OPEN DATA SCIENCE CONFERENCE

#ODSC

@ODSC

San Francisco | October 31 - Nov. 3 2018

Microsoft

#ODSC

Using Data Science for Good

David Smith
Cloud Developer Advocate
Microsoft

@revodavid

AI for Good Workshop: Outline

- Intro to AI
- AI for Earth: monitoring diversity with iNaturalist
  - Workshop: Azure Notebooks setup
- AI for Accessibility: Seeing AI App
  - Workshop: The AI behind Seeing AI
- AI for Humanitarian Action: Disaster Recovery with AirSim
  - Workshop: Custom Vision and Not Hotdog
- Q & A

Microsoft

About David Smith

Data Scientist
Co-author, *Introduction to R*
Developer, ESS (Emacs Speaks Statistics)
Editor, *Revolutions blog* blog.revolutionanalytics.com

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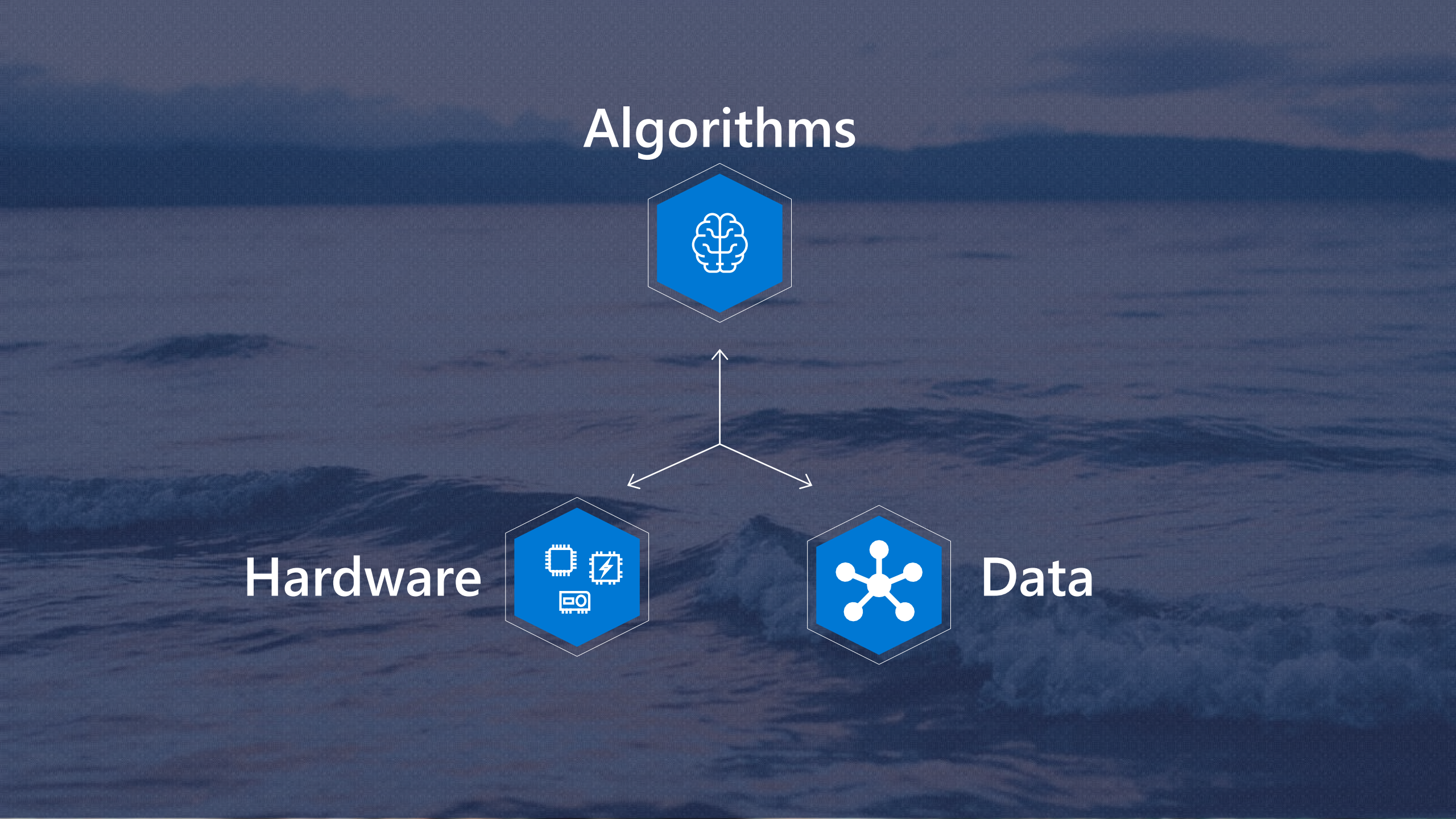
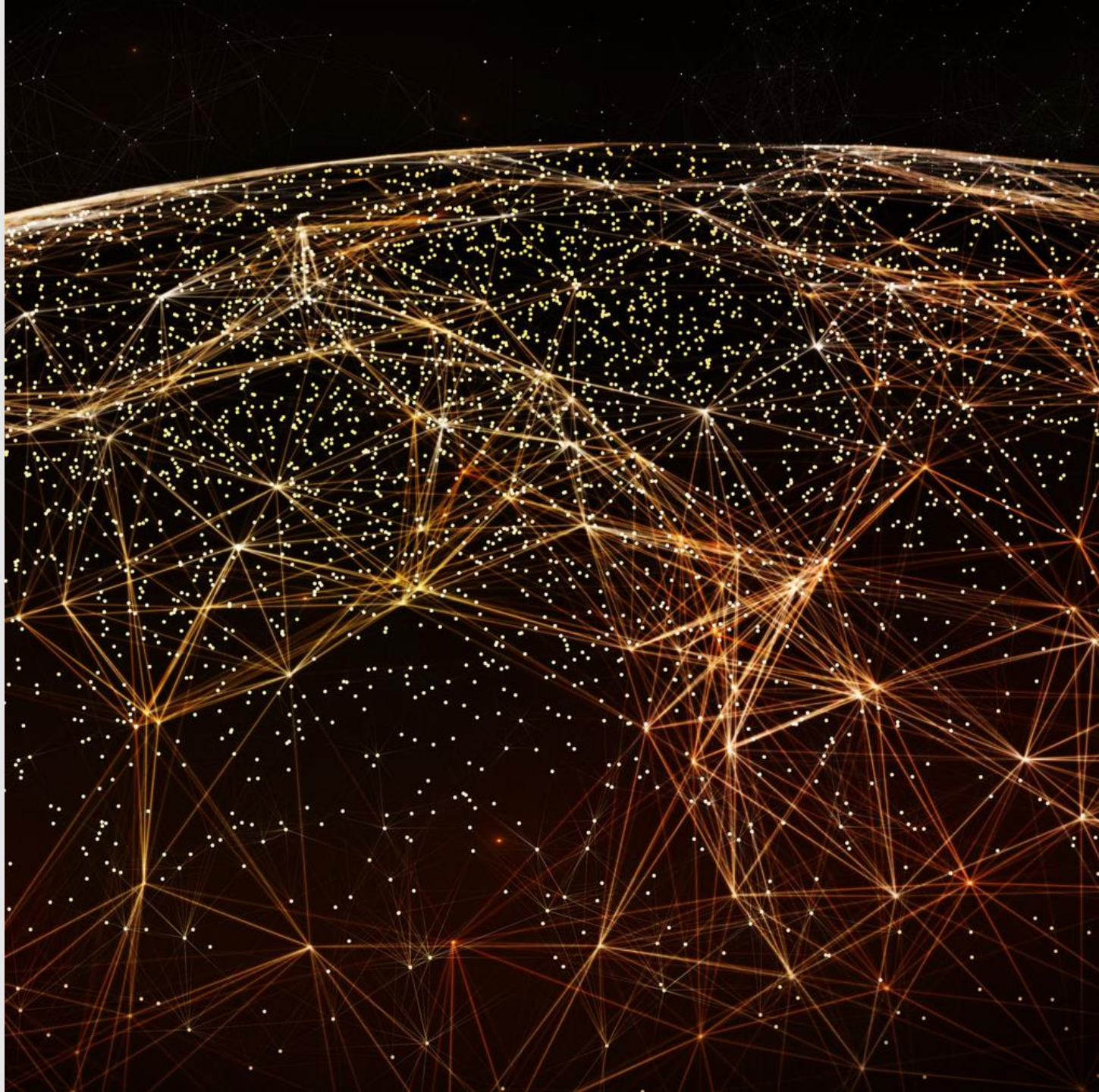
Data Science


