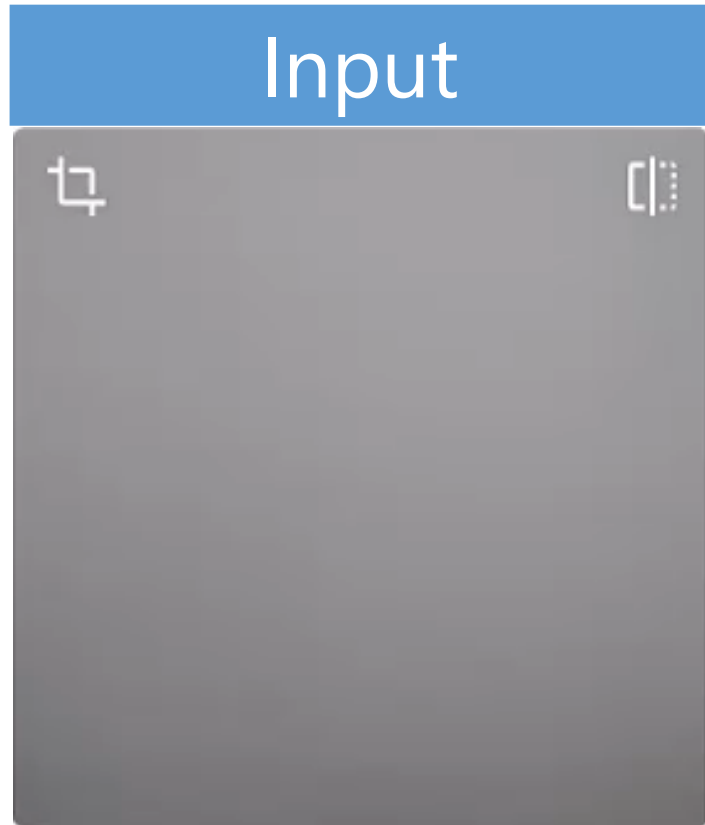
Gait
recognition

Lip
reading

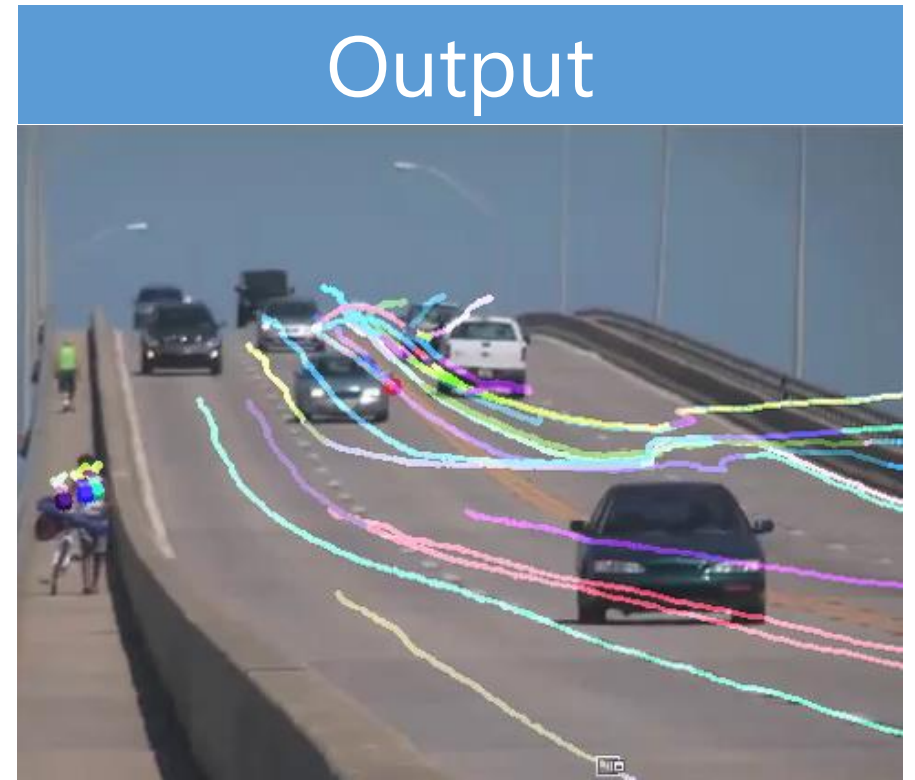
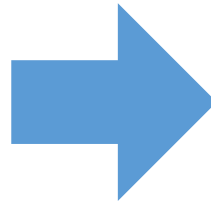
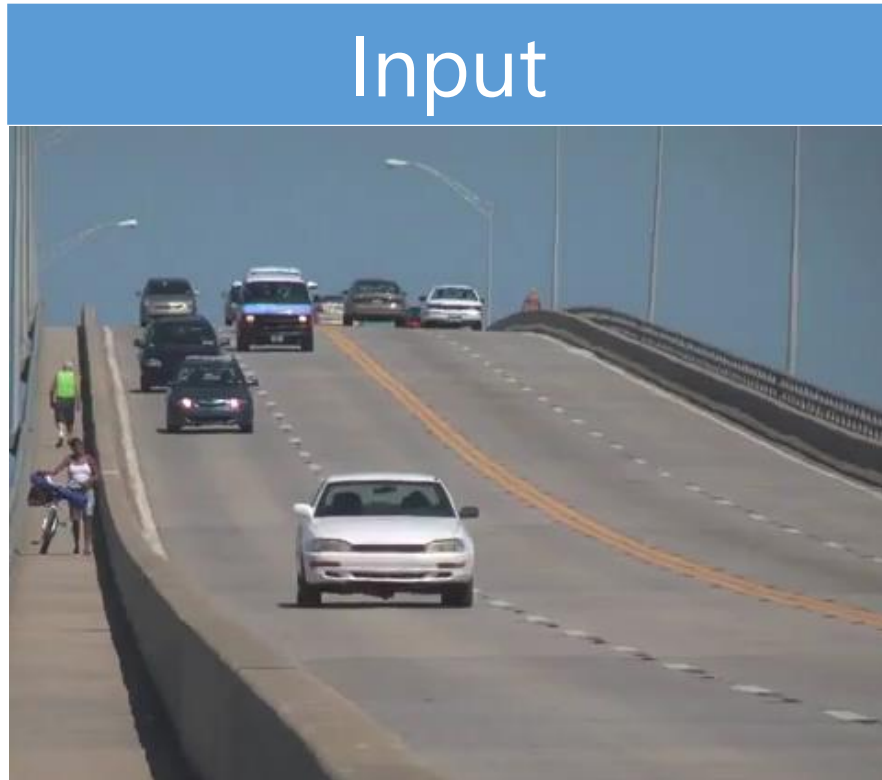
Object Tracking



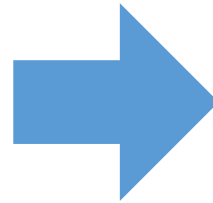
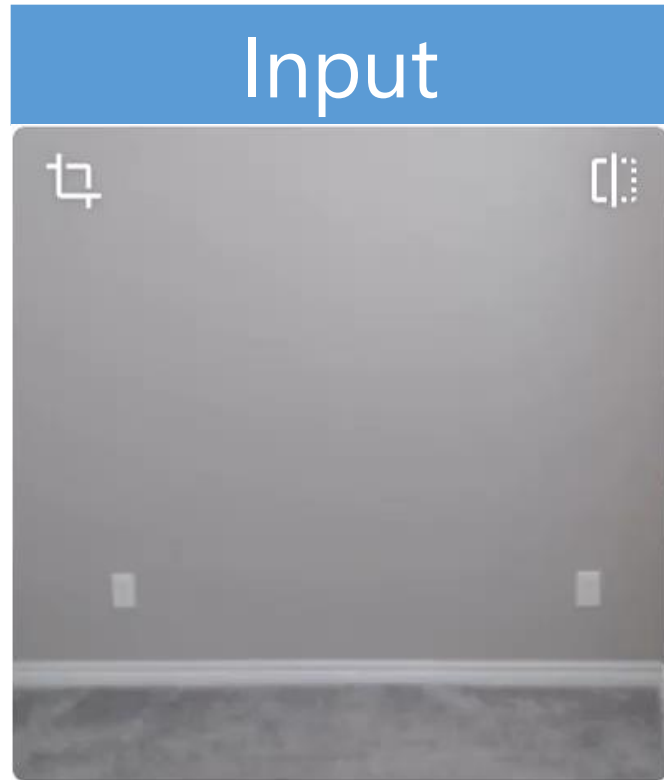
Action Recognition



Optical Flow



Gait Recognition



| Output | |
|---------|------------|
| Person | Prediction |
| Matthew | |
| Zhang | |
| Priya | |

Lip Reading

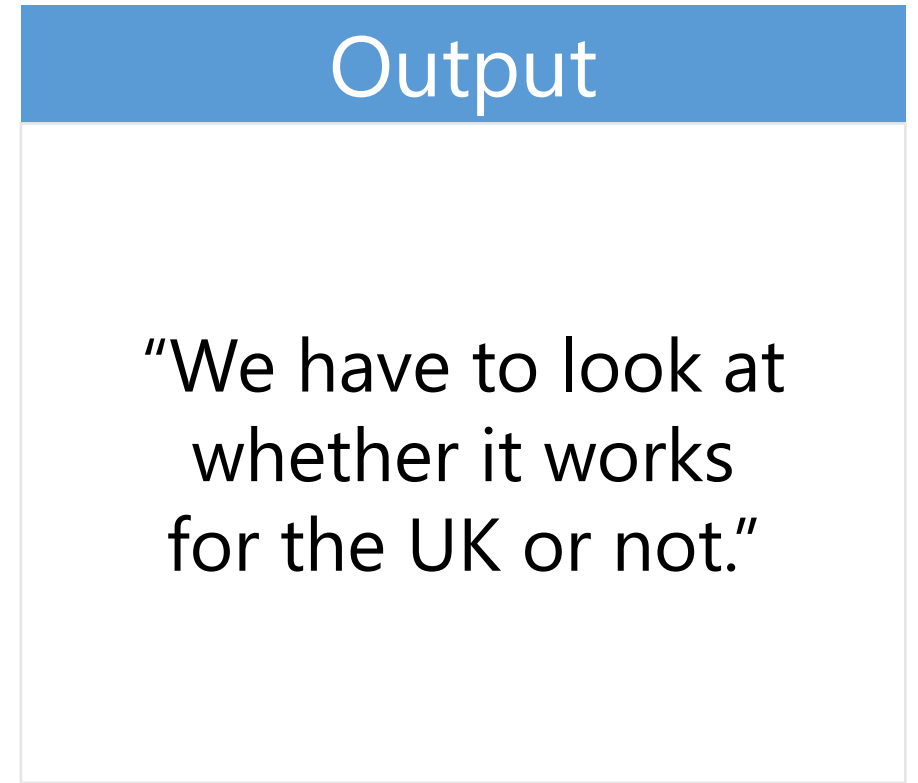
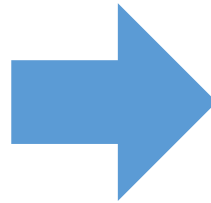
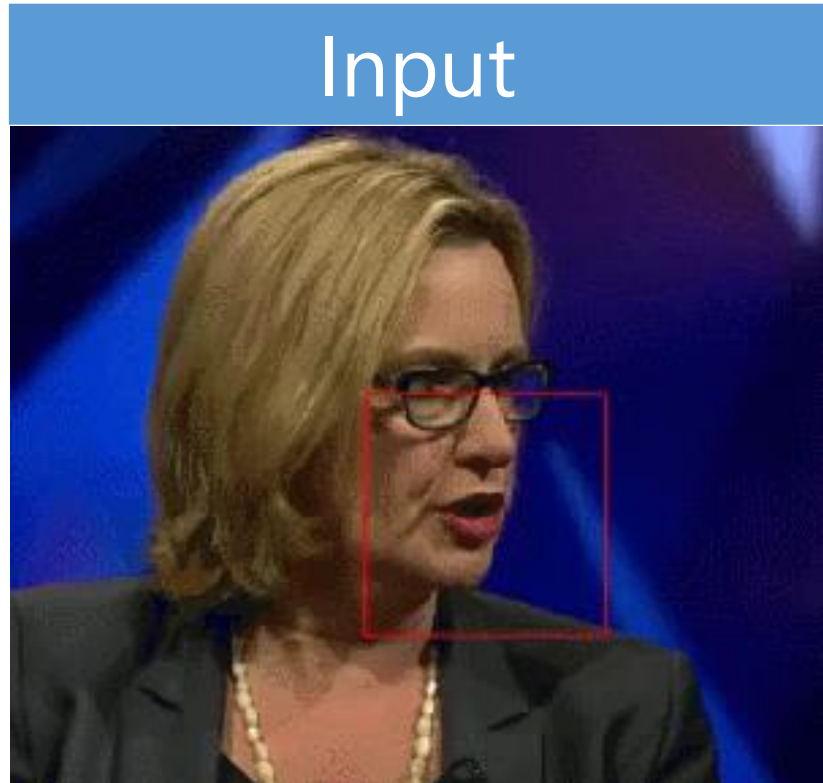


Image Synthesis Tools

Video
interpolation

Video
generation

Video
prediction

Video
transfer

Video
completion

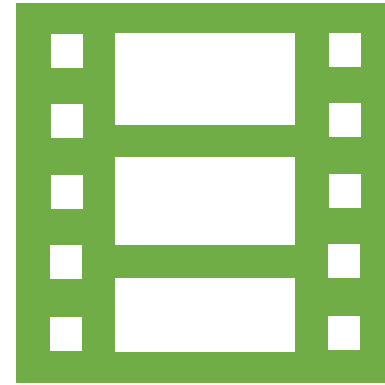
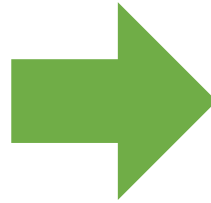
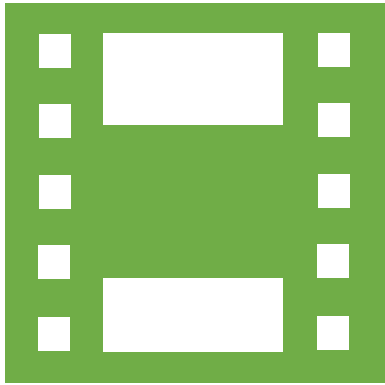
Video face
synthesis

Video pose
transfer

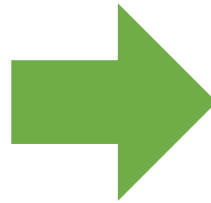
Video face
swap

Video lip
sync

Video Interpolation



Video Interpolation



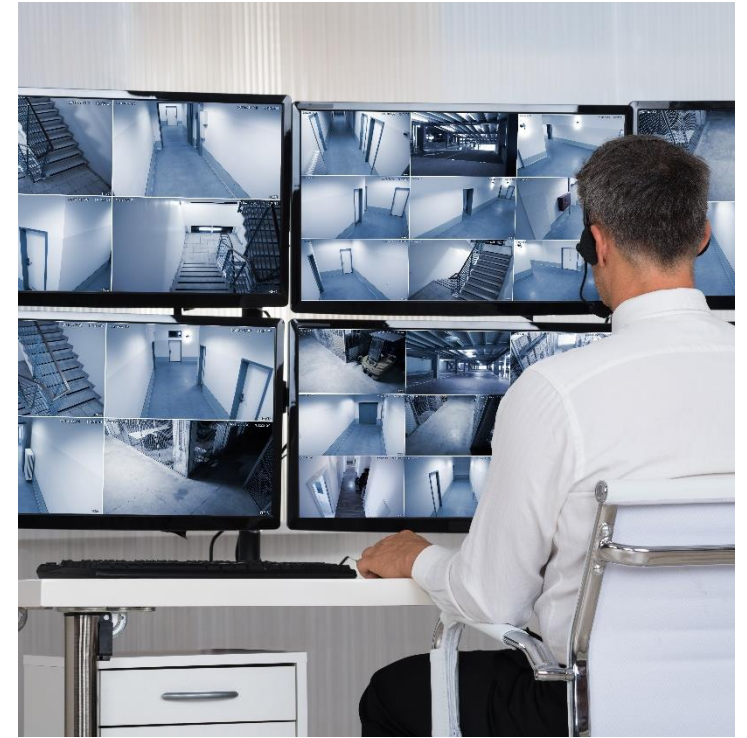
Video Interpolation



Frame-rate conversion



Film restoration



Video multiplexing

Other Video Synthesis Tools

Video
interpolation

Video
generation

Video
prediction

Video
transfer

Video
completion

Video face
synthesis

Video pose
transfer

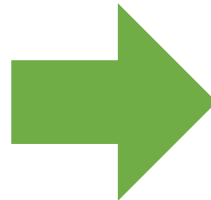
Video face
swap

Video lip
sync

Video Completion

Input

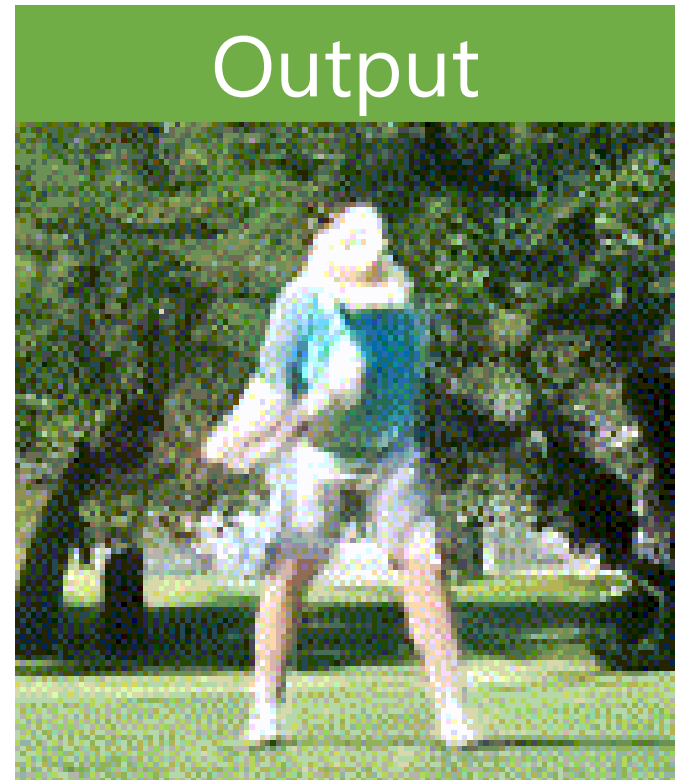
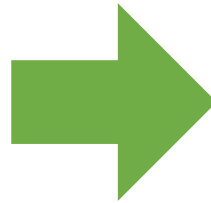
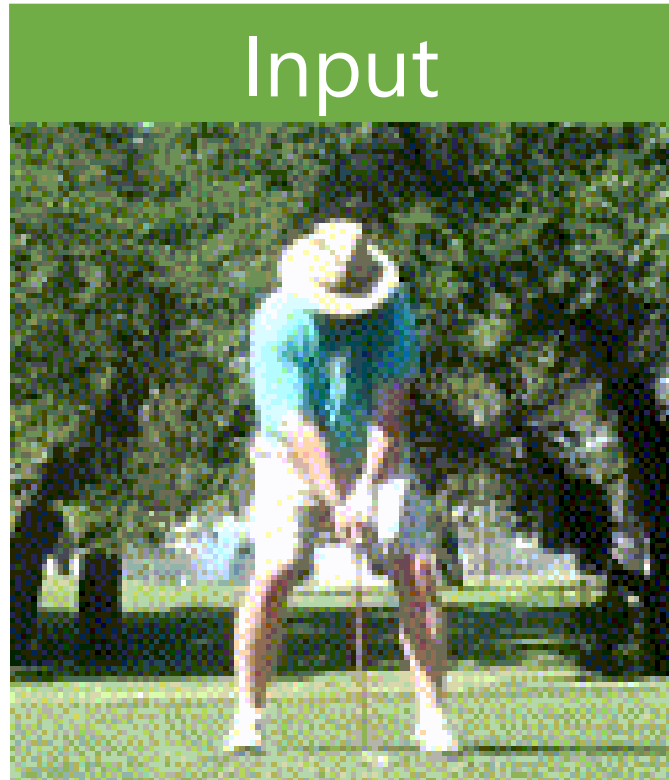
A teddy bear is playing the electric guitar, high definition, 4k.