Artificial
Intelligence


Algorithms
Hardware
Data

Microsoft's values and principles for AI

- Enable people
- Inclusive
- Ethical




Artificial
Intelligence
for Good

AI for Good

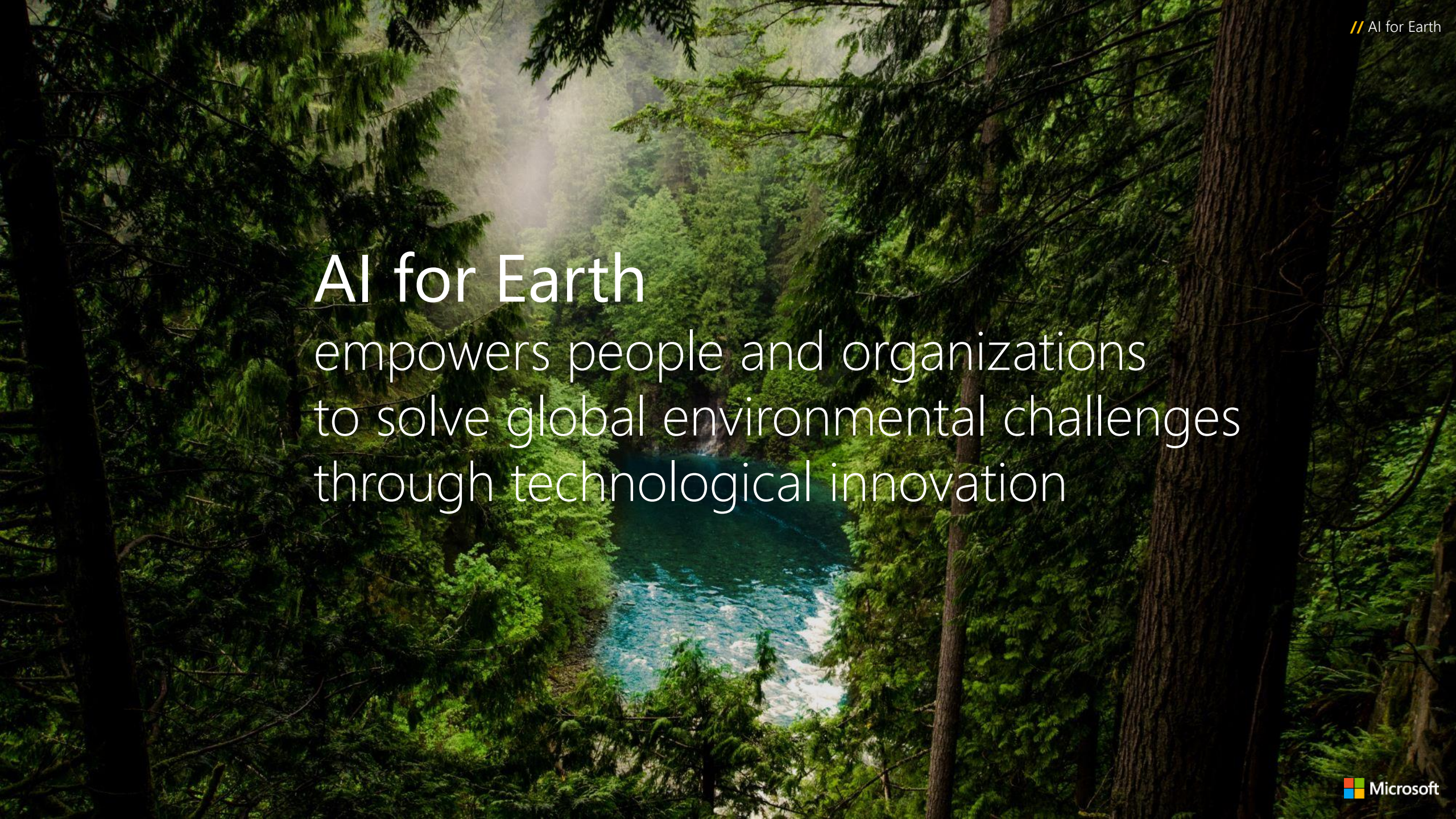
AI for Earth

AI for Accessibility

AI for
Humanitarian Action

AI for Earth

Access | Education | Innovation



AI for Earth

empowers people and organizations
to solve global environmental challenges
through technological innovation

Areas of Focus

AI for Earth is focused on four areas that are vital in building a sustainable future:

Feed the growing world population

Conserve & protect fresh water supplies

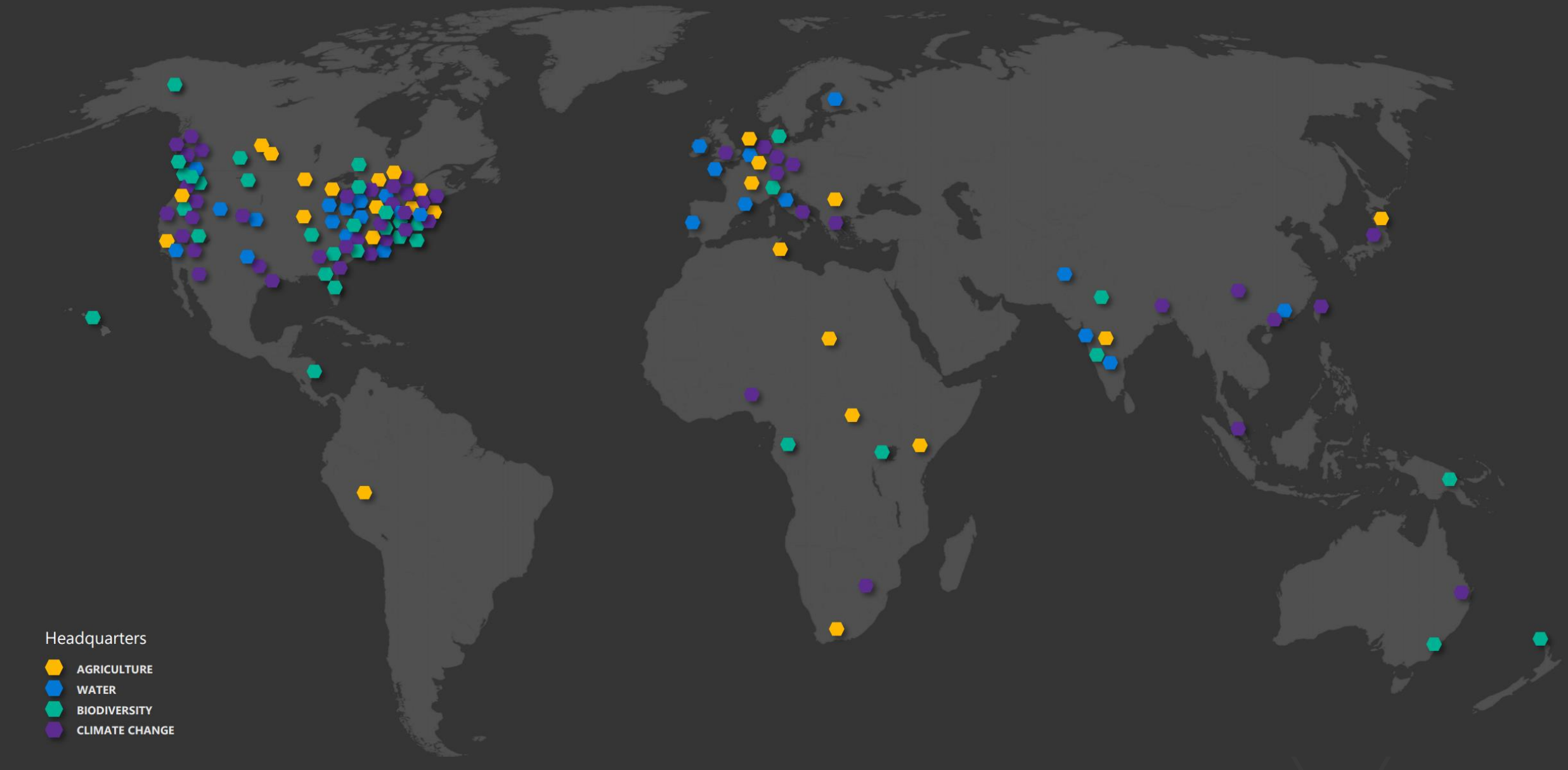
Monitor & protect species from going extinct