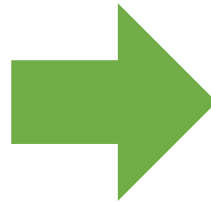
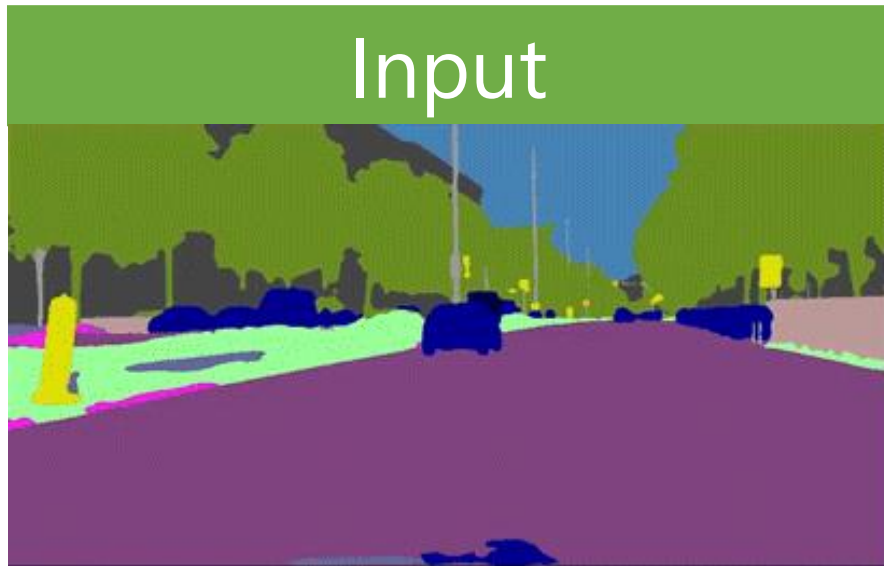
Output



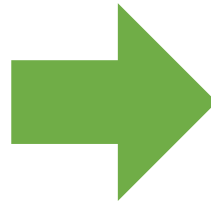
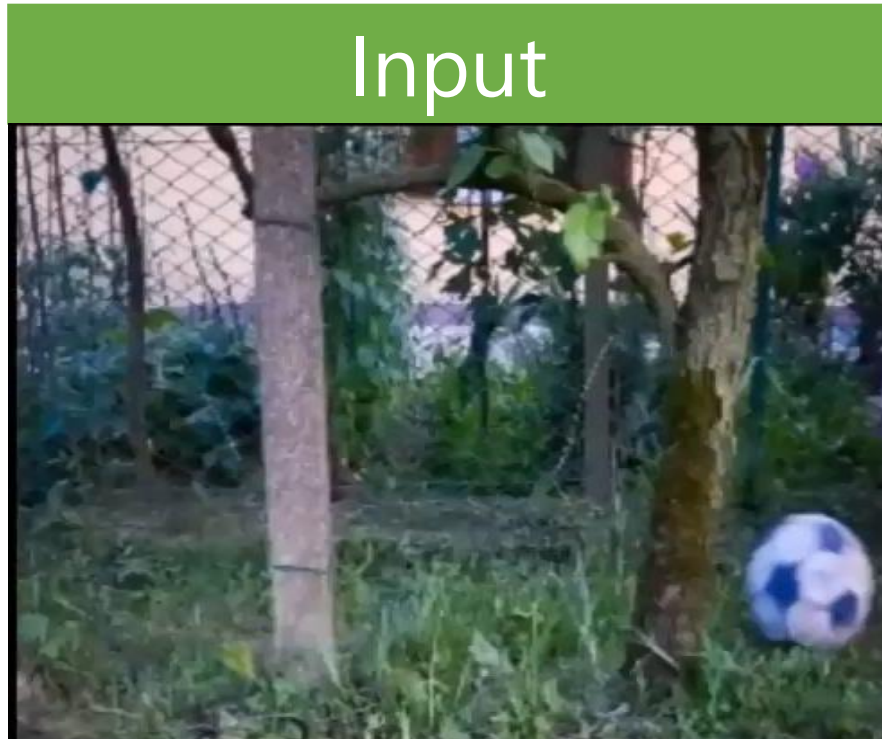
Video Prediction



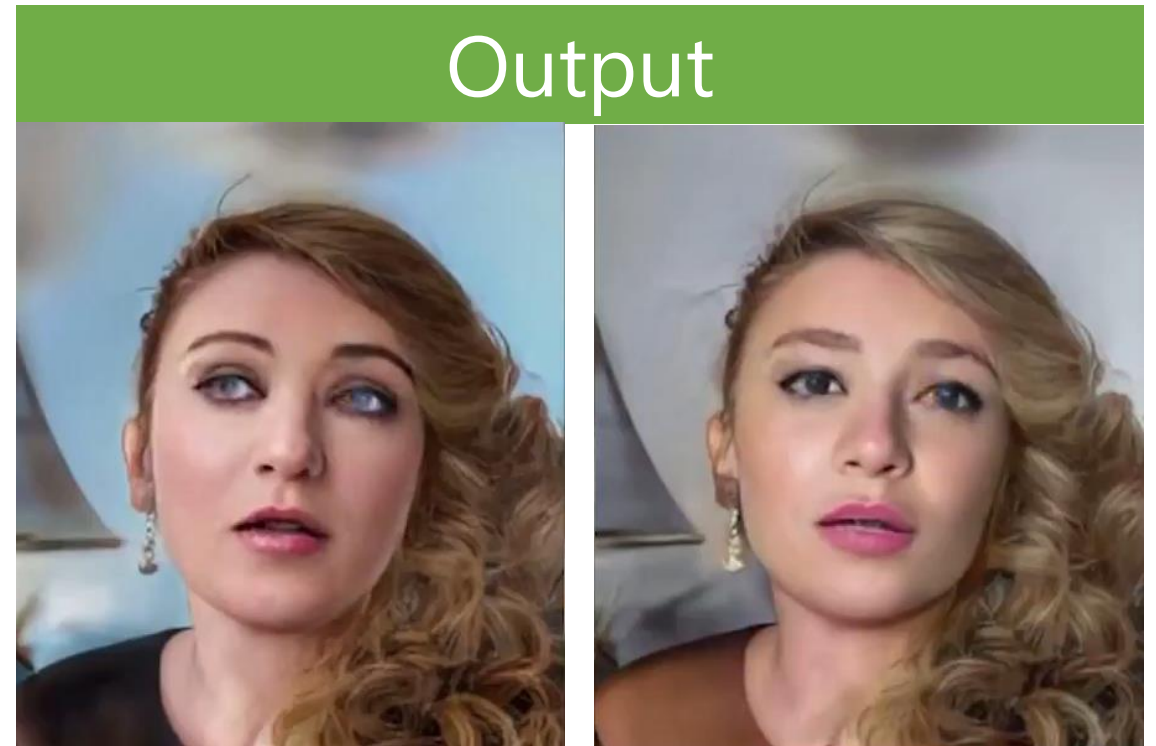
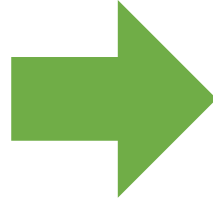
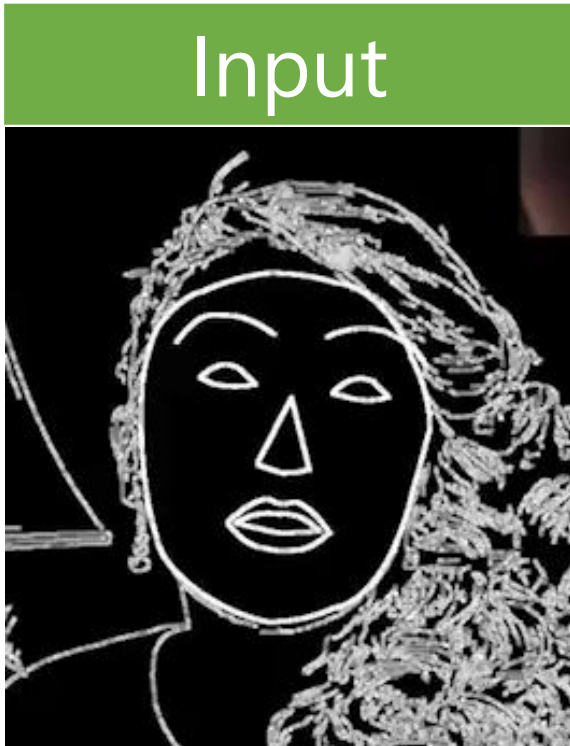
Video Transfer



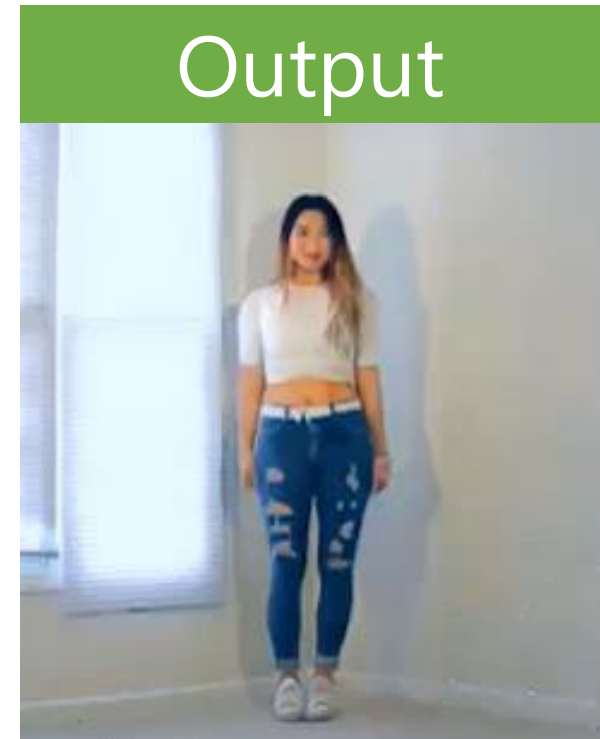
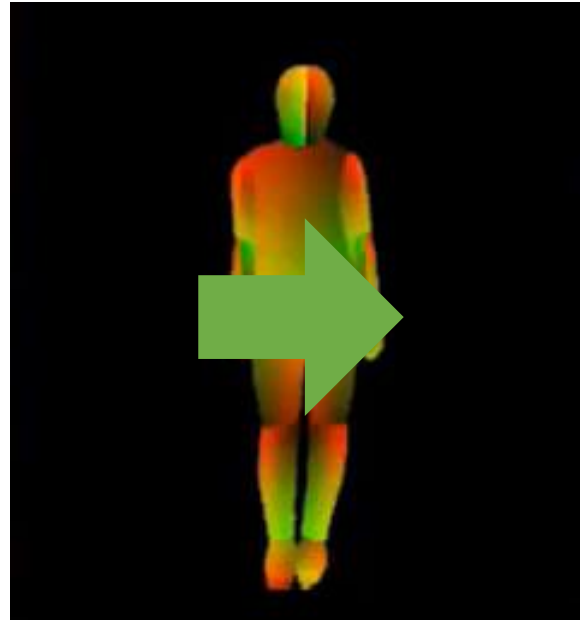
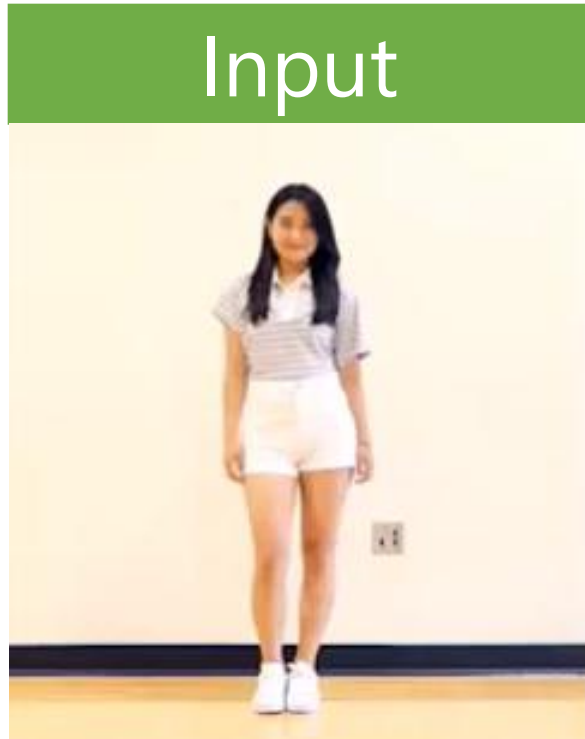
Video Completion



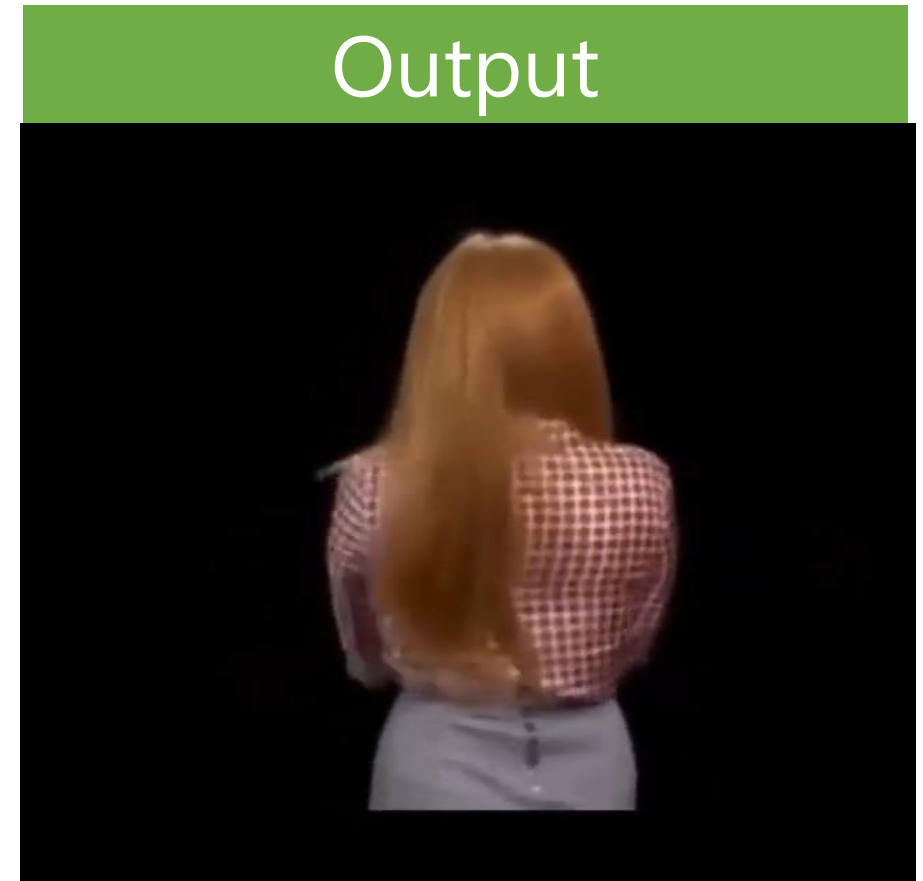
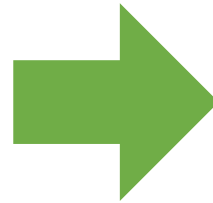
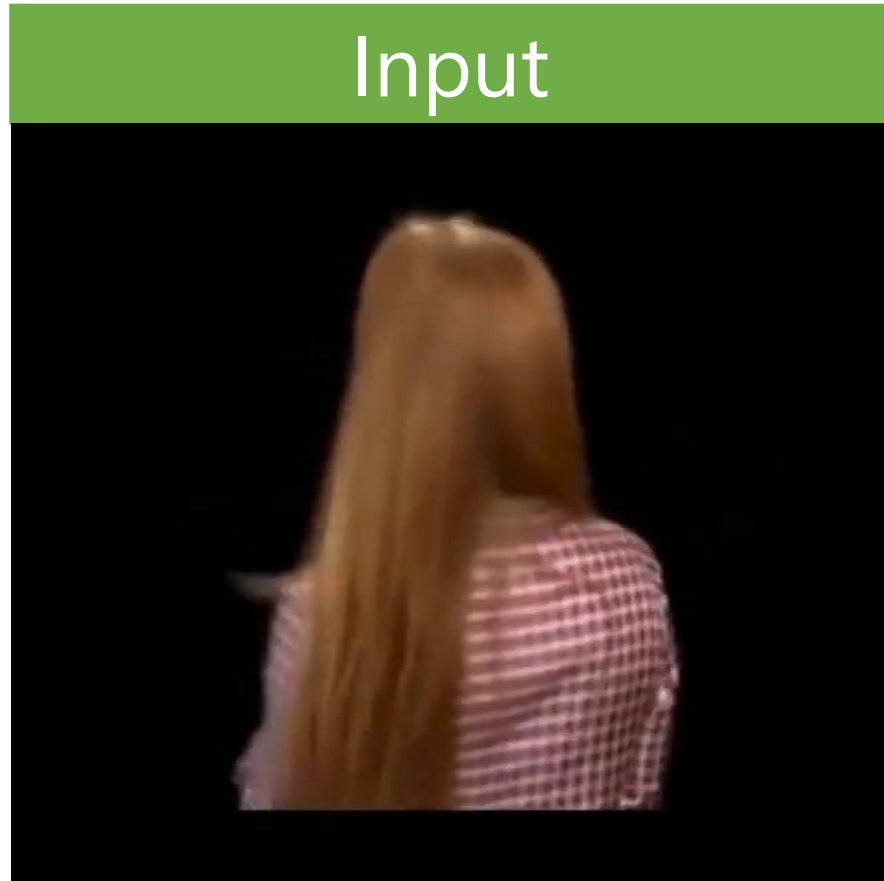
Video Face Synthesis



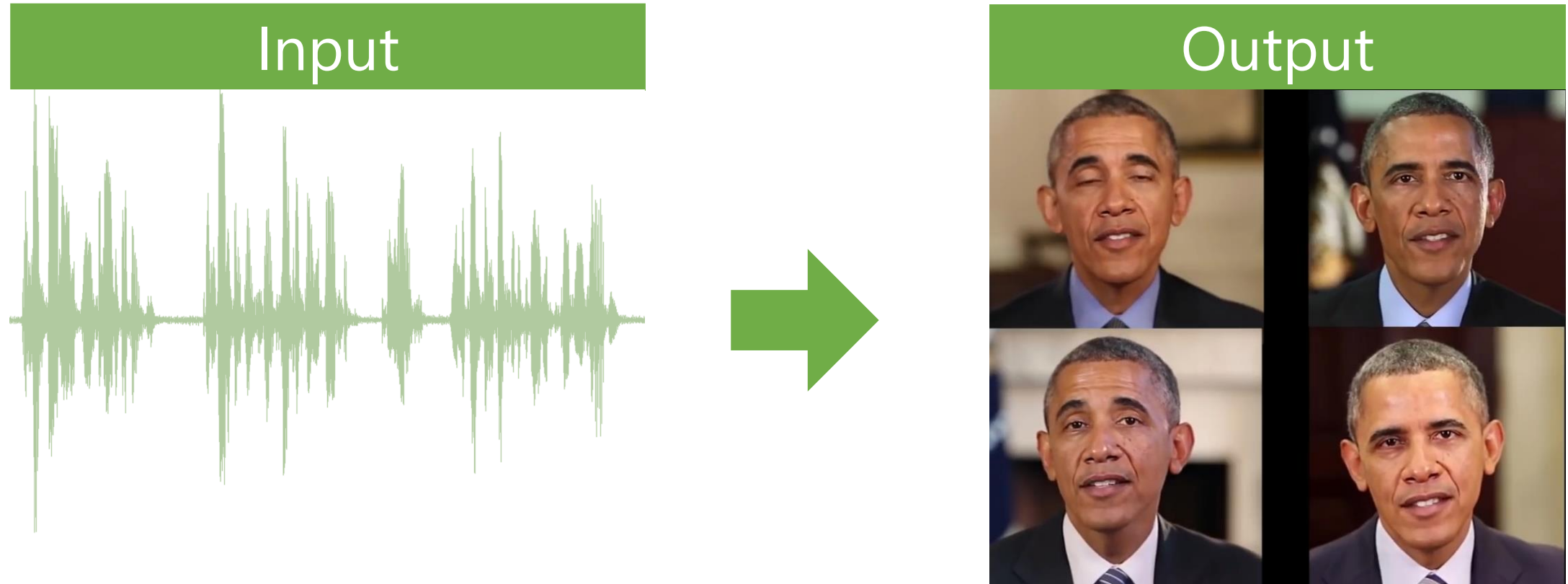
Video Pose Transfer



Video Face Swap



Video Lip Syncing



Source: Synthesizing Obama: Learning Lip Sync from Audio

Video Summary

Video Analysis

Motion detection
Object tracking
Action recognition

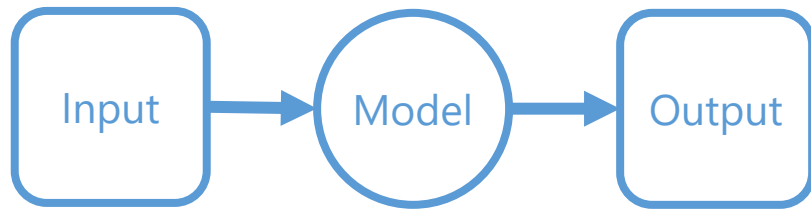
Video Synthesis

Video interpolation
Video generation
Video prediction

Applications

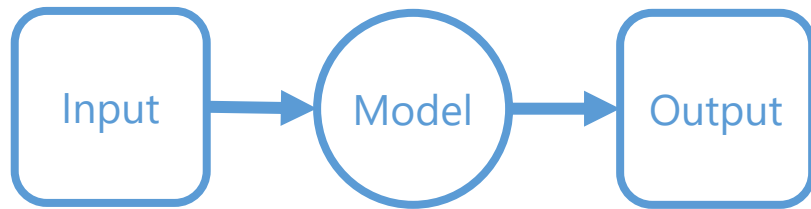
Applications

Simple Application

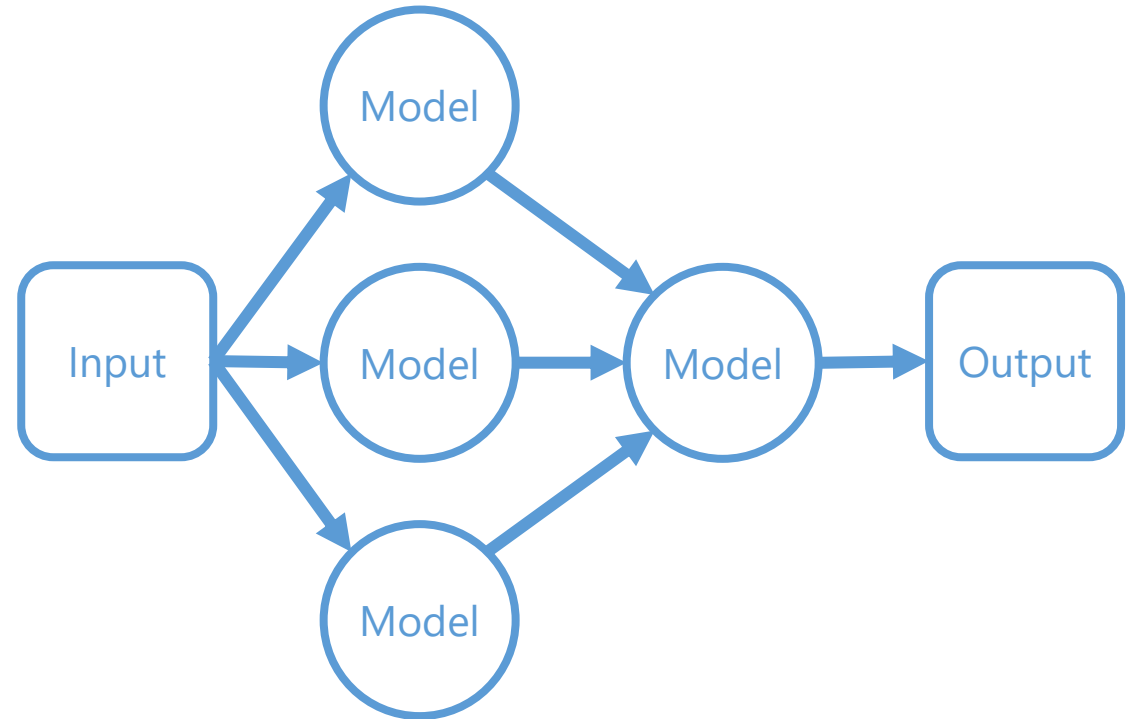


Applications

Simple Application




Complex Application



Applications

Applications

 New message — ↗ ✕

To










Subject

Dear Sir,


I'm very angry about the service
I received from you're employees.

On Oct 28, I went into your shop ...

SEND

Applications

 New message — ↗ ×

To










Subject

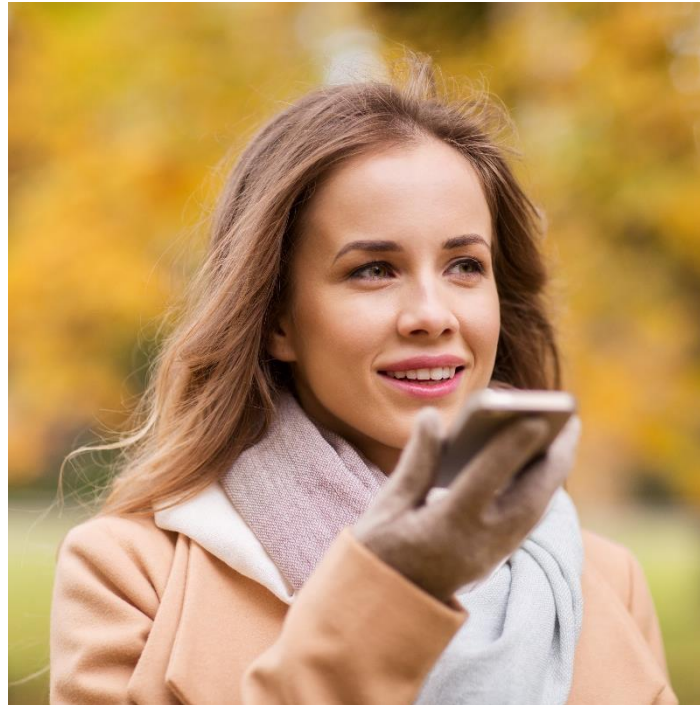
Dear Sir,

I'm very angry about the service
I received from you're employees.


On Oct 28, I went into your shop ...

SEND



Applications

 New message — ↗ ✕

To









Subject

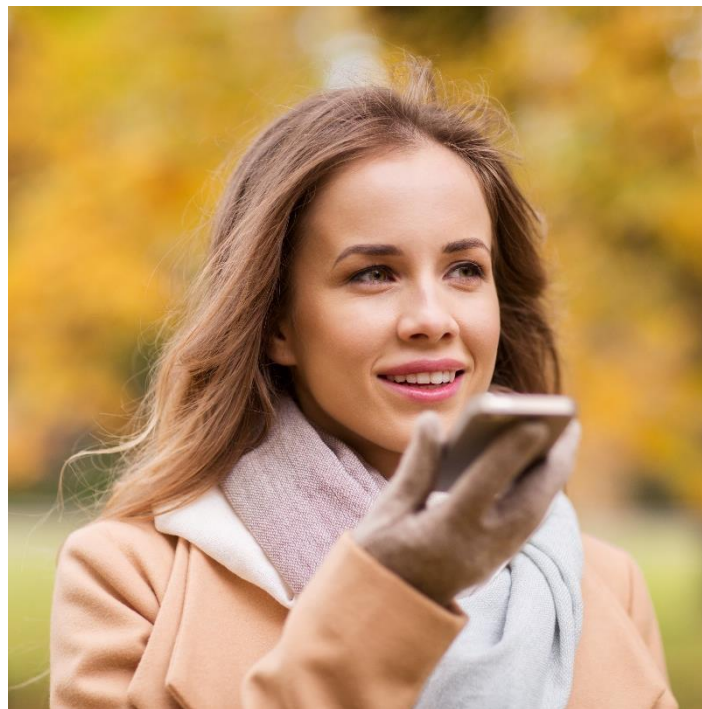
Dear Sir,

I'm very angry about the service
I received from you're employees.

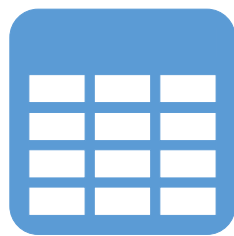
On Oct 28, I went into your shop ...

SEND

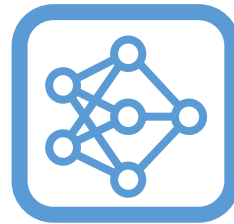
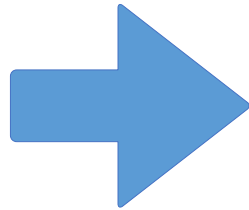
        ⋮



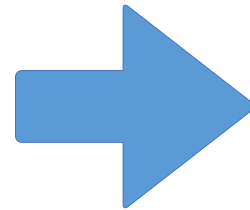
It's All Just a Function



New data



Model



Prediction

input

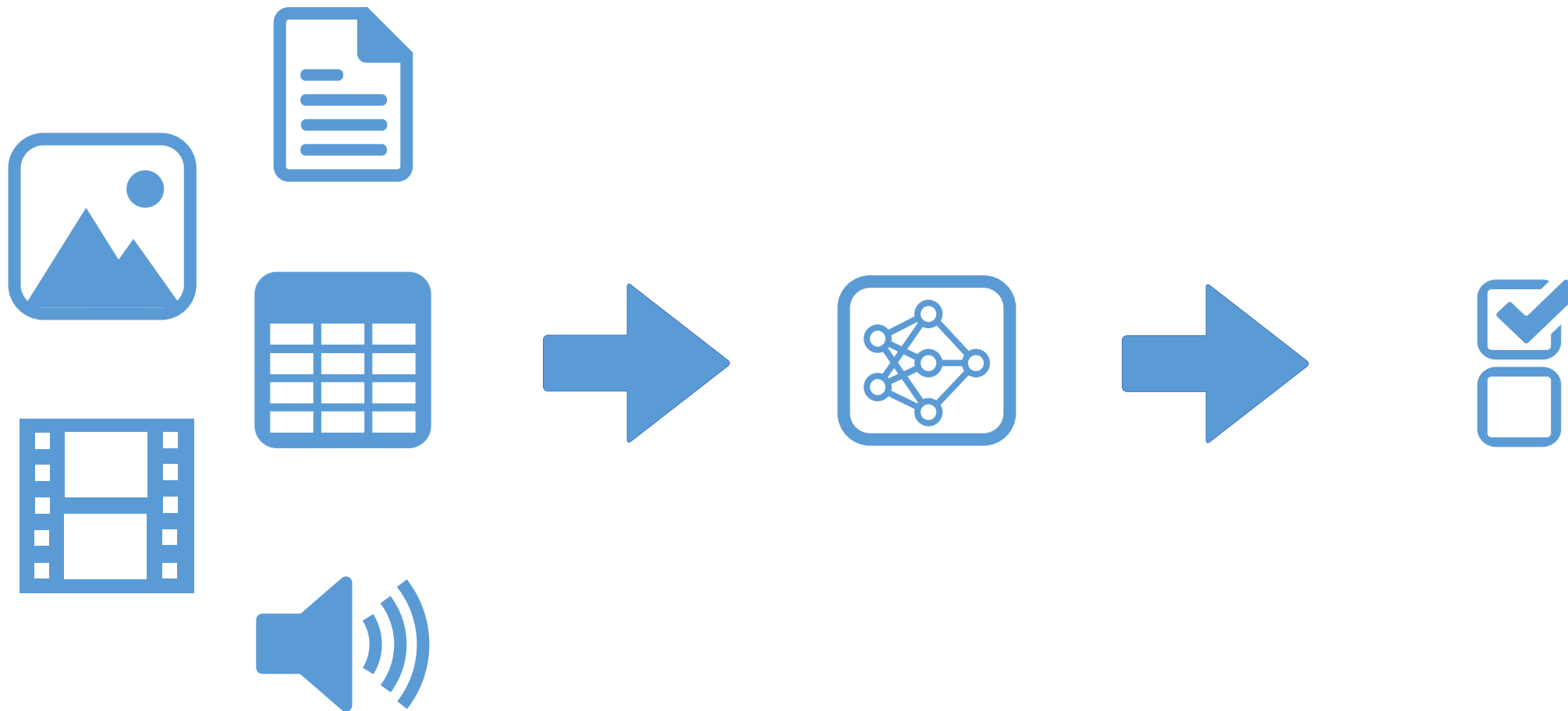


$f(x)$

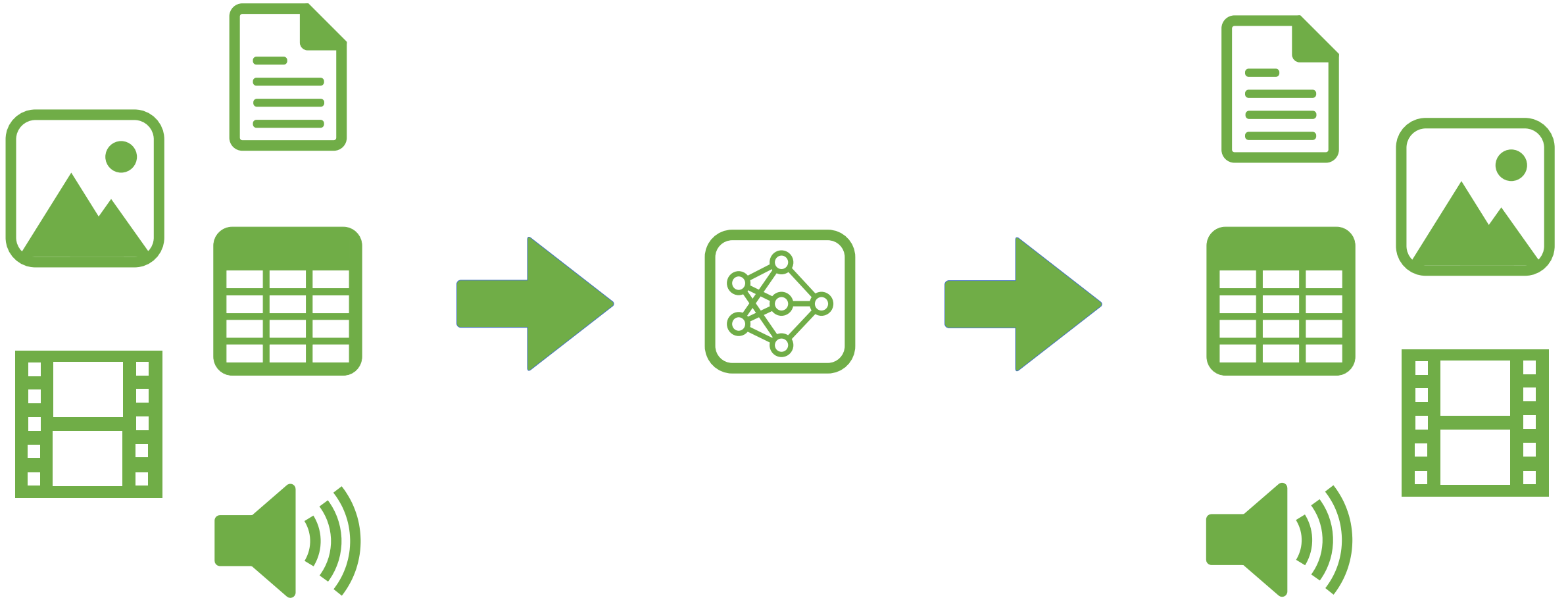


output

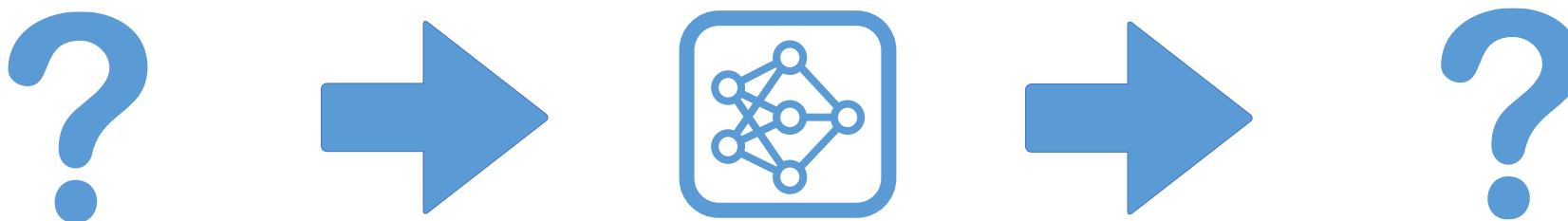
Analysis Functions



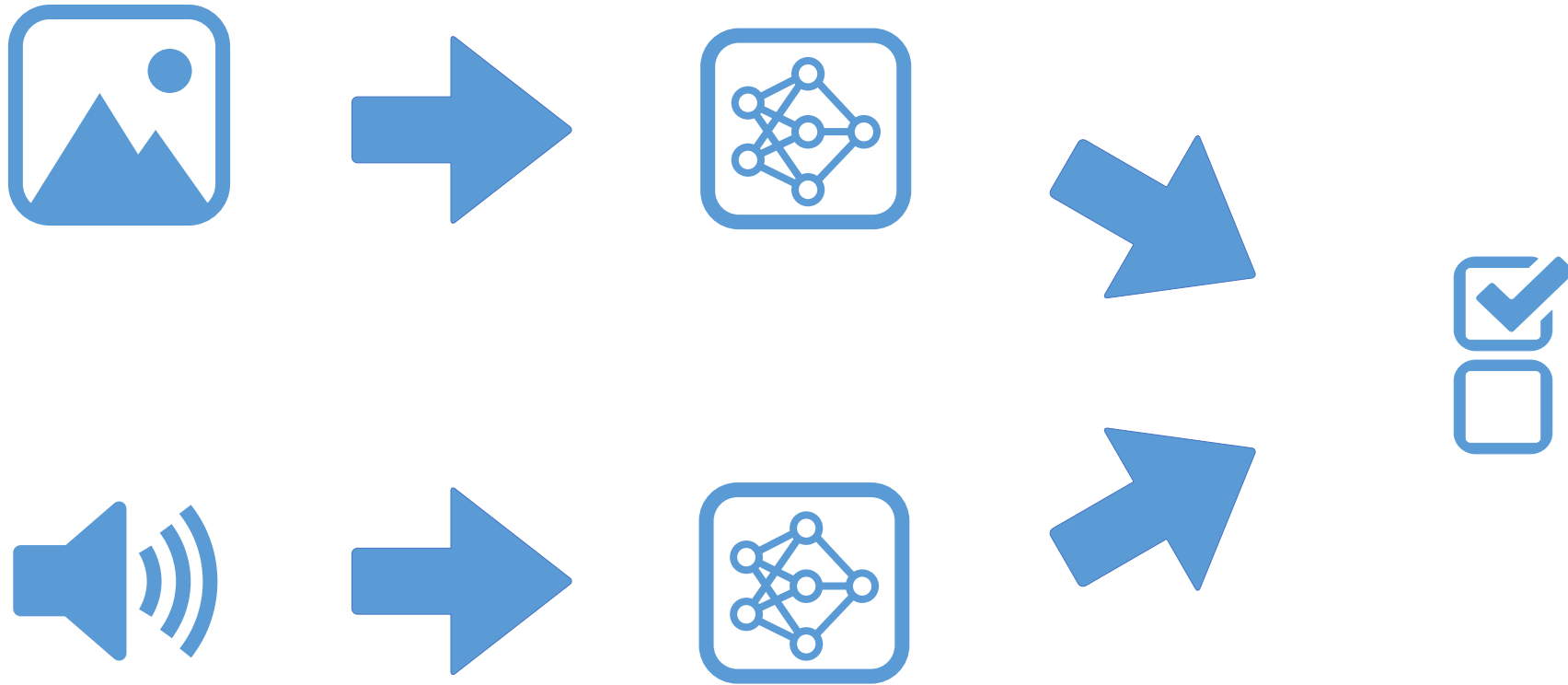
Synthesis Functions



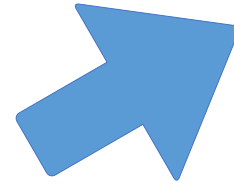
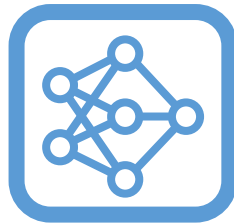
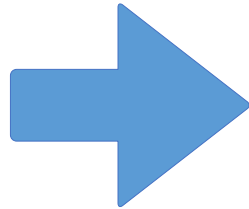
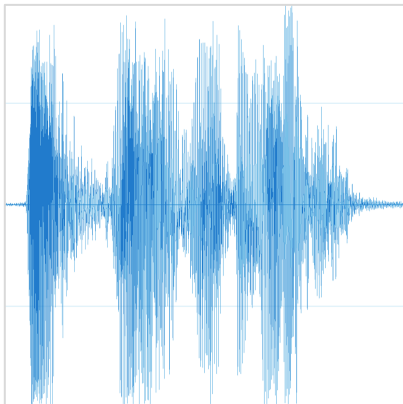
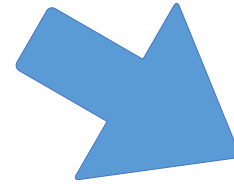
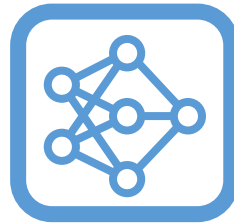
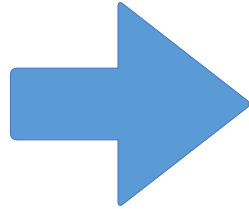
Other Functions?