Reduce climate change impact on communities

AI FOR EARTH

Azure Award Grantees

Microsoft



Biodiversity Monitoring: iNaturalist

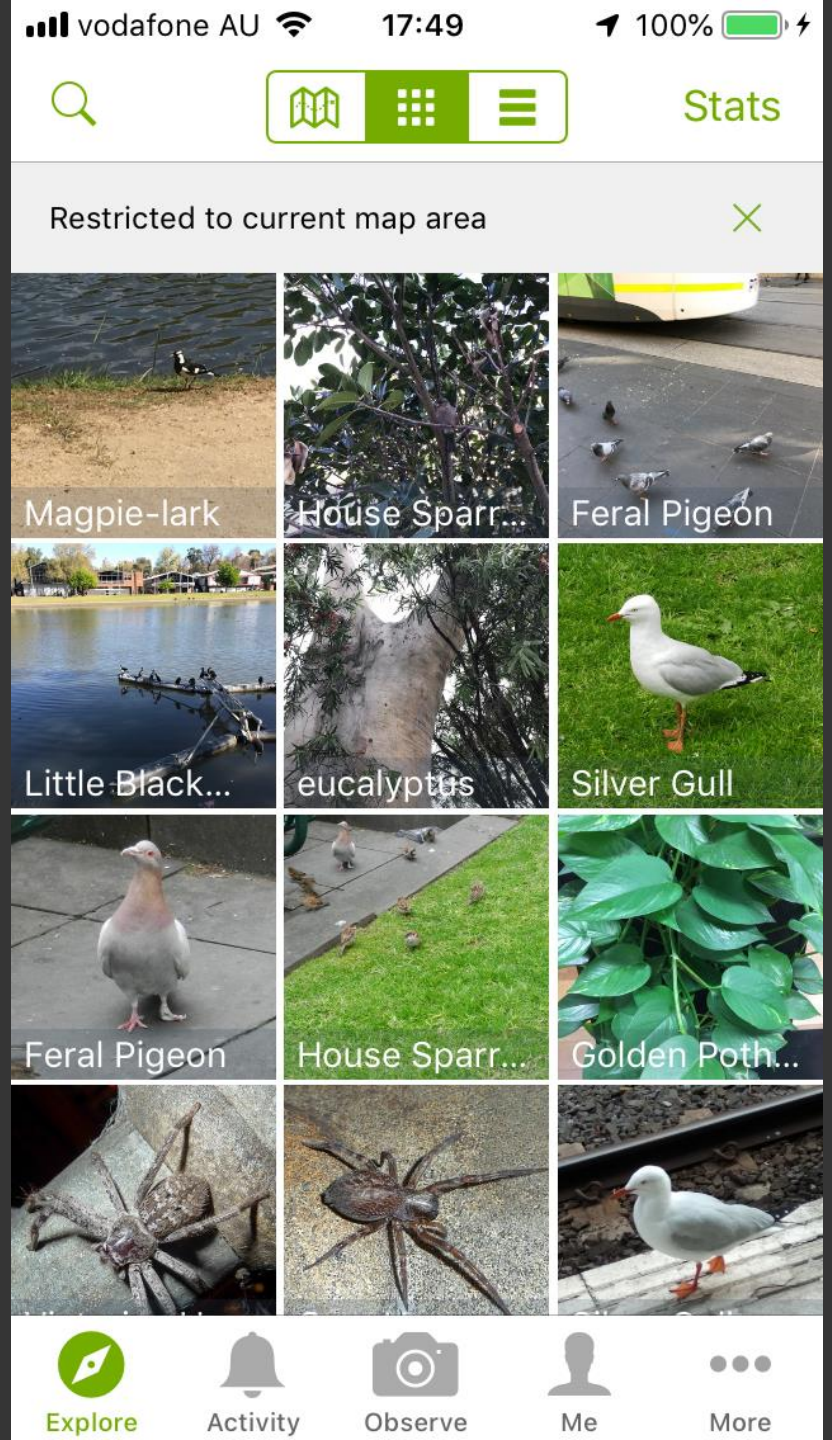
iNaturalist

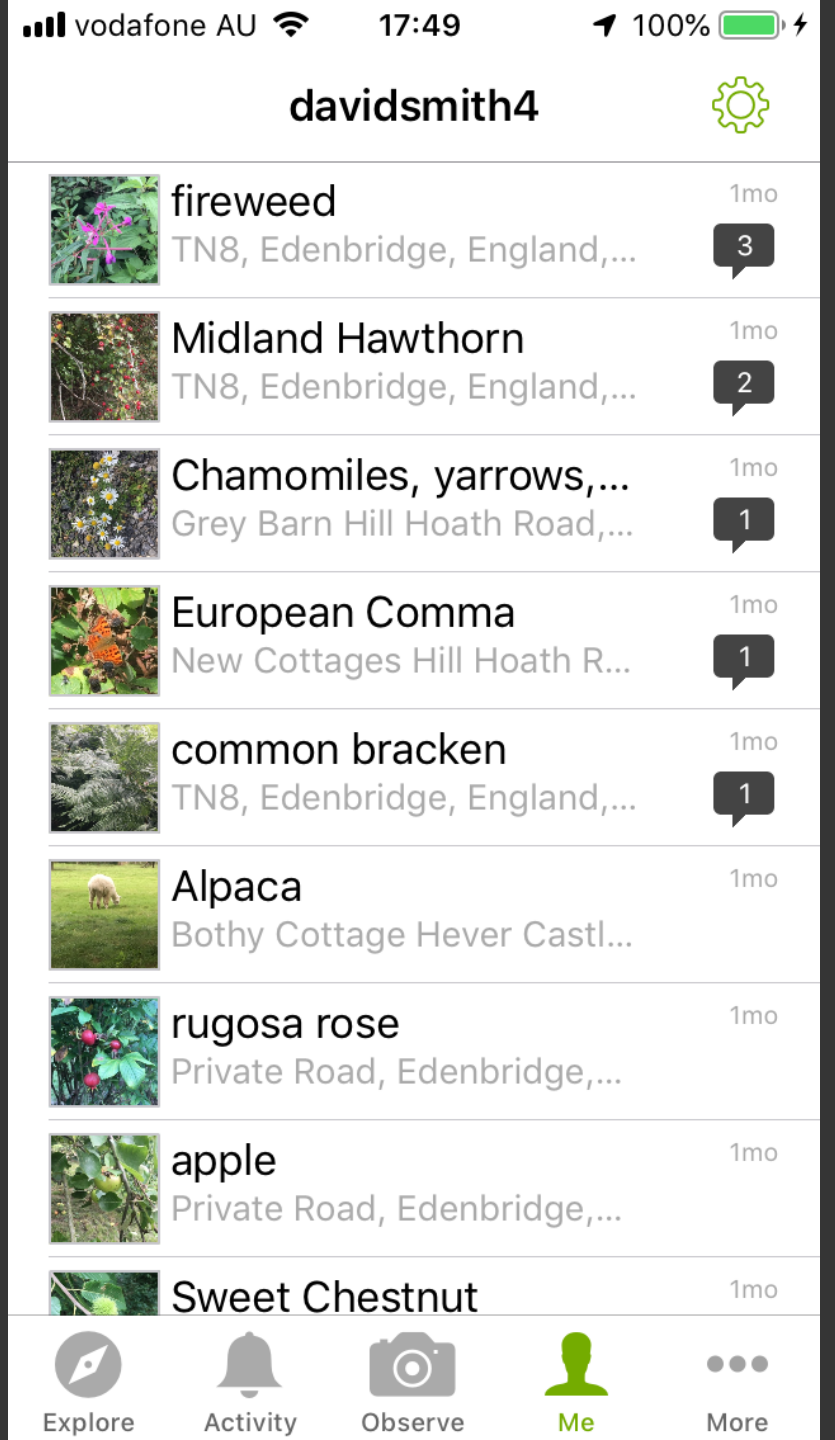
is an online community of citizen scientists recording data on the distribution of Earth's biodiversity

>500k
Online registered users

>6M
Observations recorded

>120k
Distinct species observed


vodafone AU
17:49
100%
Stats
Restricted to current map area
Magpie-lark
House Sparr...
Feral Pigeon
Little Black...
eucalyptus
Silver Gull
Feral Pigeon
House Sparr...
Golden Poth...
Explore
Activity
Observe
Me
More


vodafone AU
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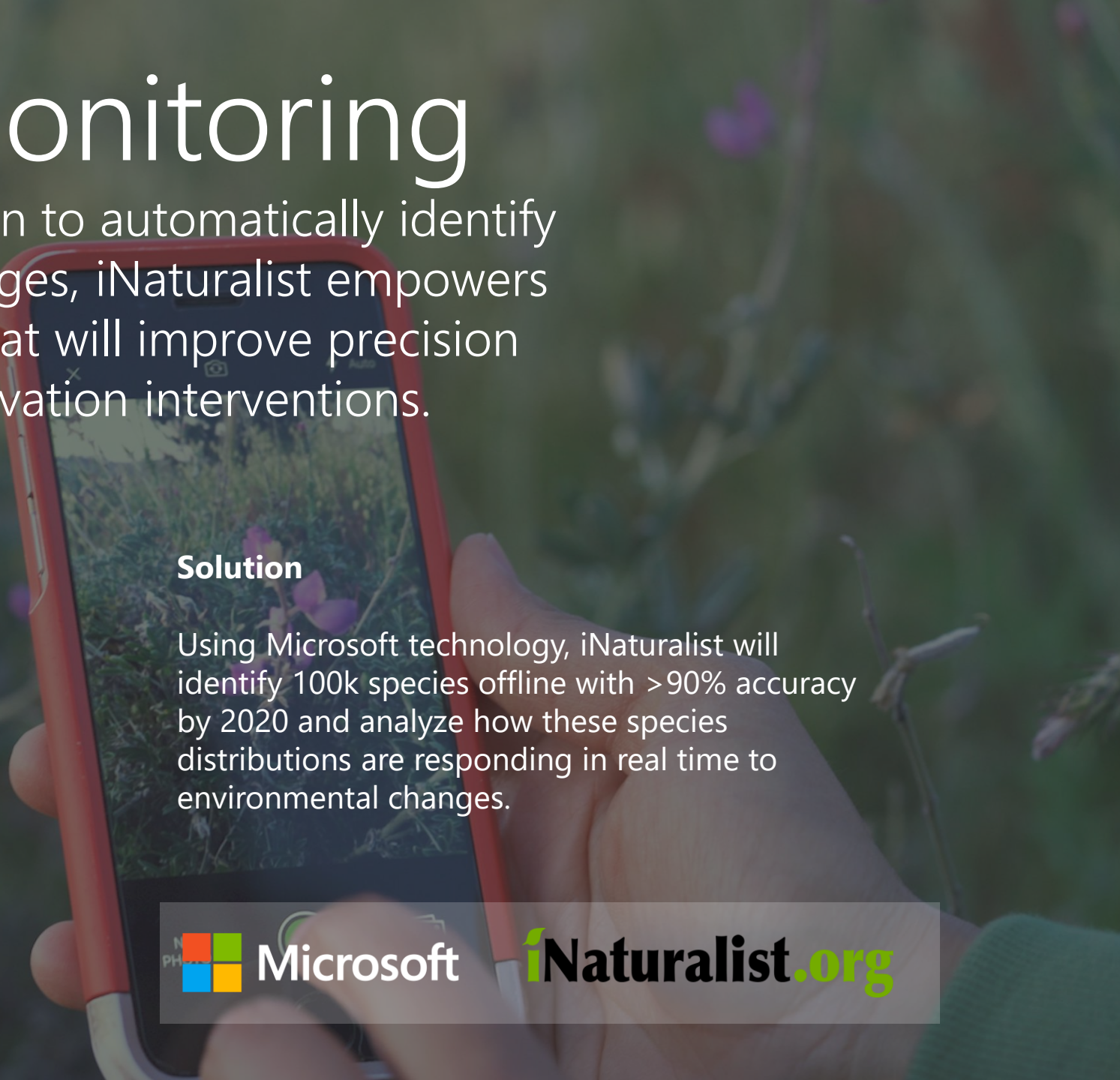
davidsmith4
fireweed
TN8, Edenbridge, England,...
1mo
3
Midland Hawthorn
TN8, Edenbridge, England,...
1mo
2
Chamomiles, yarrows,...
Grey Barn Hill Hoath Road,...
1mo
1
European Comma
New Cottages Hill Hoath R...
1mo
1
common bracken
TN8, Edenbridge, England,...
1mo
1
Alpaca
Bothy Cottage Hever Castl...
1mo
rugosa rose
Private Road, Edenbridge,...
1mo
apple
Private Road, Edenbridge,...
1mo
Sweet Chestnut
1mo
Explore
Activity
Observe
Me
More

Biodiversity Monitoring

Using AI-powered computer vision to automatically identify species in wildlife monitoring images, iNaturalist empowers citizen scientists to collect data that will improve precision decision-making and local conservation interventions.