Combining Models



Combining Models



| Output | |
|---------|-------|
| Class | Score |
| Matthew | 99% |
| Zhang | 50% |
| Priya | 10% |

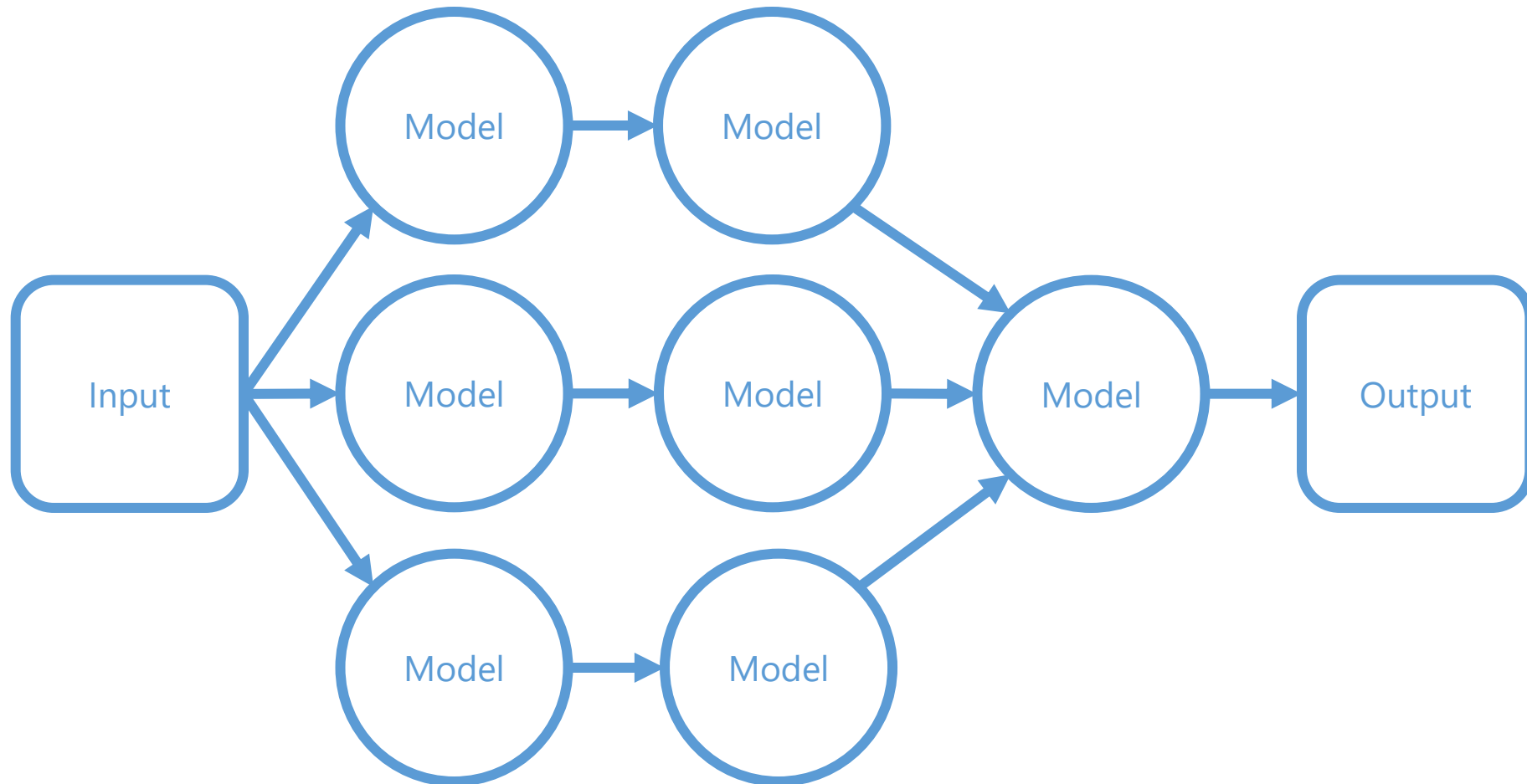
Chaining Models



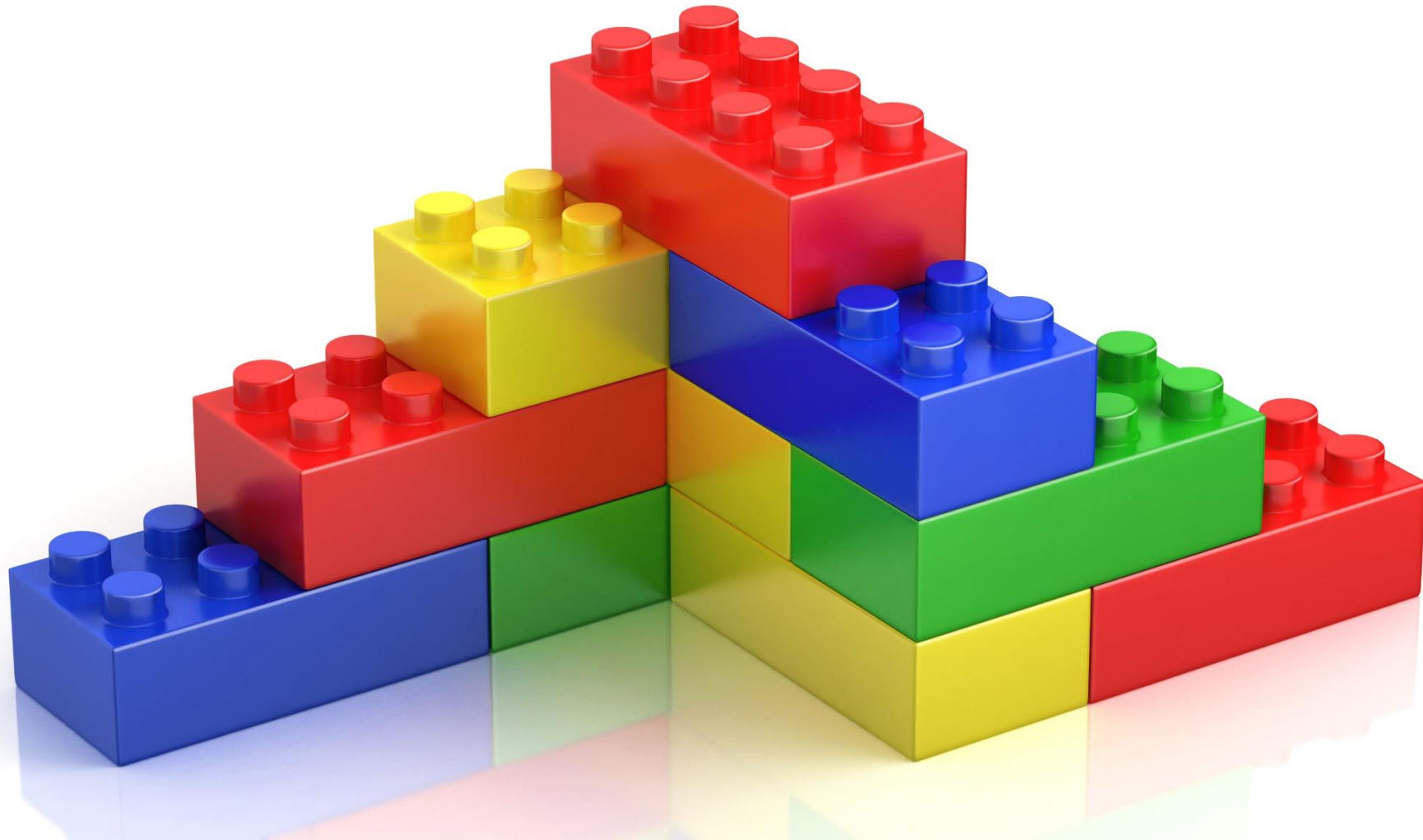
Chaining Models



Modular AI Applications



It's a lot like Legos!



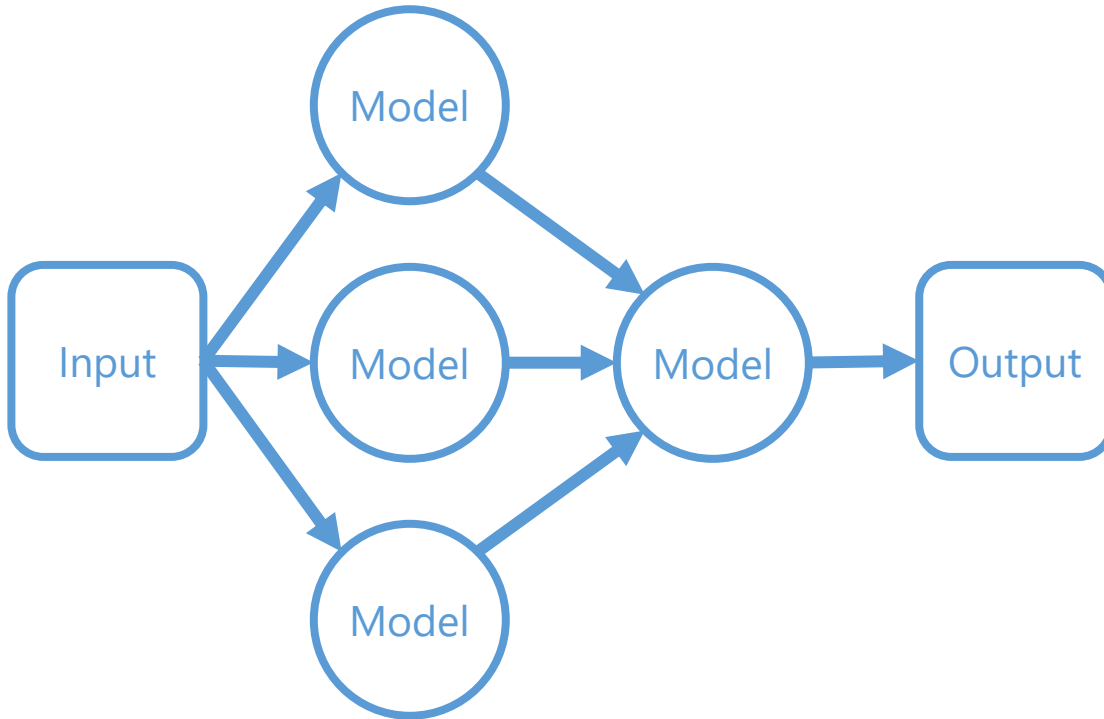
AI Application Types

Modular AI Application

End-to-end AI Application

AI Application Types

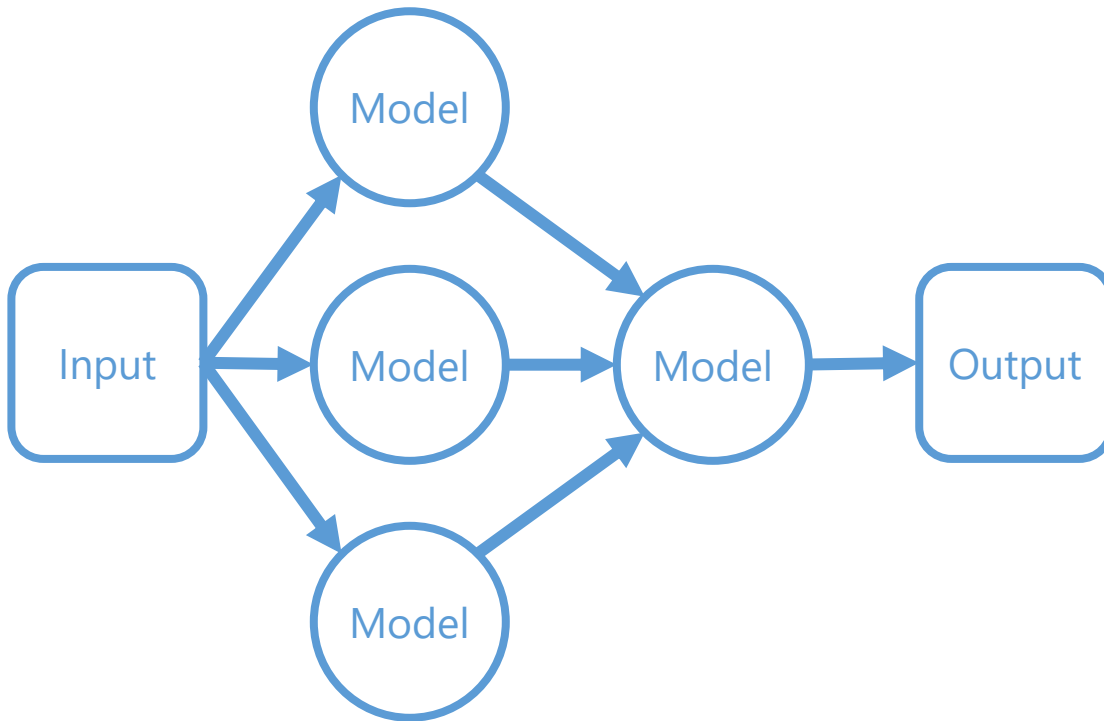
Modular AI Application



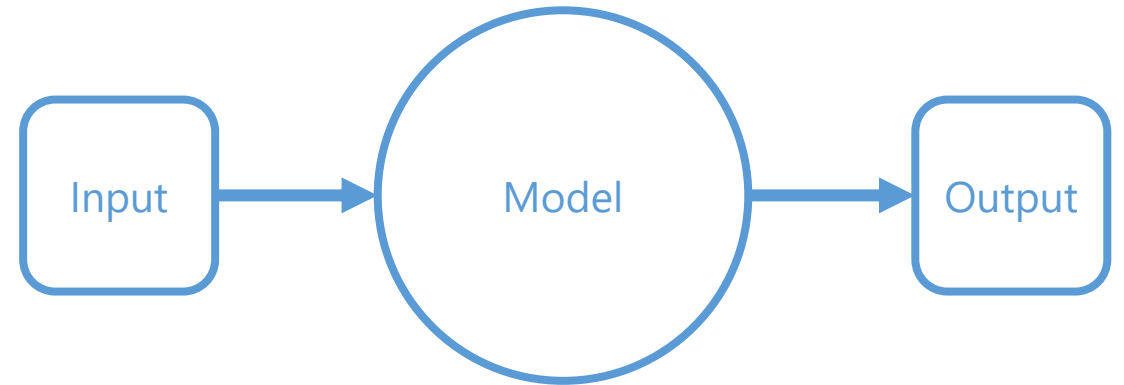
End-to-end AI Application

AI Application Types

Modular AI Application



End-to-end AI Application



AI Application Types

Modular AI Application

Pros
Cons

End-to-end AI Application

Pros
Cons

AI Application Types

Modular AI Application

Easier to create

Easier to maintain

Easier to debug

Requires expertise

Requires more code

End-to-end AI Application

AI Application Types

Modular AI Application

- Easier to create
- Easier to maintain
- Easier to debug
- Requires expertise
- Requires more code

End-to-end AI Application

- More efficient
- More powerful
- Less biased
- Harder to create
- Not transparent

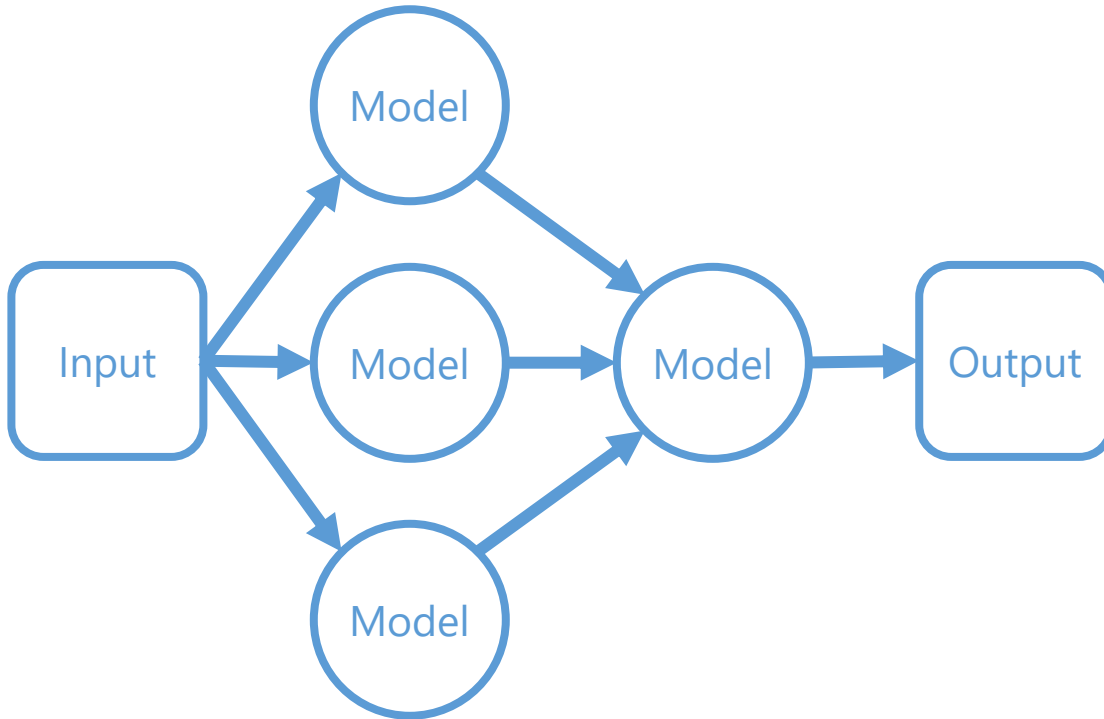
AI Application Types

Modular AI Application

End-to-end AI Application

AI Application Types

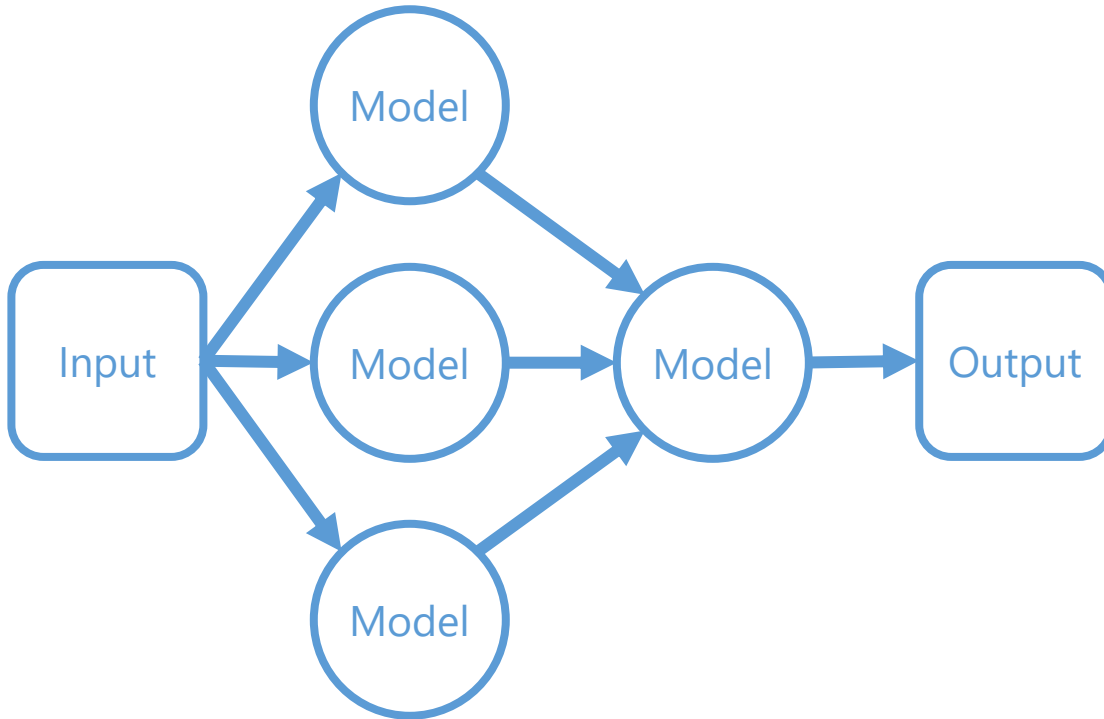
Modular AI Application



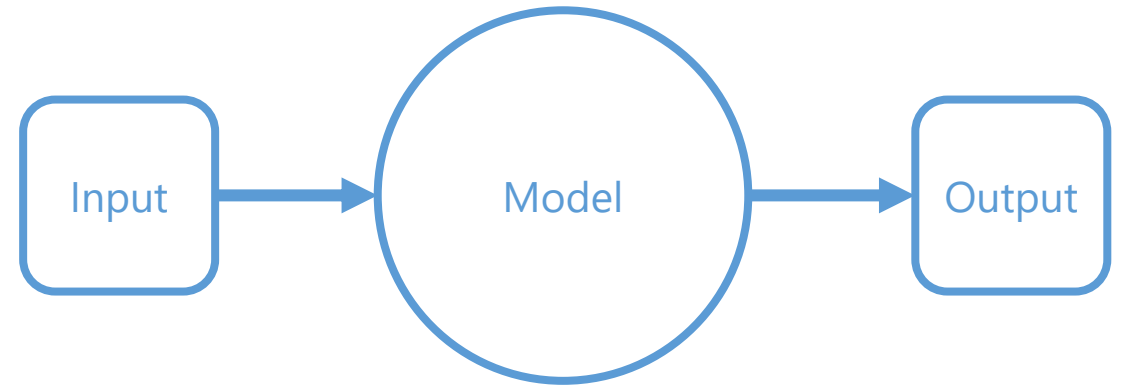
End-to-end AI Application

AI Application Types

Modular AI Application

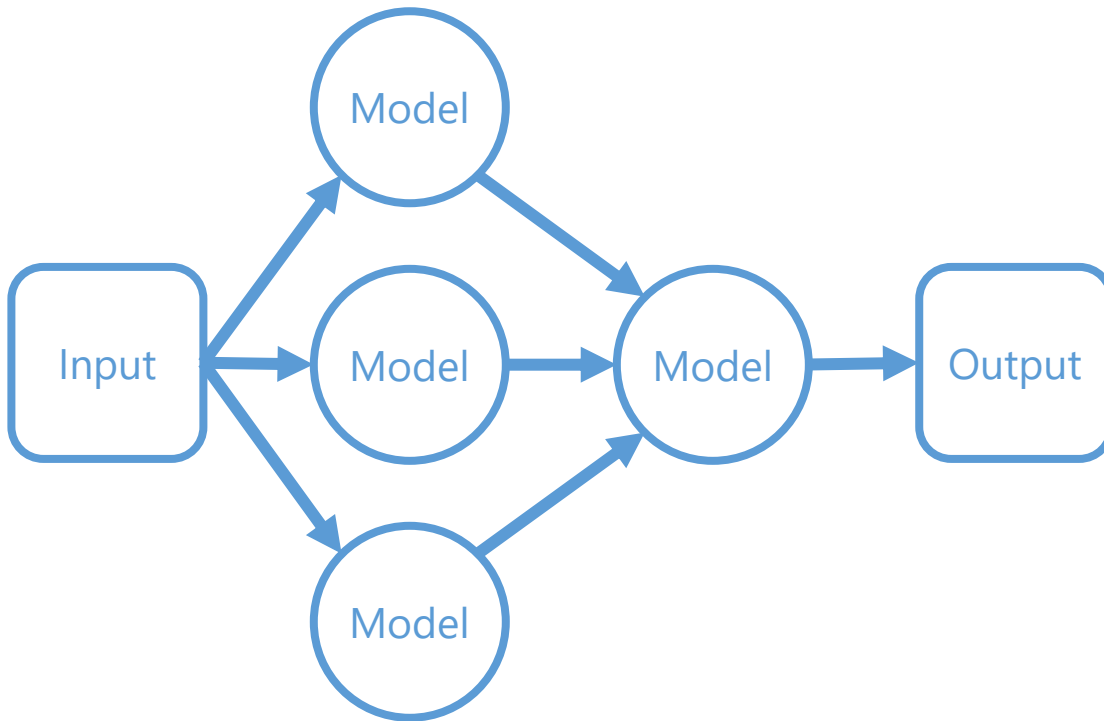


End-to-end AI Application

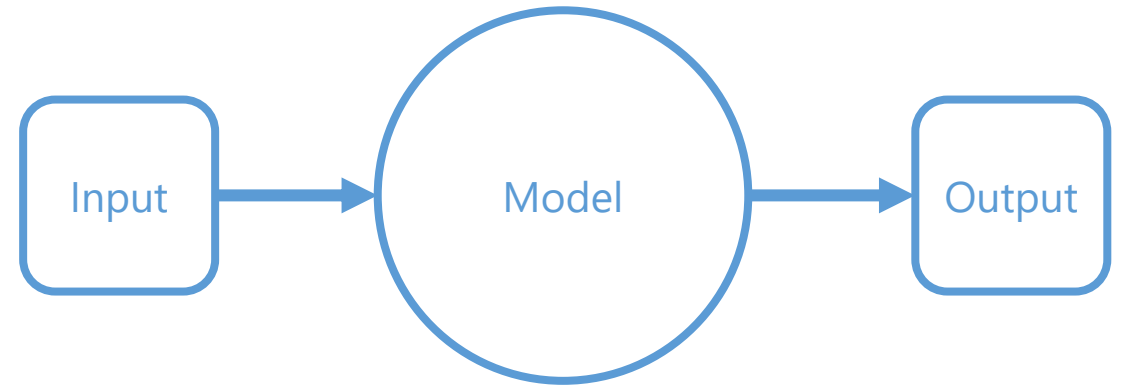


AI Application Types

Modular AI Application



End-to-end AI Application



Easy

Hard

Application Summary

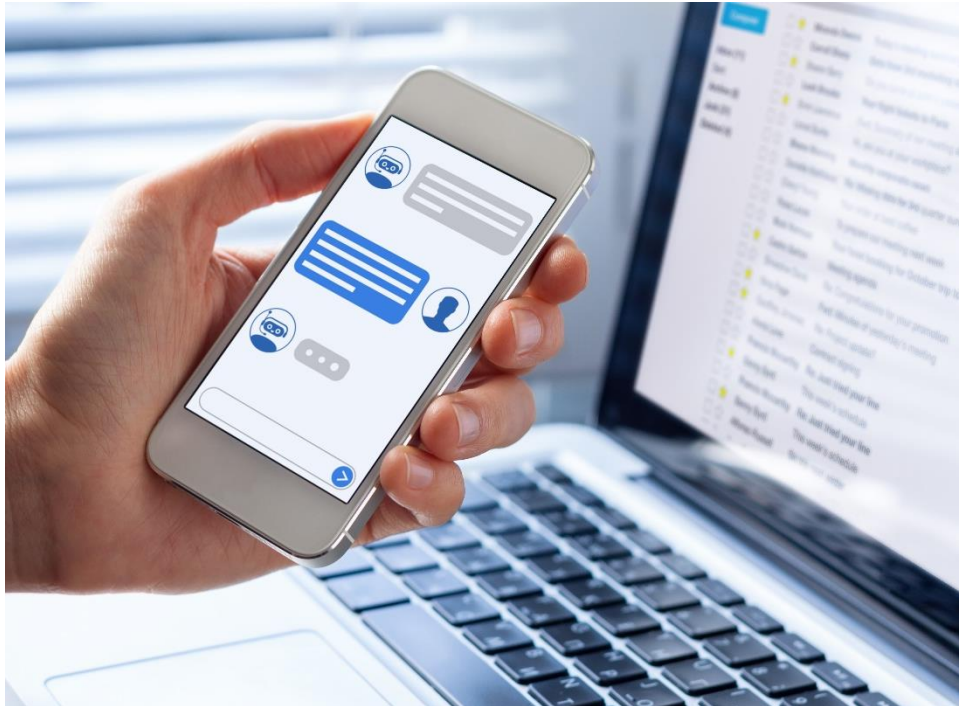
Modular AI
applications

End-to-end AI
applications

Systems

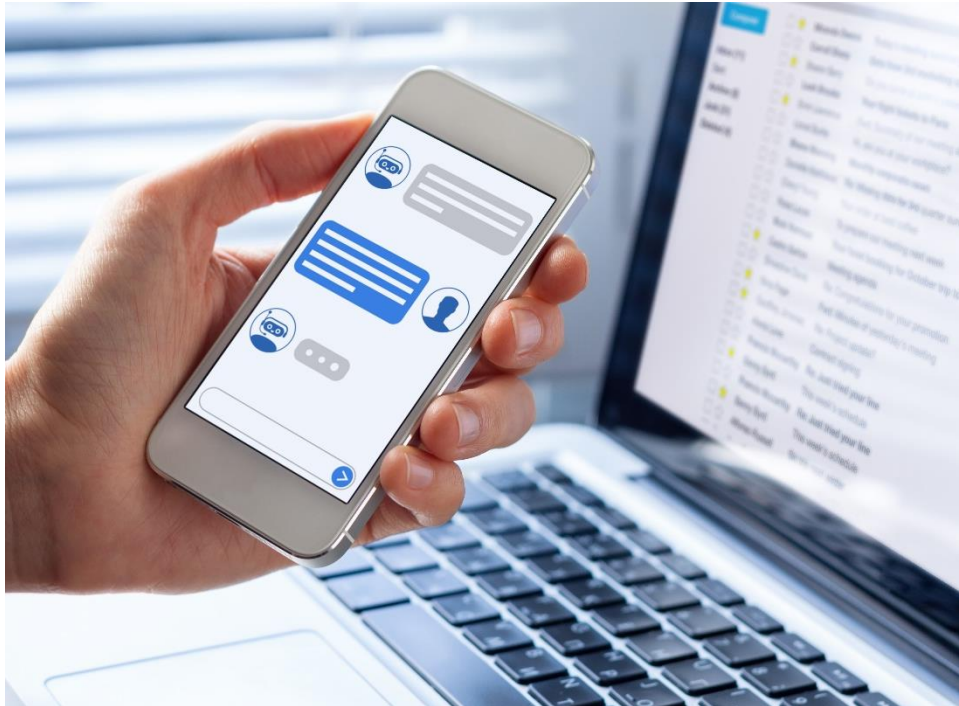
Systems

AI Application