Challenge

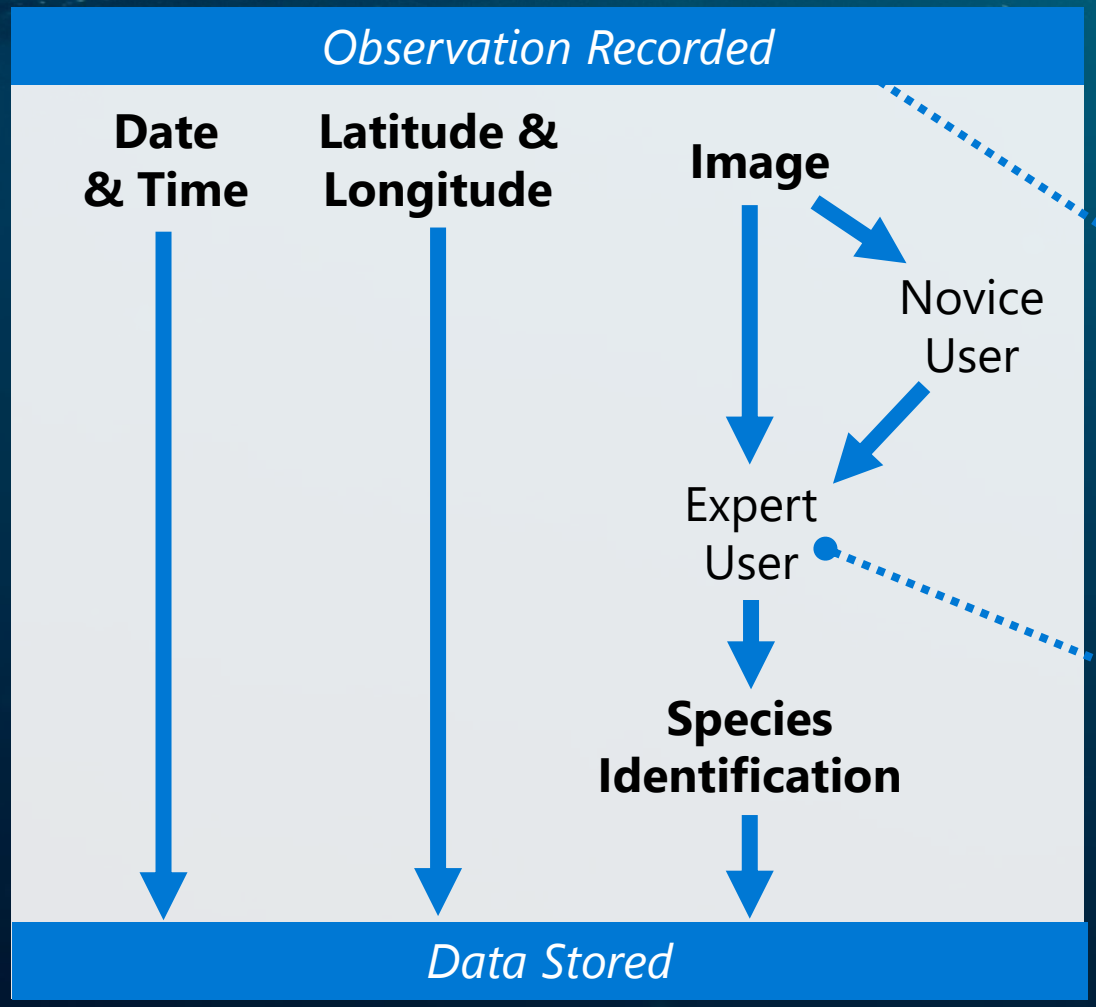
Without action, 38% of all species will go extinct by the end of this century.
To coordinate and implement conservation action, decision makers need information on where and when species occur, and how these distributions are changing. Current monitoring data face a bottleneck in identifying the species pictured – since only trained experts can do so.

Solution

Using Microsoft technology, iNaturalist will identify 100k species offline with >90% accuracy by 2020 and analyze how these species distributions are responding in real time to environmental changes.