Systems

AI Application

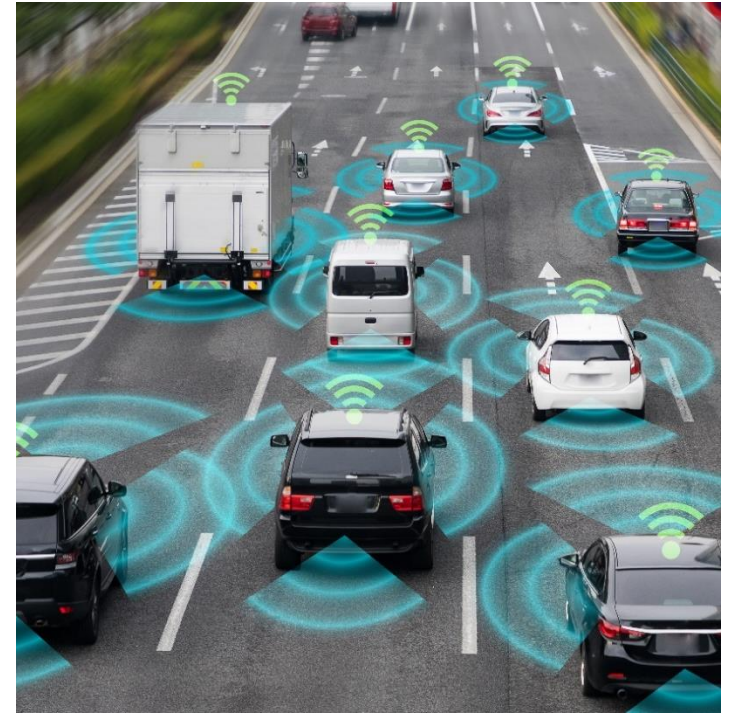


VS

Cyber-physical System

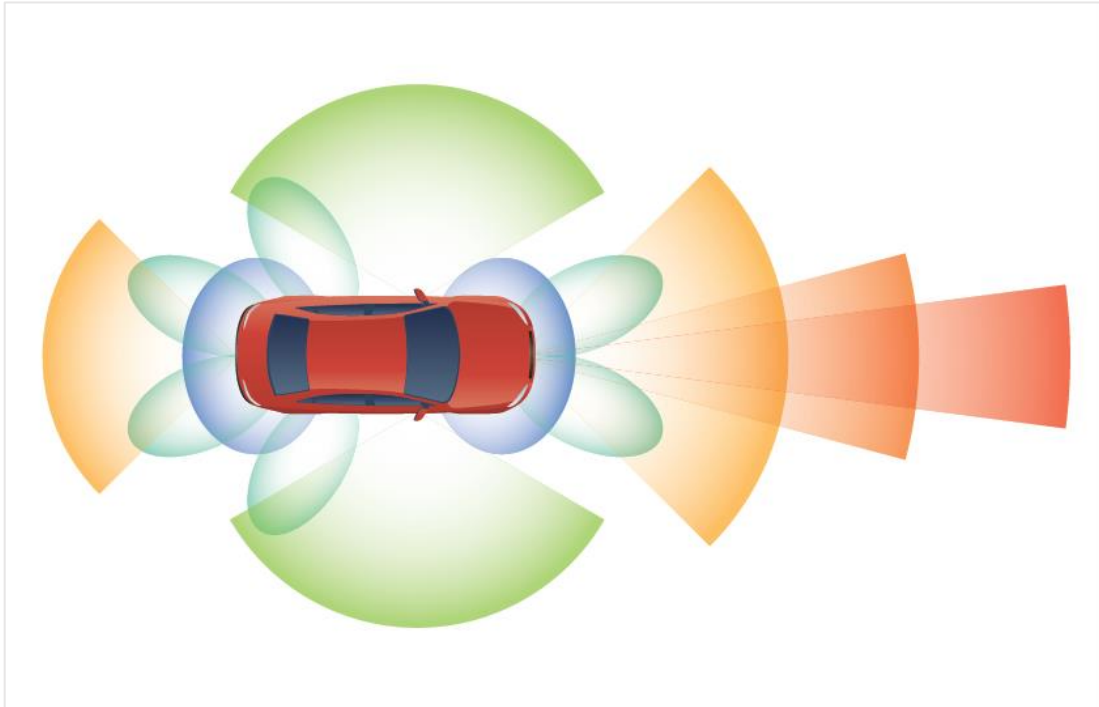


Systems



Systems

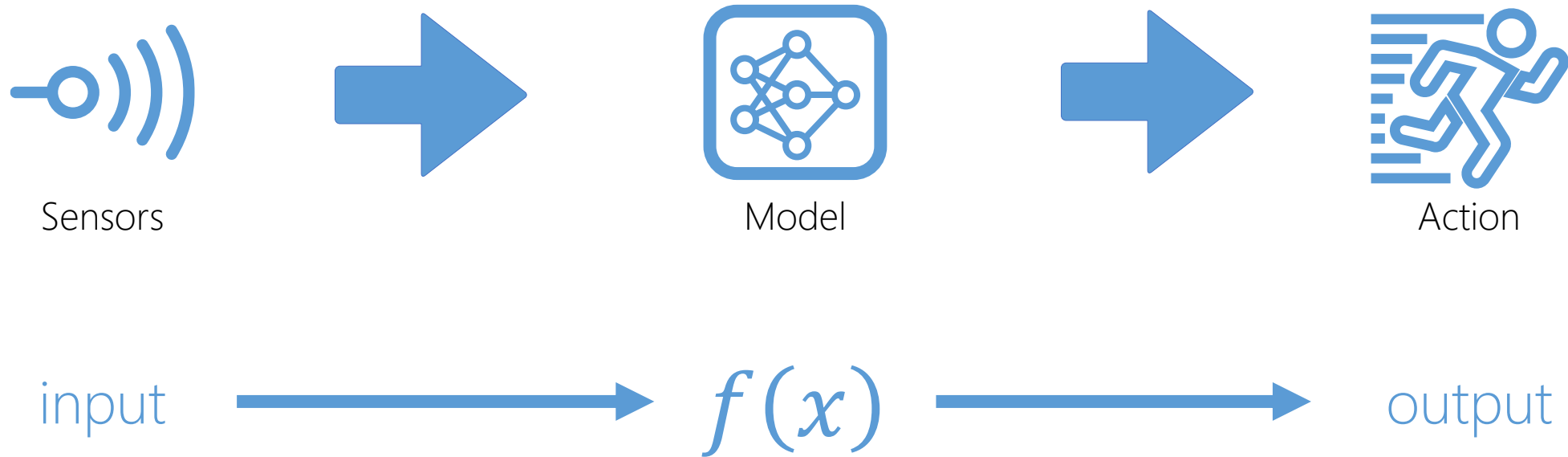
Sensors



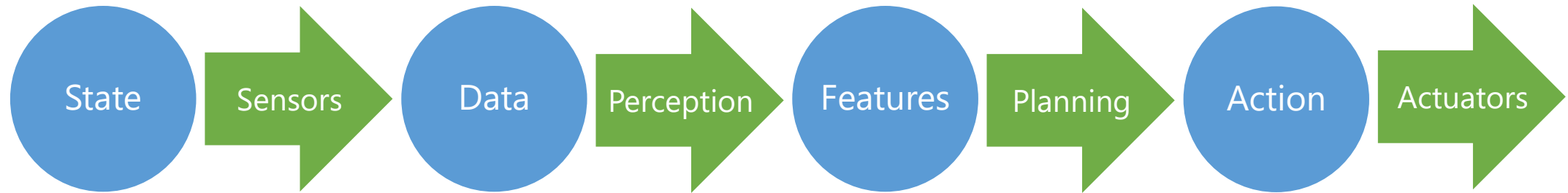
Actuators



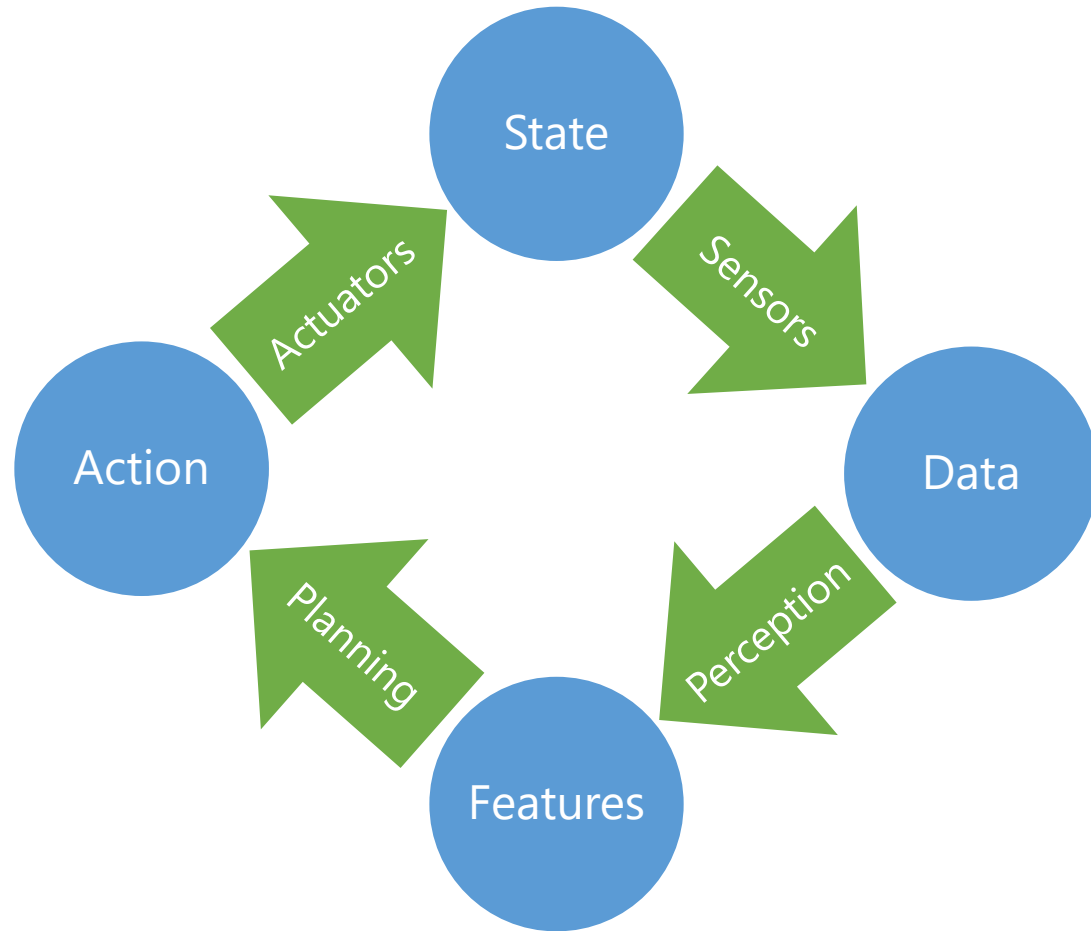
It's All Just a Function



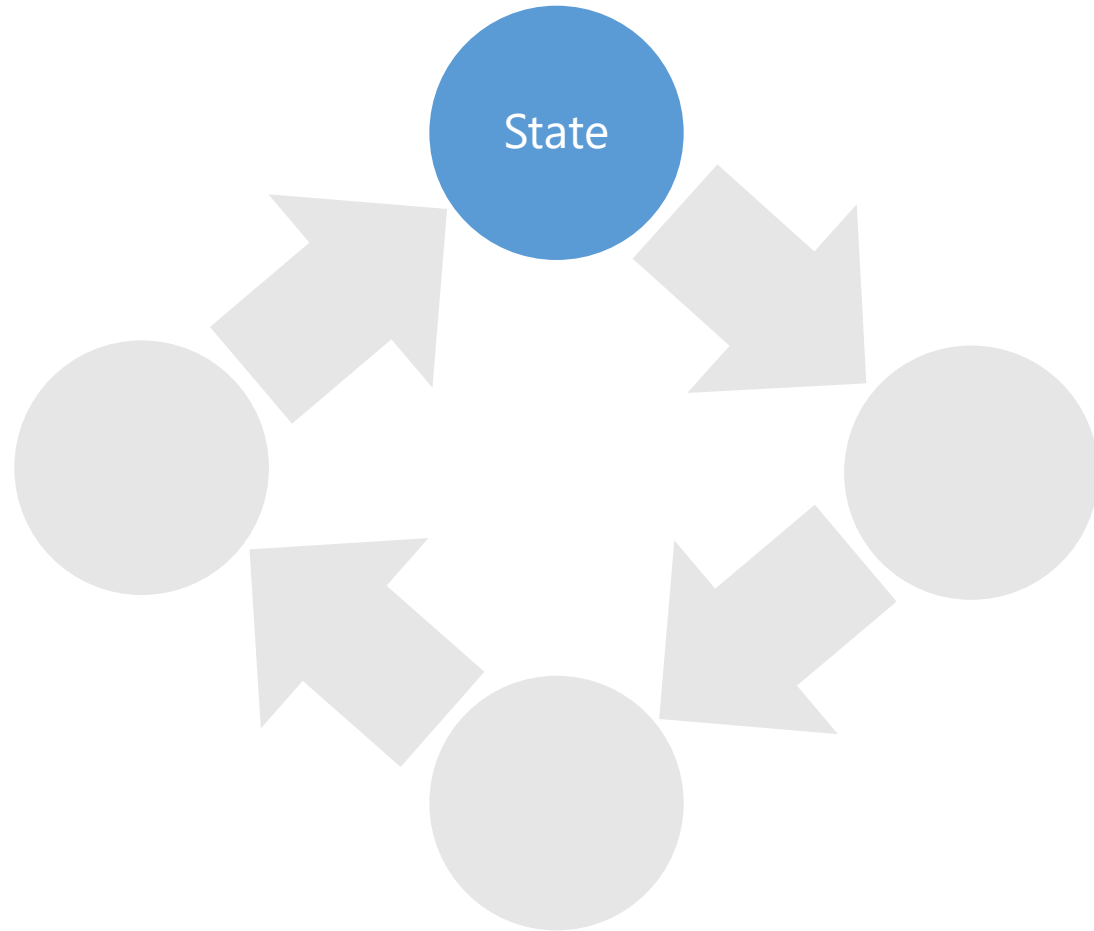
It's All Just a Function



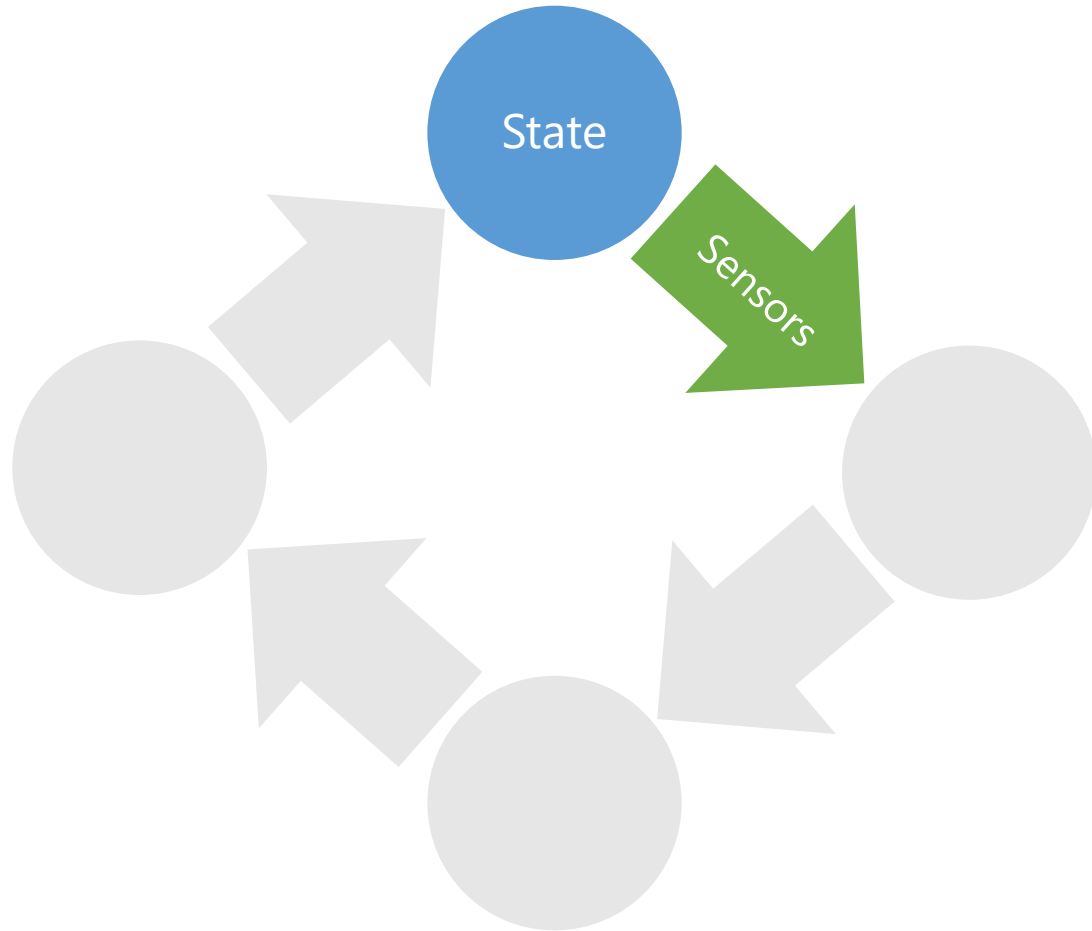
It's All Just a Function



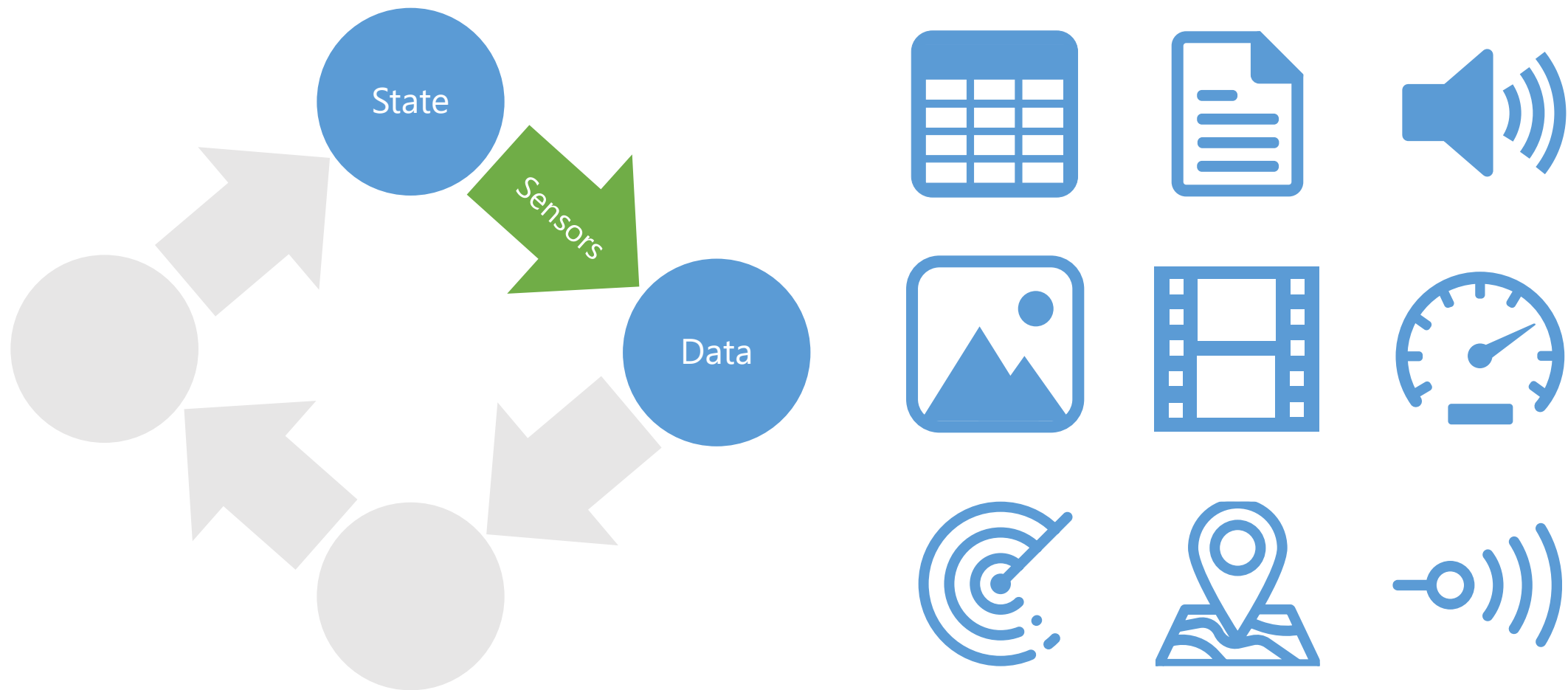
State



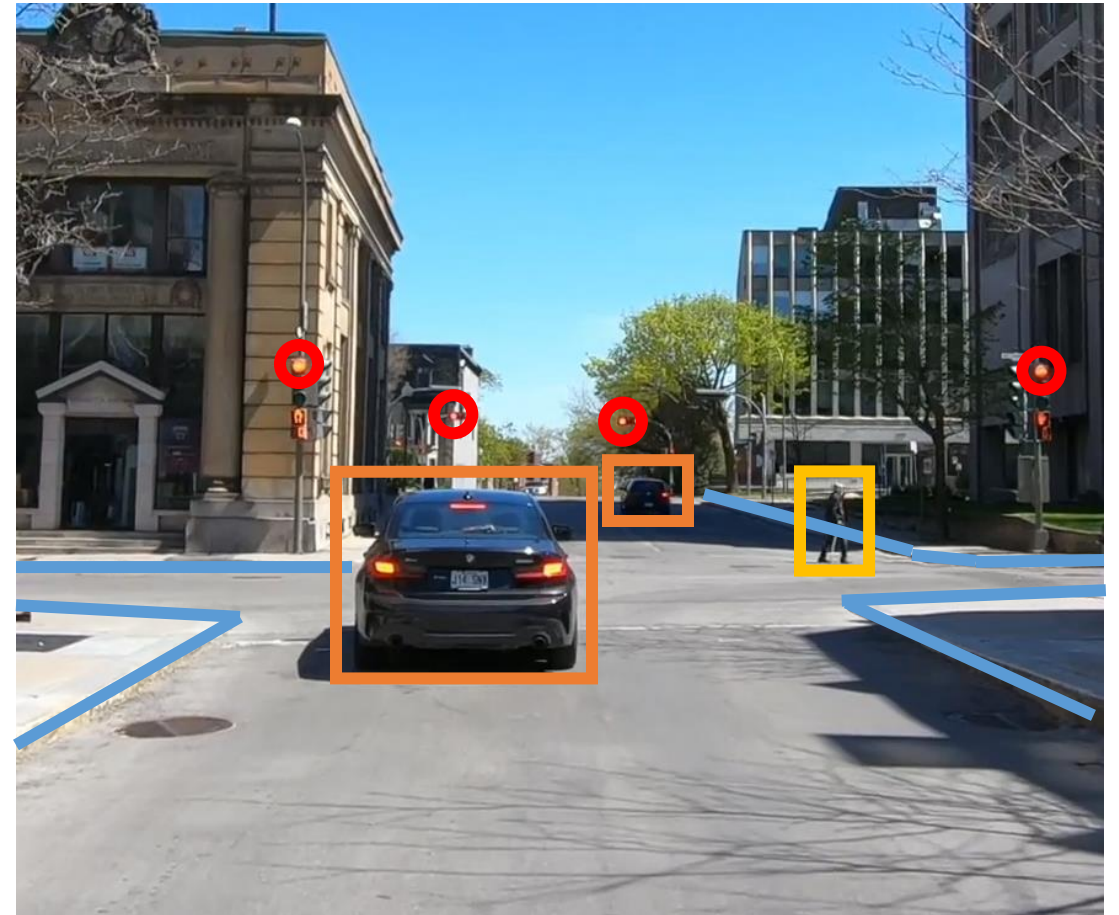
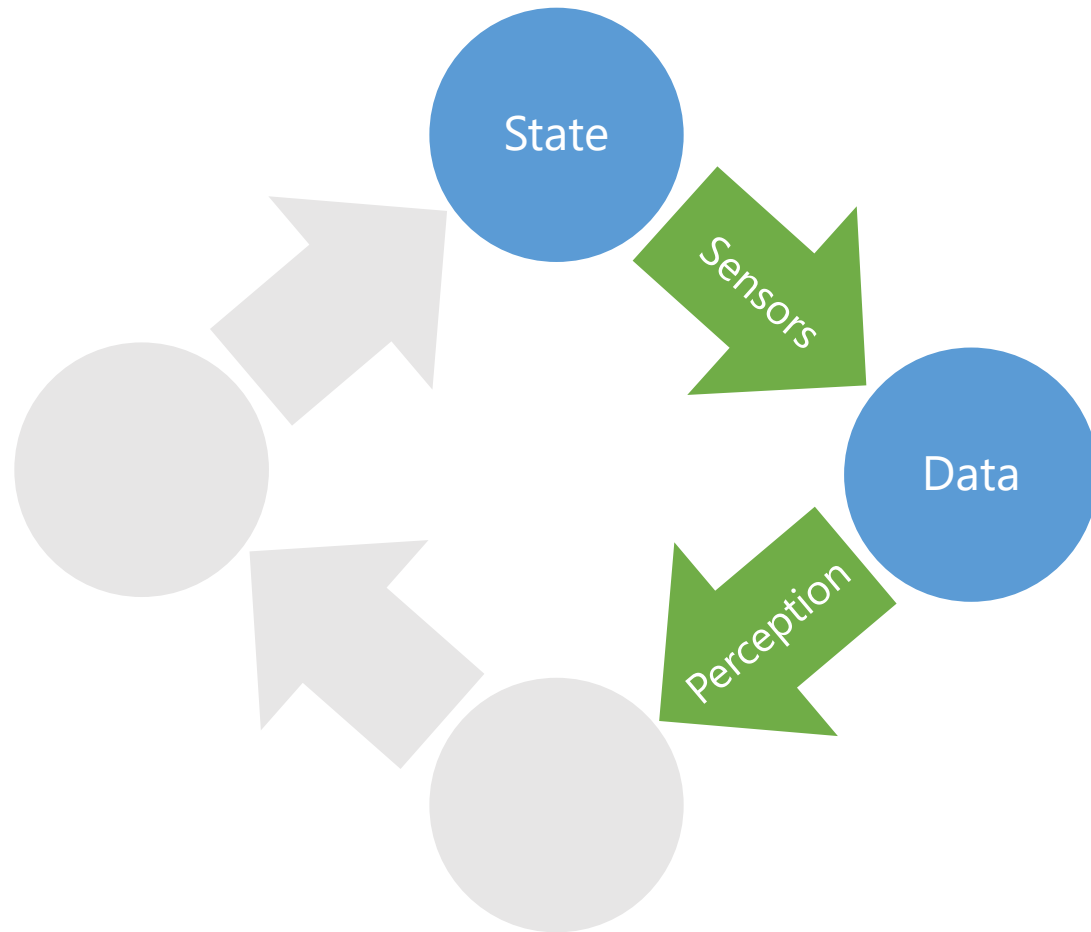
Sensors



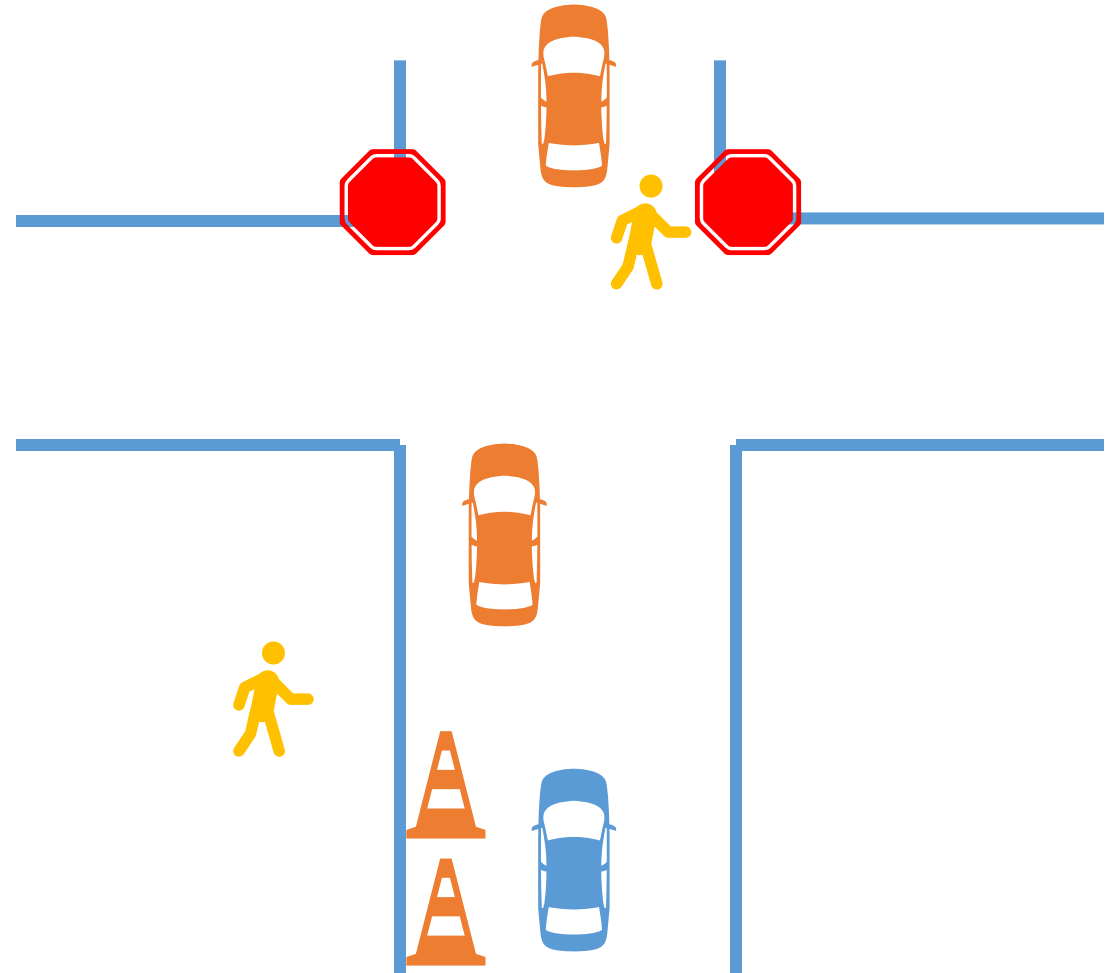
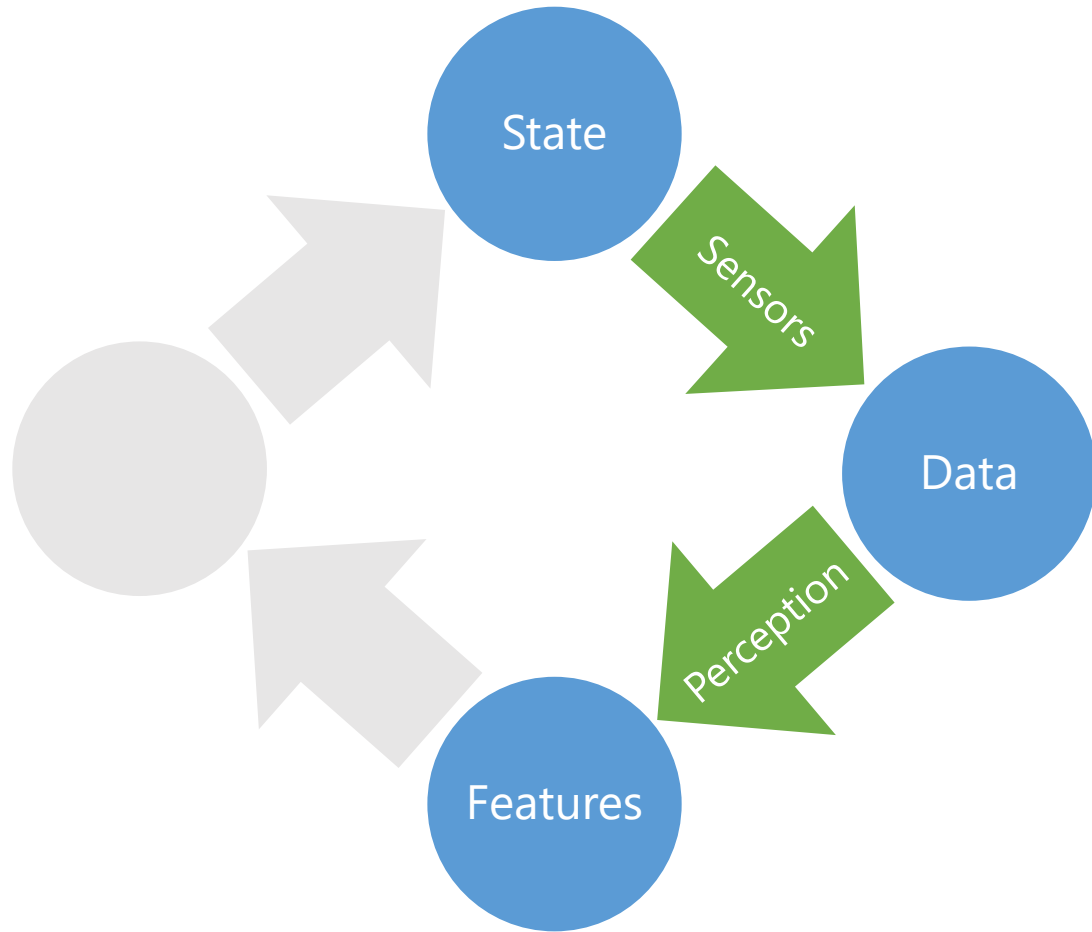
Data