Microsoft iNaturalist.org

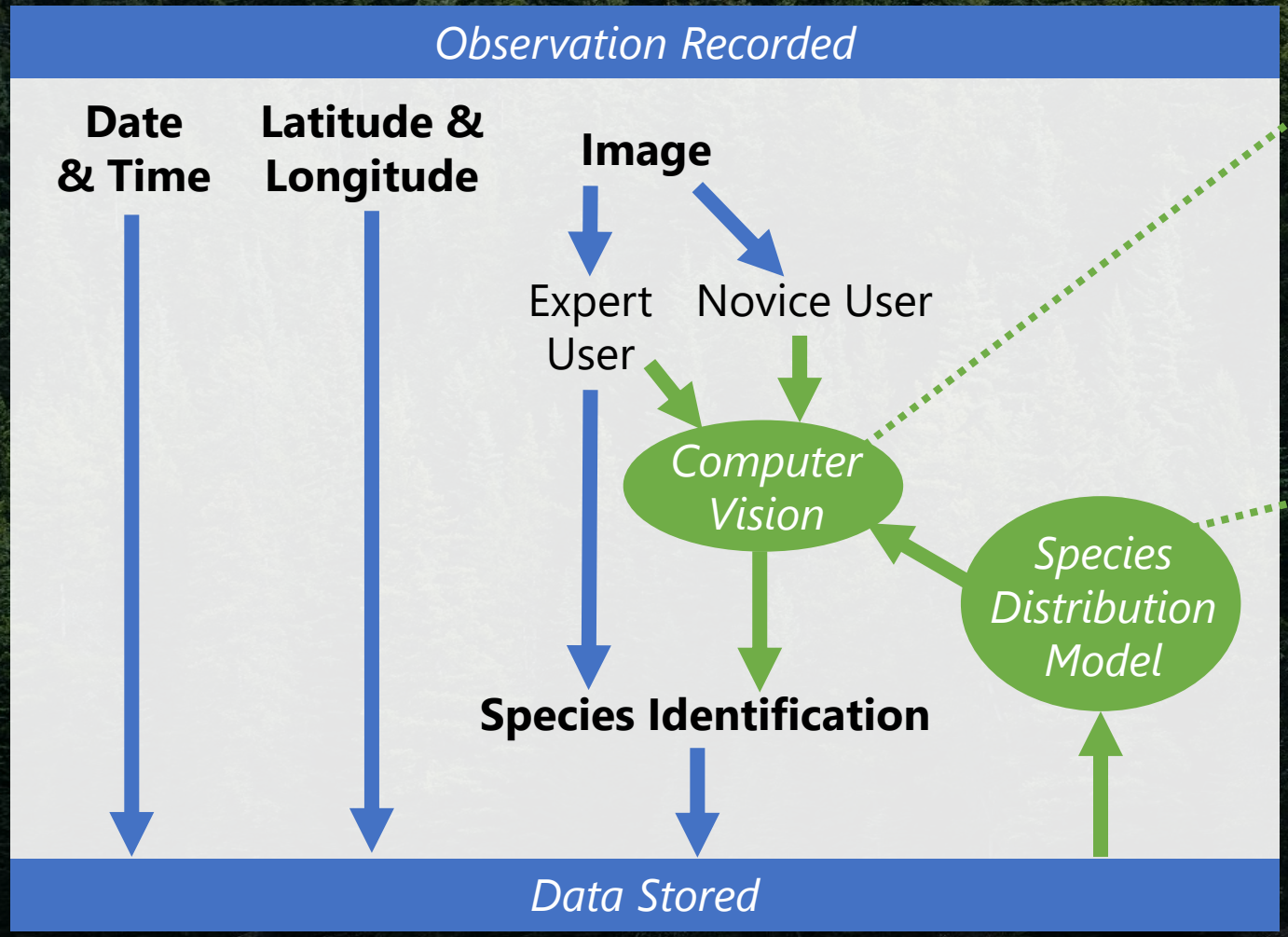
How iNaturalist Used to Work



With the iNaturalist app on their mobile phones, users record observations of organisms by taking a geo & time-tagged photo.

Users are responsible for identifying species. ID by novice users need expert verification. This created a **bottleneck** of images awaiting species ID by experts.

Microsoft AI Augmented System

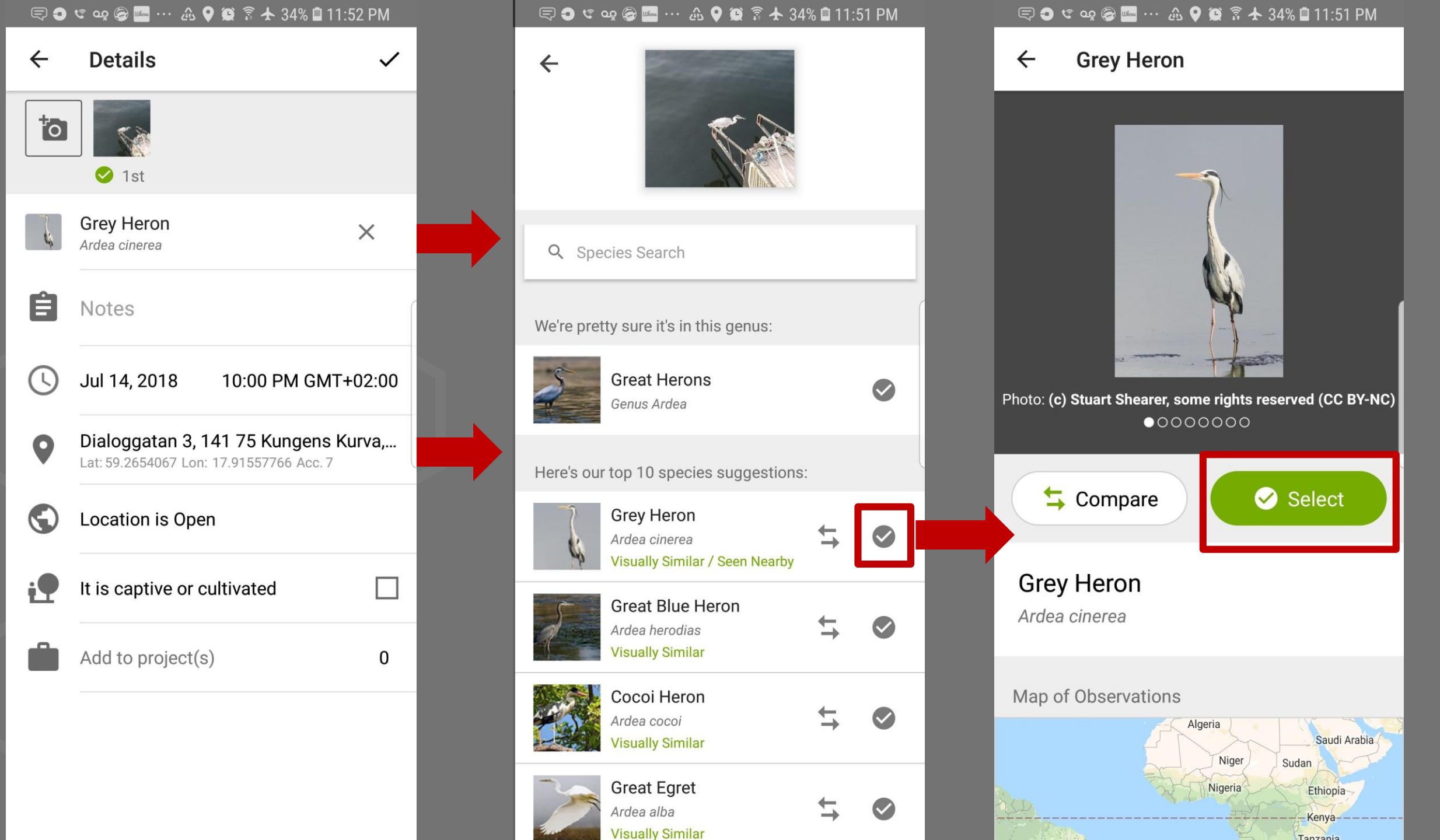


Computer vision models (MSFT Custom Vision and Cognitive Toolkit) are trained to ID species from images.

This lets anyone instantly and accurately ID species.

Data stored is used for **species distribution model** (MSFT R Server, Data Science Virtual Machine) which predicts where species are located at given time.

This can also increase the prediction accuracy of computer vision model by taking into account location of recorded observation.


34% 11:52 PM
Details
1st
Grey Heron
Ardea cinerea
Notes
Jul 14, 2018
10:00 PM GMT+02:00
Dialoggatan 3, 141 75 Kungens Kurva,...
Lat: 59.2654067 Lon: 17.91557766 Acc. 7
Location is Open
It is captive or cultivated
Add to project(s)
0
34% 11:51 PM
Species Search
We're pretty sure it's in this genus:
Great Herons
Genus Ardea
Here's our top 10 species suggestions:
Grey Heron
Ardea cinerea
Visually Similar / Seen Nearby
Great Blue Heron
Ardea herodias
Visually Similar
Cocoi Heron
Ardea cocoi
Visually Similar
Great Egret
Ardea alba
Visually Similar
34% 11:51 PM
Grey Heron
Photo: (c) Stuart Shearer, some rights reserved (CC BY-NC)
Compare
Select
Grey Heron
Ardea cinerea
Map of Observations
Algeria
Saudi Arabia
Niger
Sudan
Nigeria
Ethiopia
Kenya

iNaturalist relies on an active user base to collect data

Help grow and engage iNaturalist's user base by:

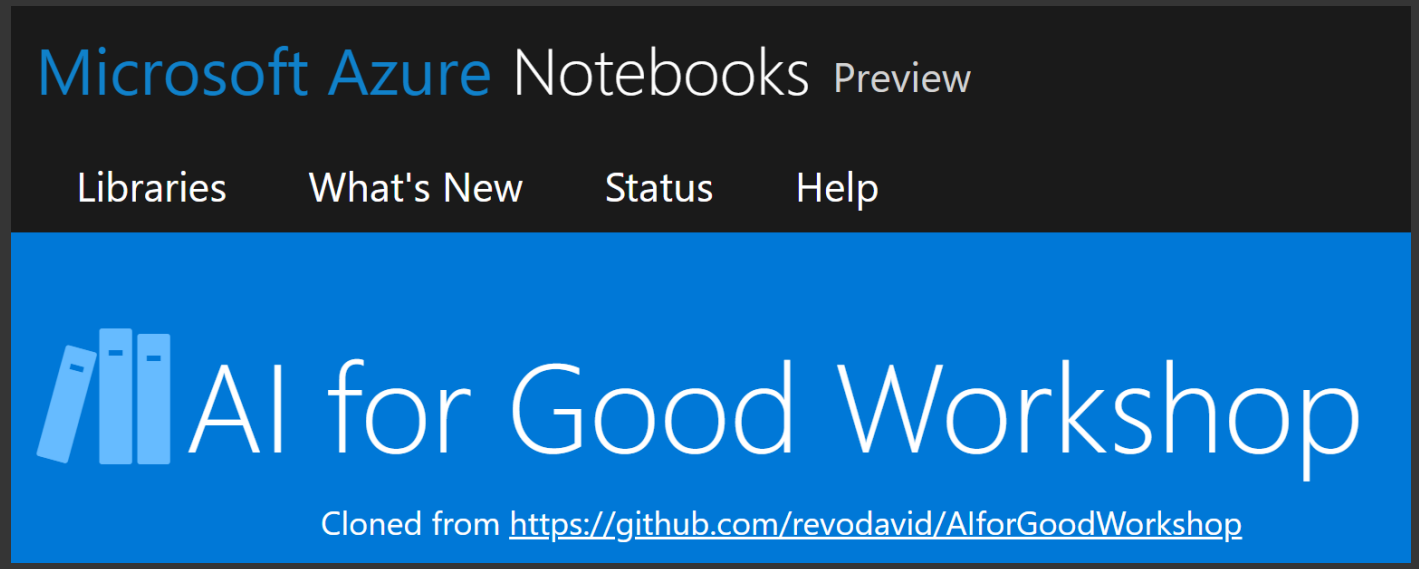
Providing users an instant and accurate species ID through computer vision, which makes recording observations more educational and rewarding.

Giving users helpful location information through species distribution model. Users can identify:

Locations where users can see species of interest

Data-poor areas where increased data collection is needed to help scientists

Workshop Setup



notebooks.azure.com/davidsmi/libraries/aiforgood
(sign in and clone notebook)

Need an Azure account?
Visit: **cda.ms/kT**
$200 credits for new users


Microsoft
AI for Accessibility
Inclusion through
intelligent technology

Microsoft AI for Accessibility

Empowering people with disabilities with tools that support independence, inclusion, and productivity.

Our vision

A world in which every person on the planet is empowered to achieve more, regardless of how they communicate, see, hear, or move.

Accessible technology has the potential to drive innovation with more intuitive and personal experiences.

AI in action

AI is already being used today to deliver meaningful and contextually relevant experiences.

Accessibility:
Seeing AI & Translator

Connecting people to their environment and to each other

Understand
Location aware
Situationally relevant

See
Screen-less
Visual

Speak
Multi-lingual
Conversational

Hear
Interactive

Feel
Sentiment personalization

Microsoft | AI for Accessibility

Seeing AI

Turning the visual world into an audible experience

Designed for the blind and low vision community, this research project harnesses the power of AI to describe people, text, and objects.

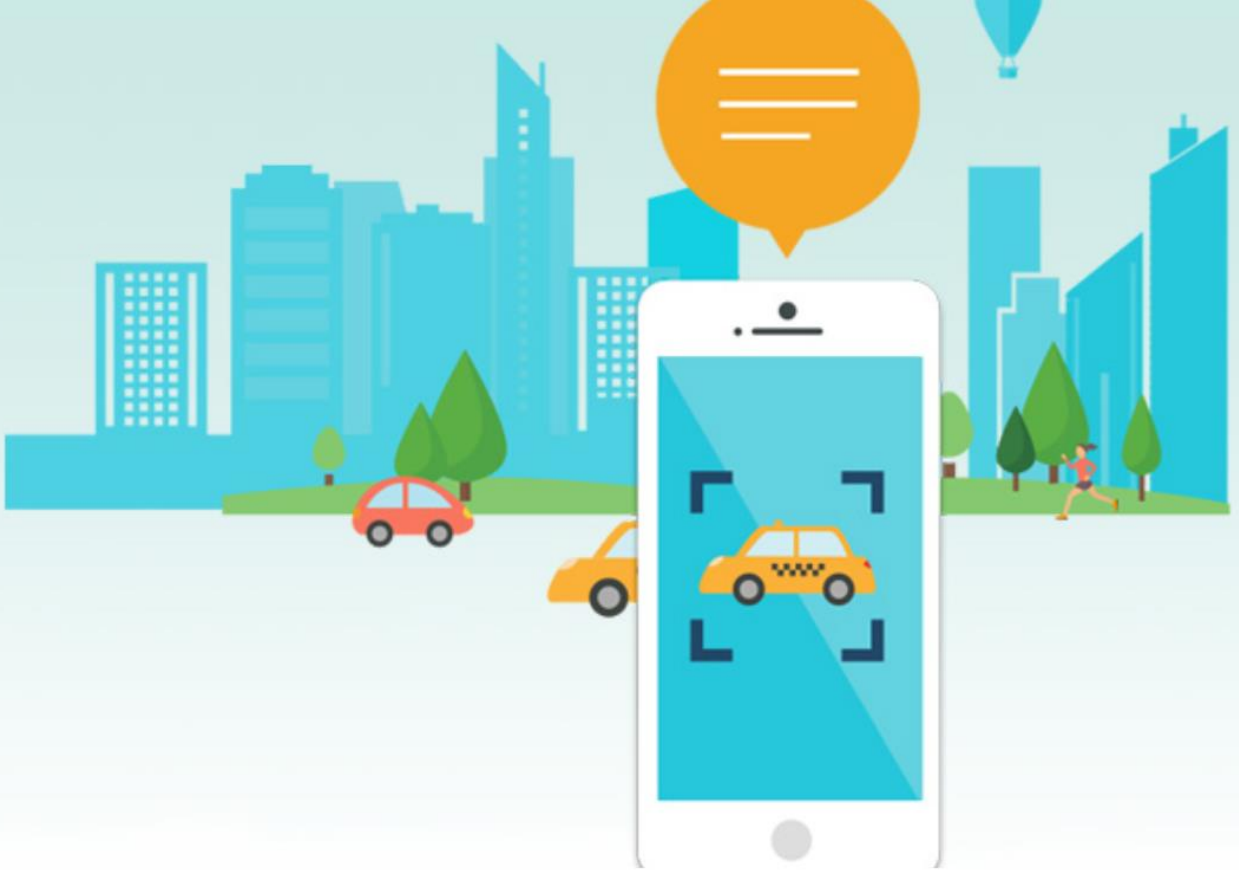
Demonstrates the practical value of computer vision.