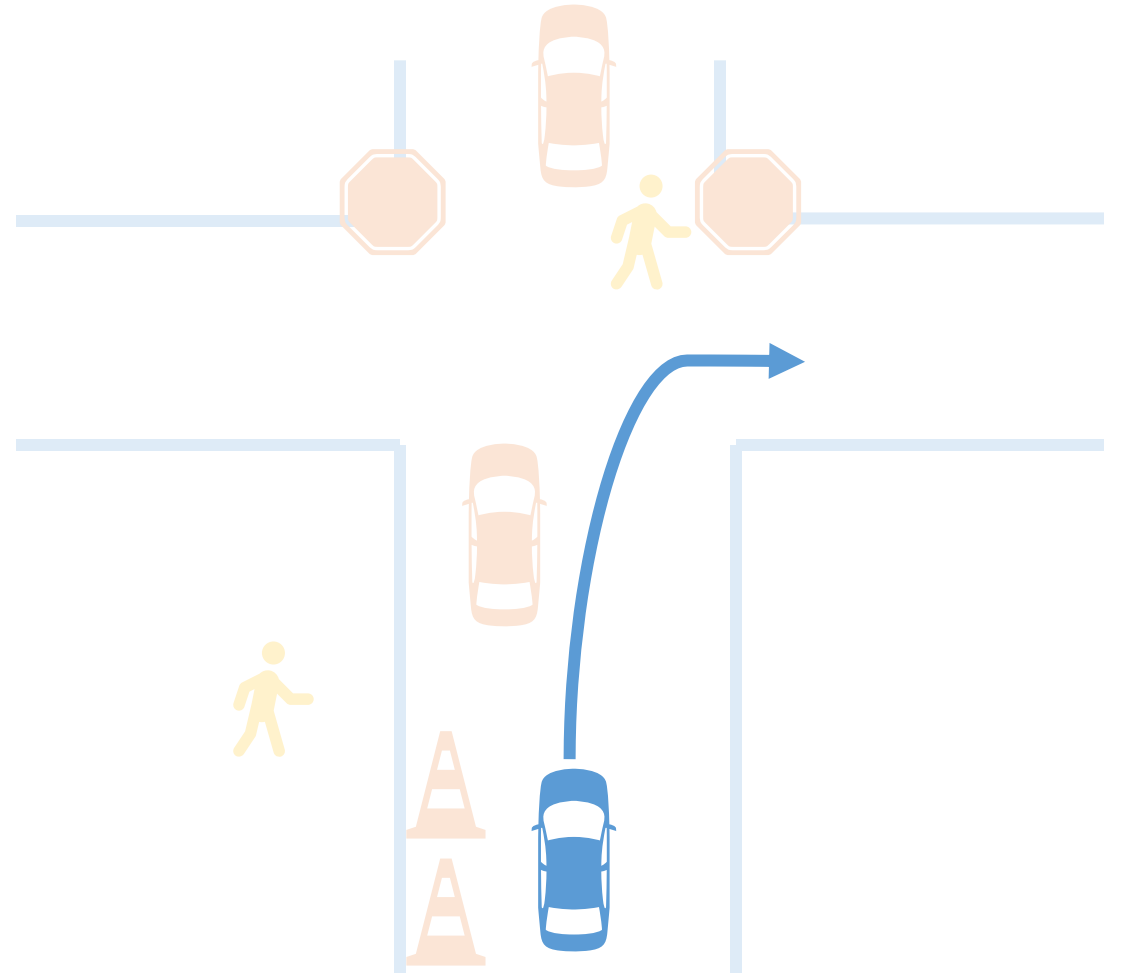
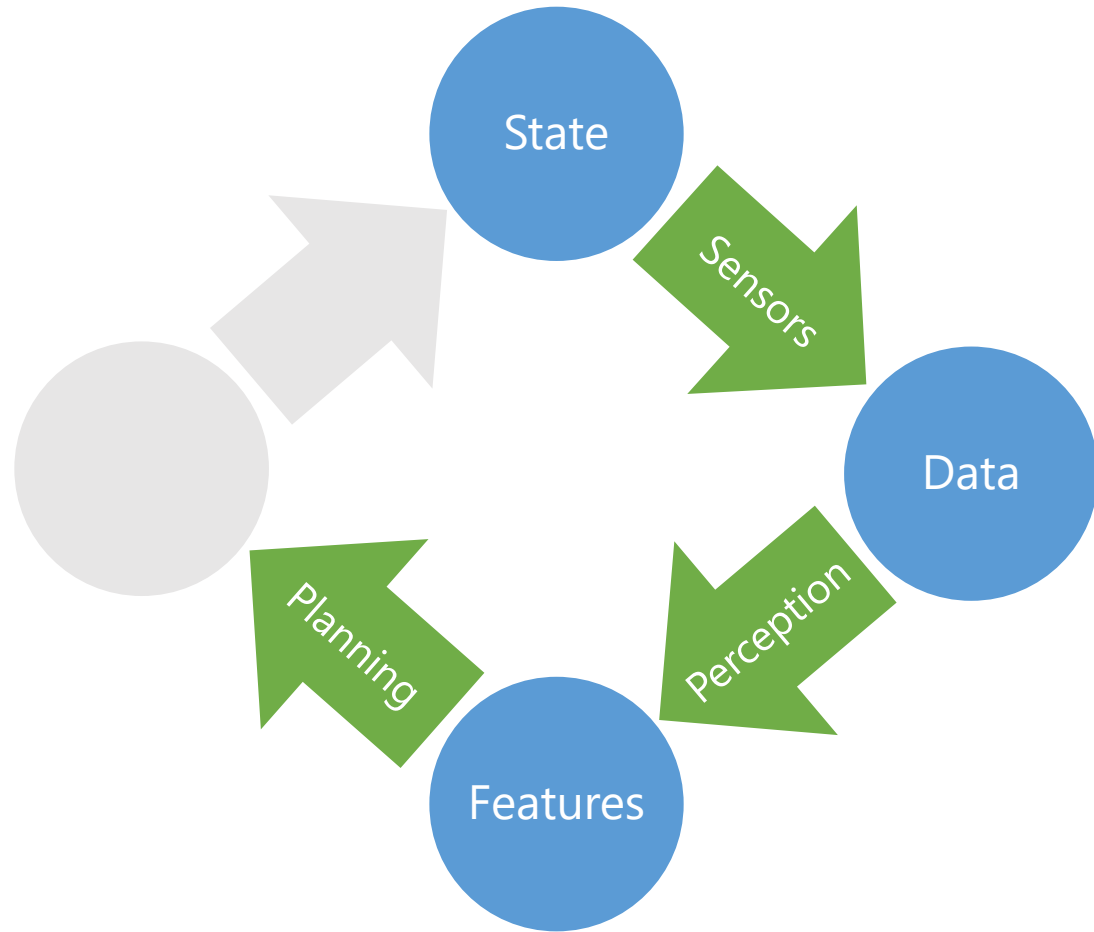
Perception



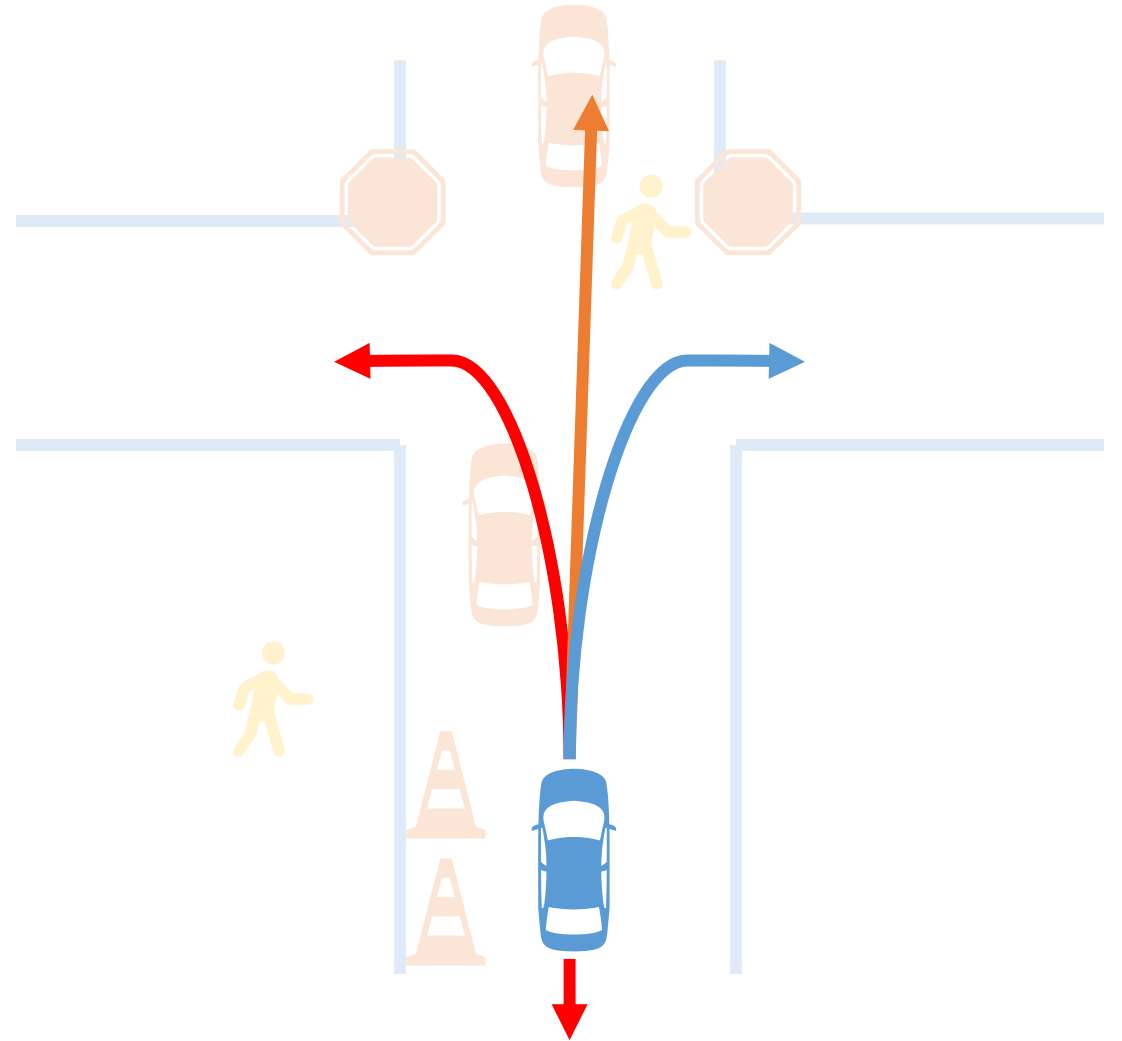
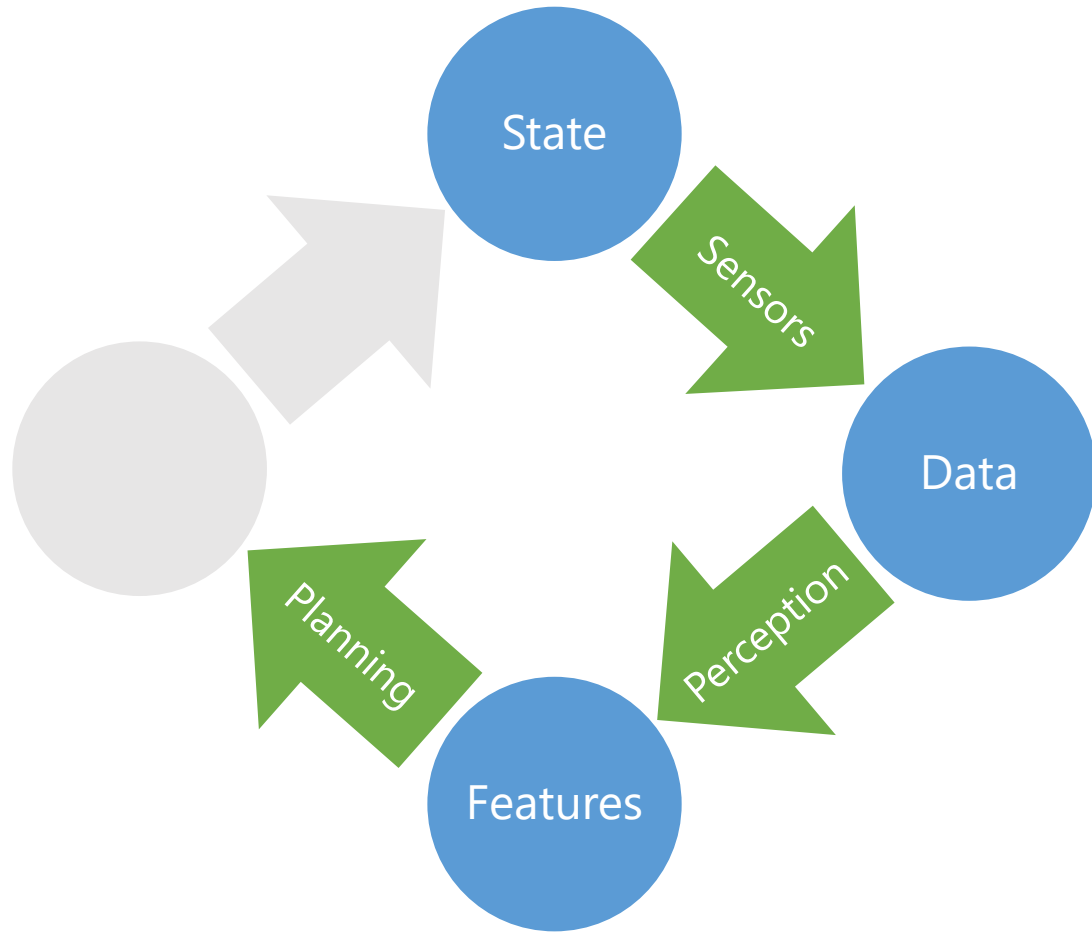
Features



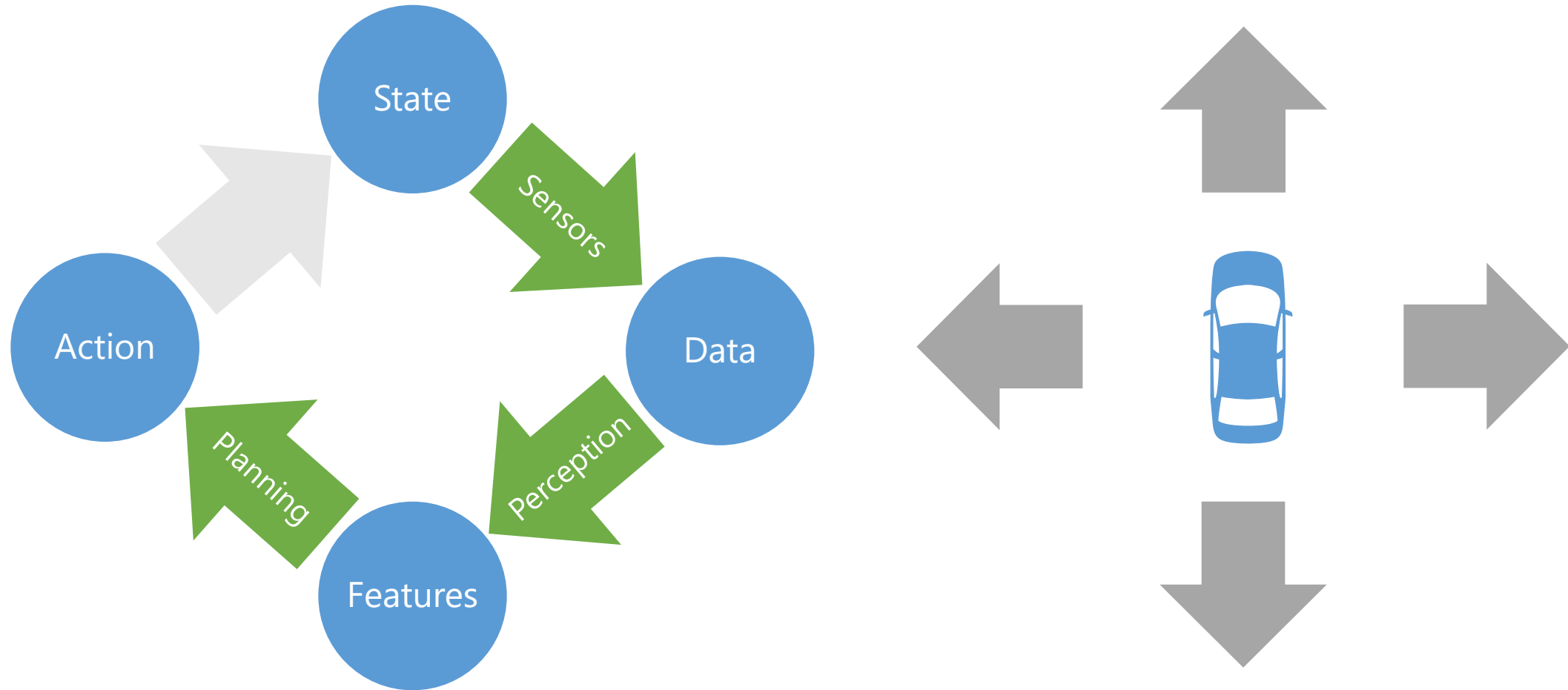
Planning



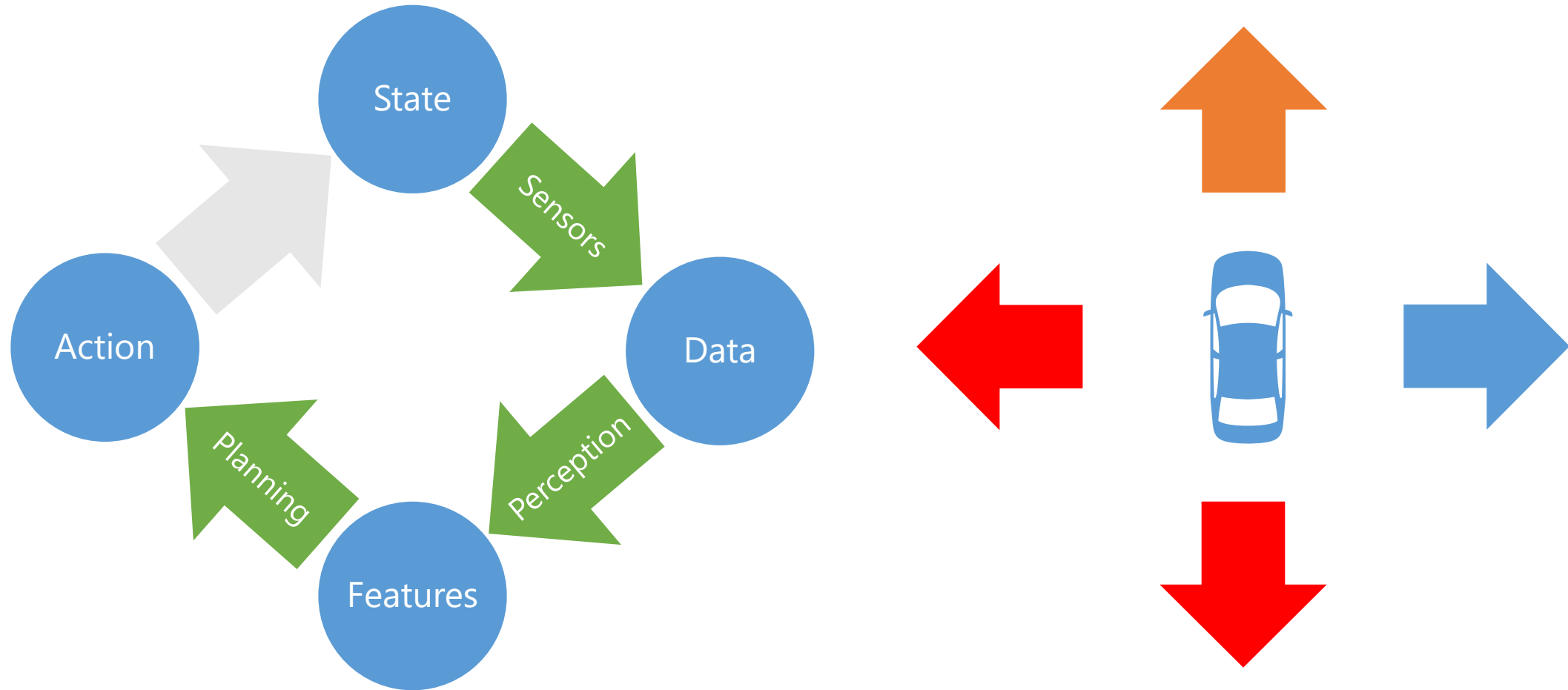
Planning



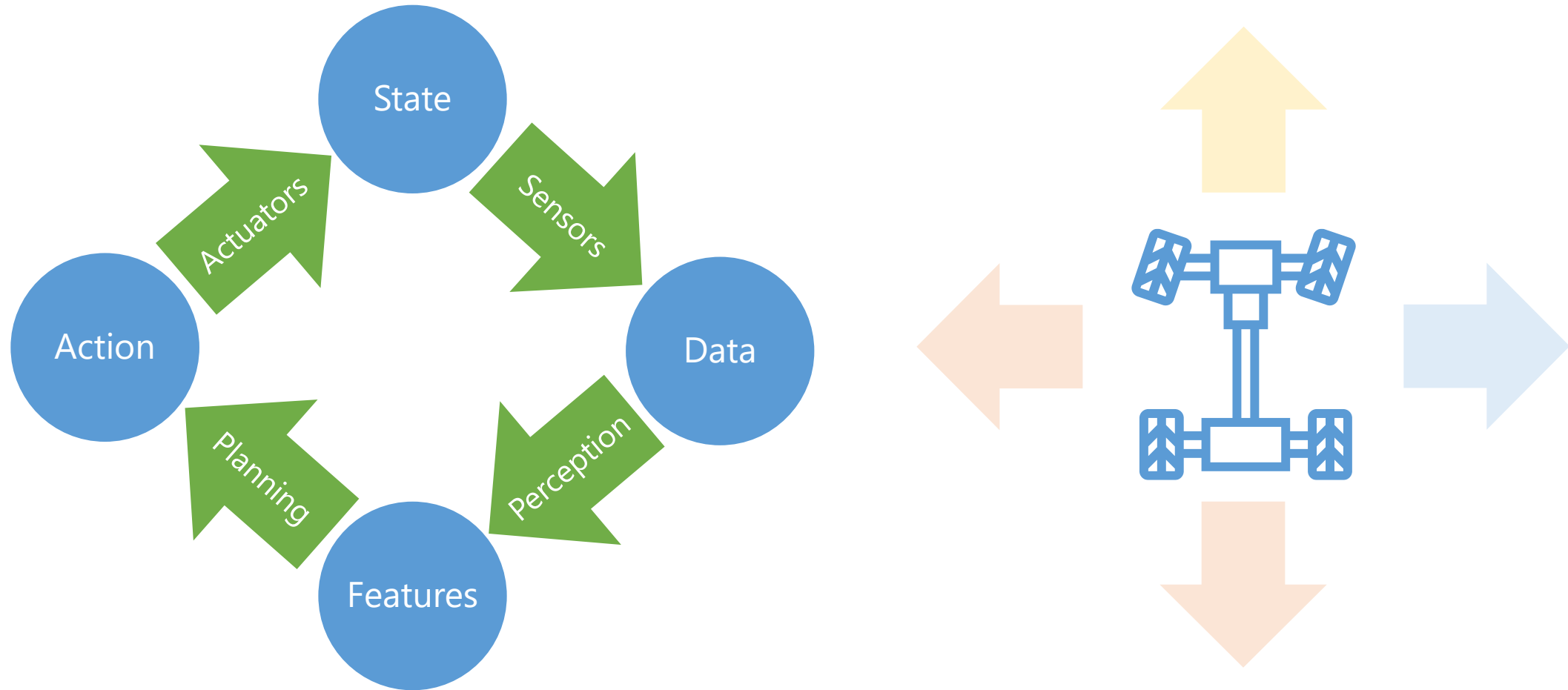
Actions



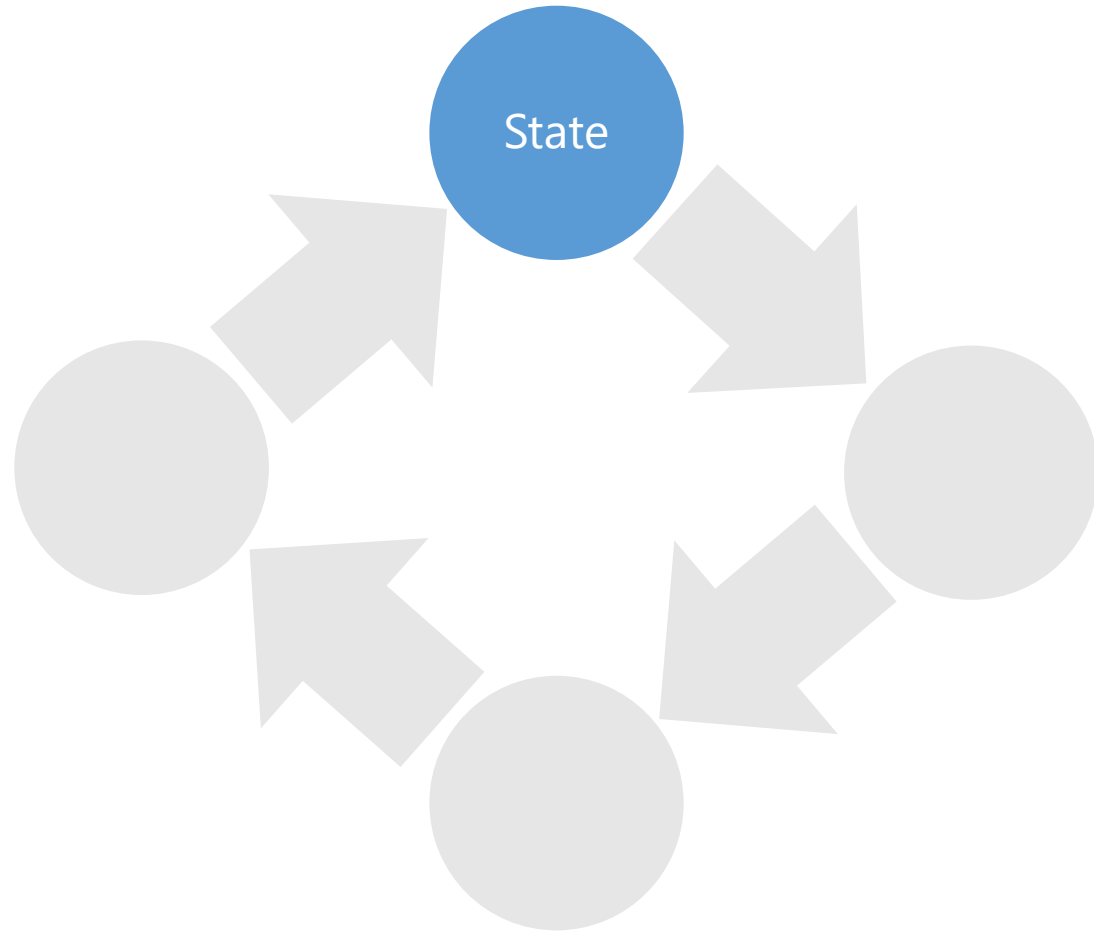
Actions



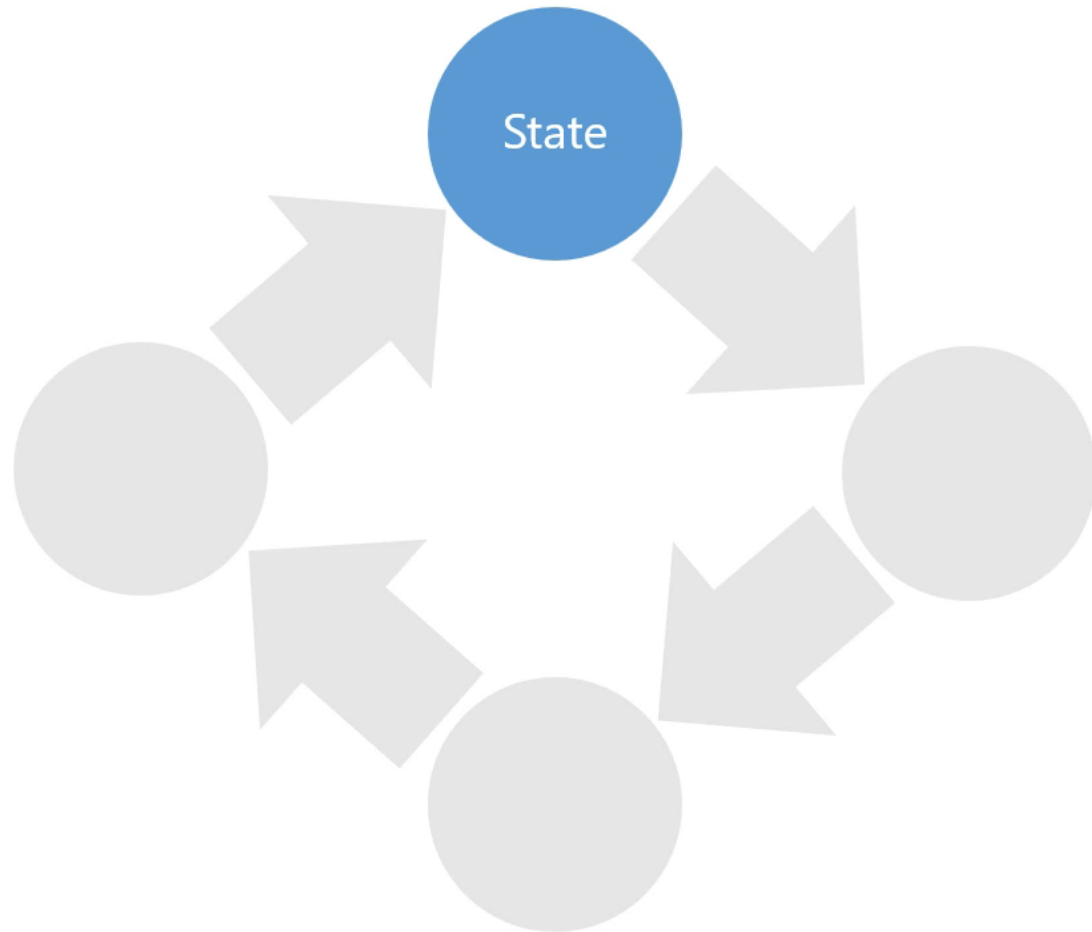
Actuators



Feedback

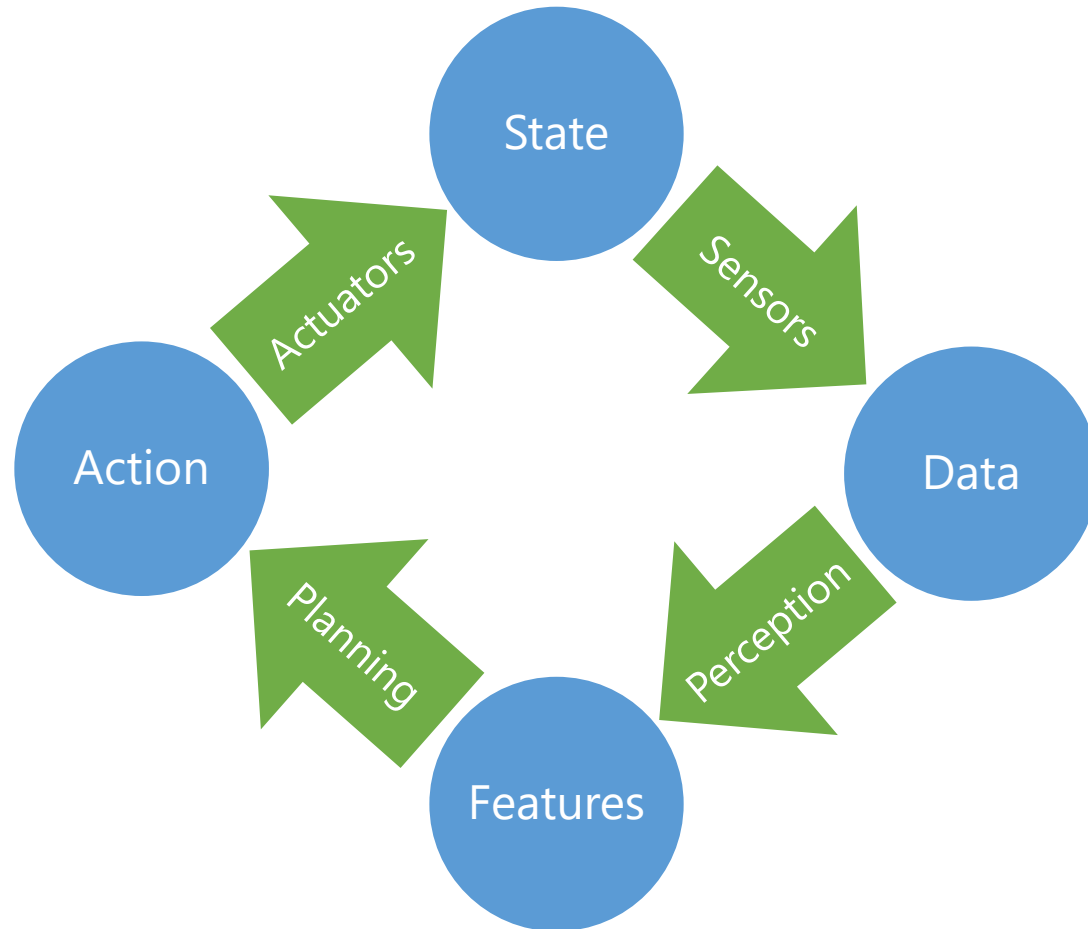


Feedback



Courtesy of Ford Motor Company

Feedback



Goal: Drive to destination

Sub-goal 1: Drive via Hwy 1

Sub-goal 2: Drive to onramp 1A

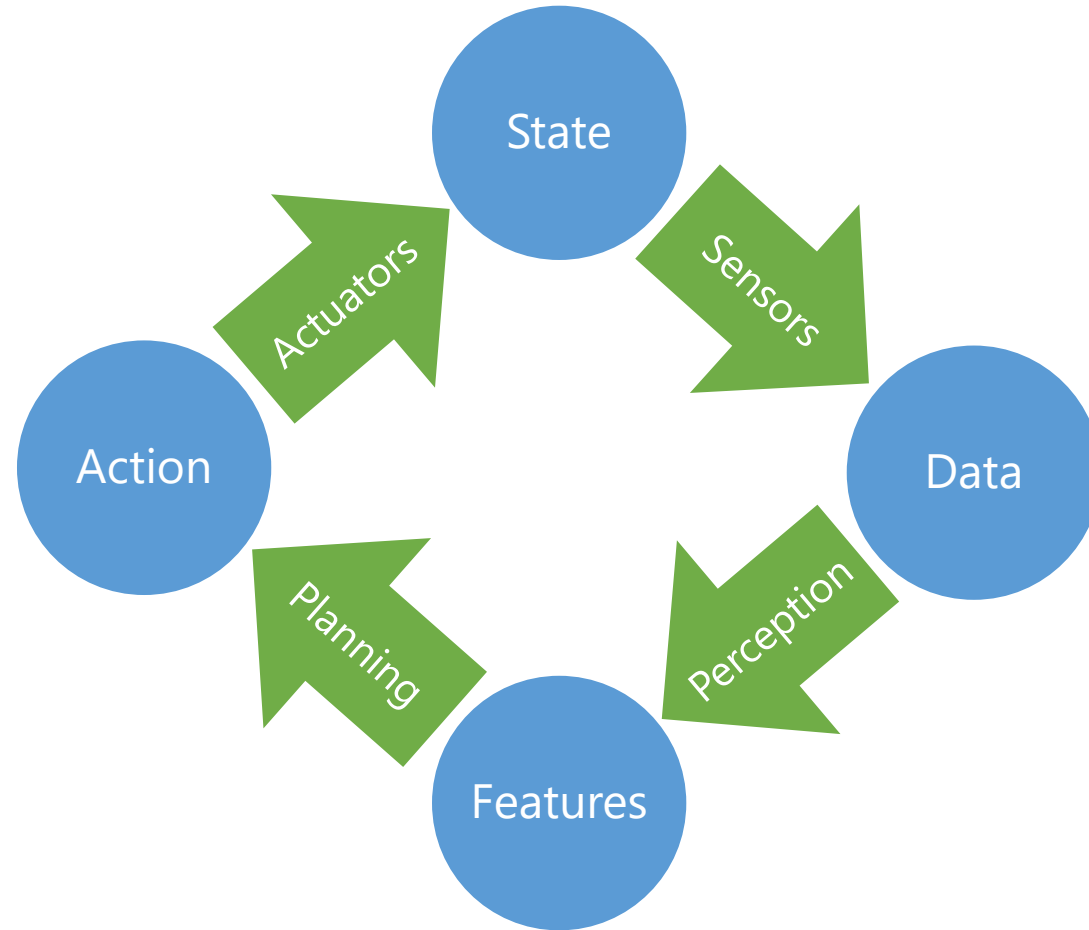
Sub-goal 3: Turn left at onramp

Constraint 1: Stay in lane

Constraint 2: Obey speed limit

Constraint 3: Avoid obstacles

System Summary



Conclusion

Summary

1. AI for Tables
2. AI for Text
3. AI for Audio
4. AI for Images
5. AI for Video
6. AI for Apps
7. AI for Systems



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by Matthew Renze

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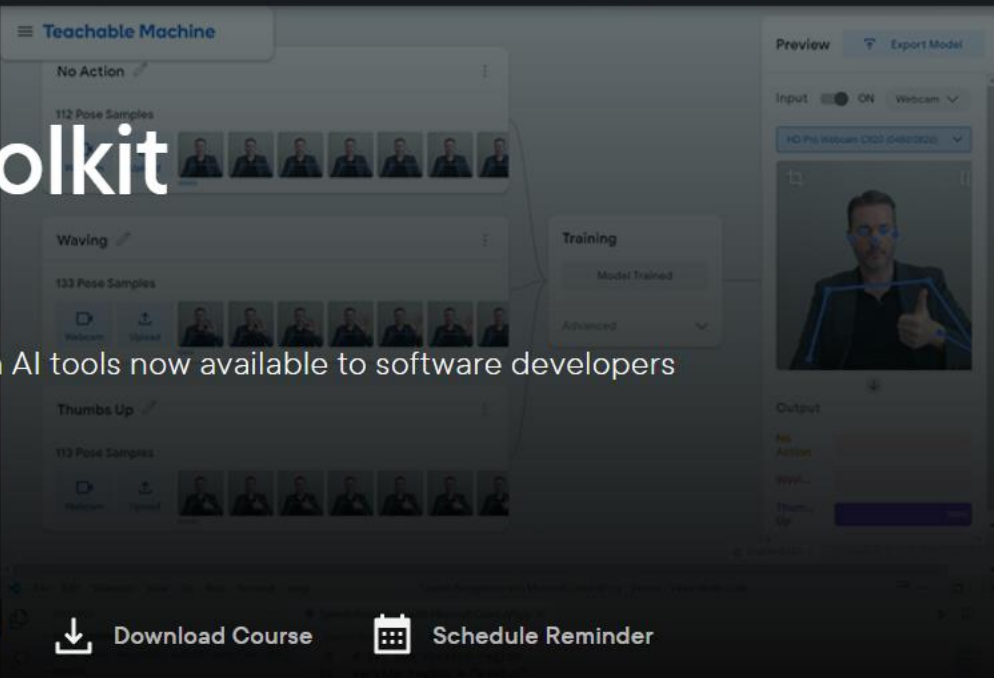
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Course author



Matthew Renze

Matthew Renze is a data science consultant, author, and public speaker. Over the past two decades, he's taught over 400,000 software developers and IT professionals. He's delivered over 100...

Course info

| | |
|-----------|-------------|
| Level | Beginner |
| Rating | ★★★★★ (30) |
| My rating | ★★★★★ |
| Duration | 1h 44m |
| Released | 14 Mar 2021 |

Table of contents

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Course Overview



Introduction



AI for Tables

<https://matthewrenze.com/courses/the-ai-developers-toolkit/>



10m 37s



17m 40s



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