Seeing AI

A free app that narrates the world around you. Designed for the low vision community, this research project harnesses the power of AI to describe people, text and objects

DOWNLOAD FOR IOS >

WATCH VIDEO >



Short Text
Speaks text as soon as it appears in front of the camera

Documents
Provides audio guidance to capture a printed page, and recognizes the text, along with its original formatting

Products
Gives audio beeps to help locate barcodes and then scans them to identify products

Person
Recognizes friends and describes people around you, including their emotions

Scene
An experimental feature to describe the scene around you

Currency
Identify currency bills when paying with cash. (Coming soon)

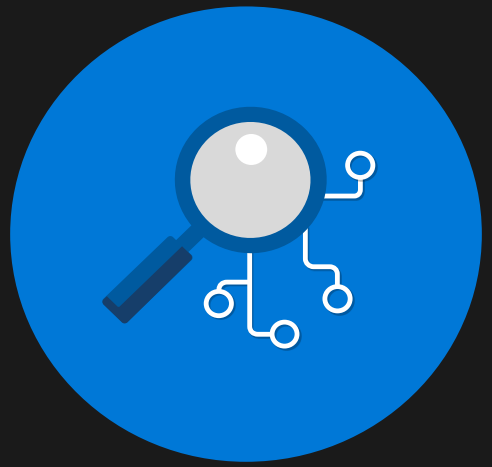
The AI behind Seeing AI

Stages of AI

Pre-Trained AI

Cognitive Services
Intelligent APIs
Data for inference

Enhanced AI



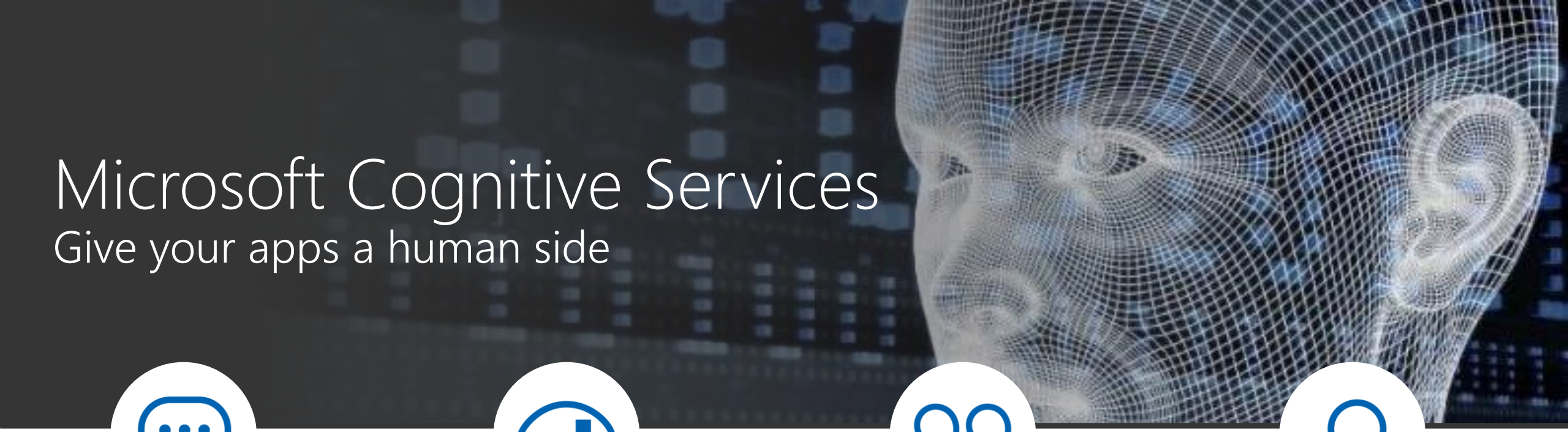
Pre-Trained models
Transfer Learning
Some training data

Bespoke AI

Developer Tools
Frameworks
Extensive training data

Microsoft Cognitive Services

Give your apps a human side



Speech

Speak to and hear your users, filtering environmental noise.

Use with **Language** for max results

Vision

From objects to faces and feelings, enable your apps to analyze still images and video

Language

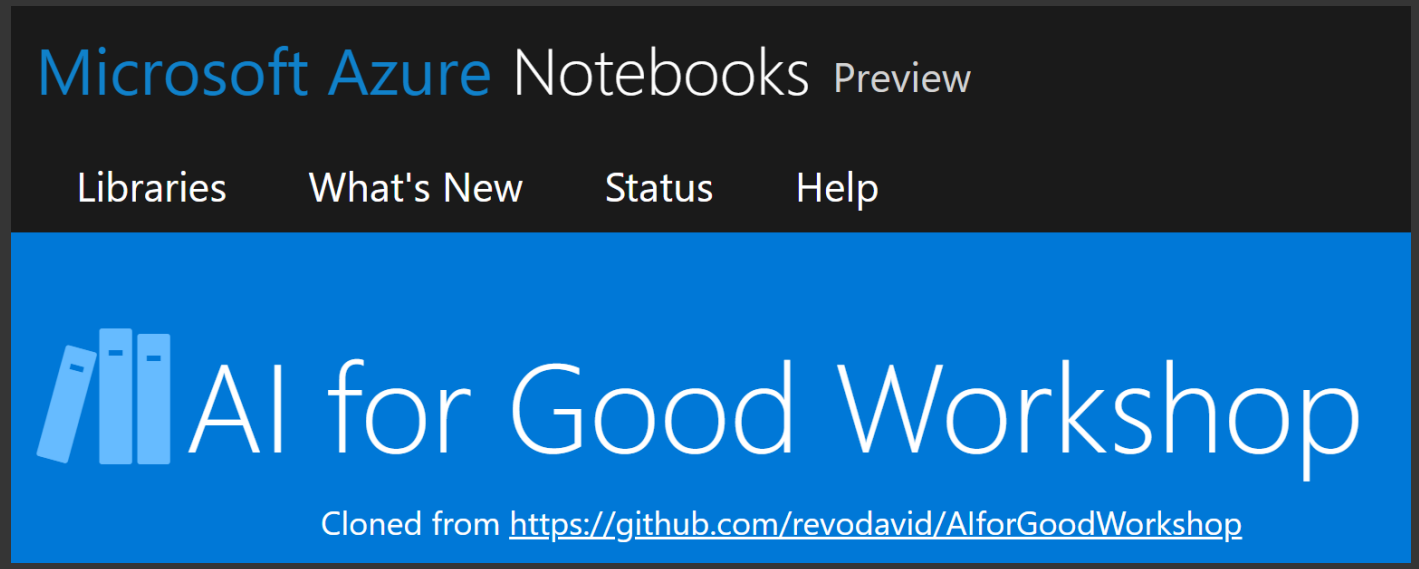
Analyze text to extract user feeling and intent.

Extract knowledge from existing sources and make it easily accessible to users

Translate between 60+ languages and growing

Search

Access billions of web pages, images, videos, and news with the power of Bing



notebooks.azure.com/davidsmi/libraries/aiforgood

Install “Seeing AI” (iOS only)

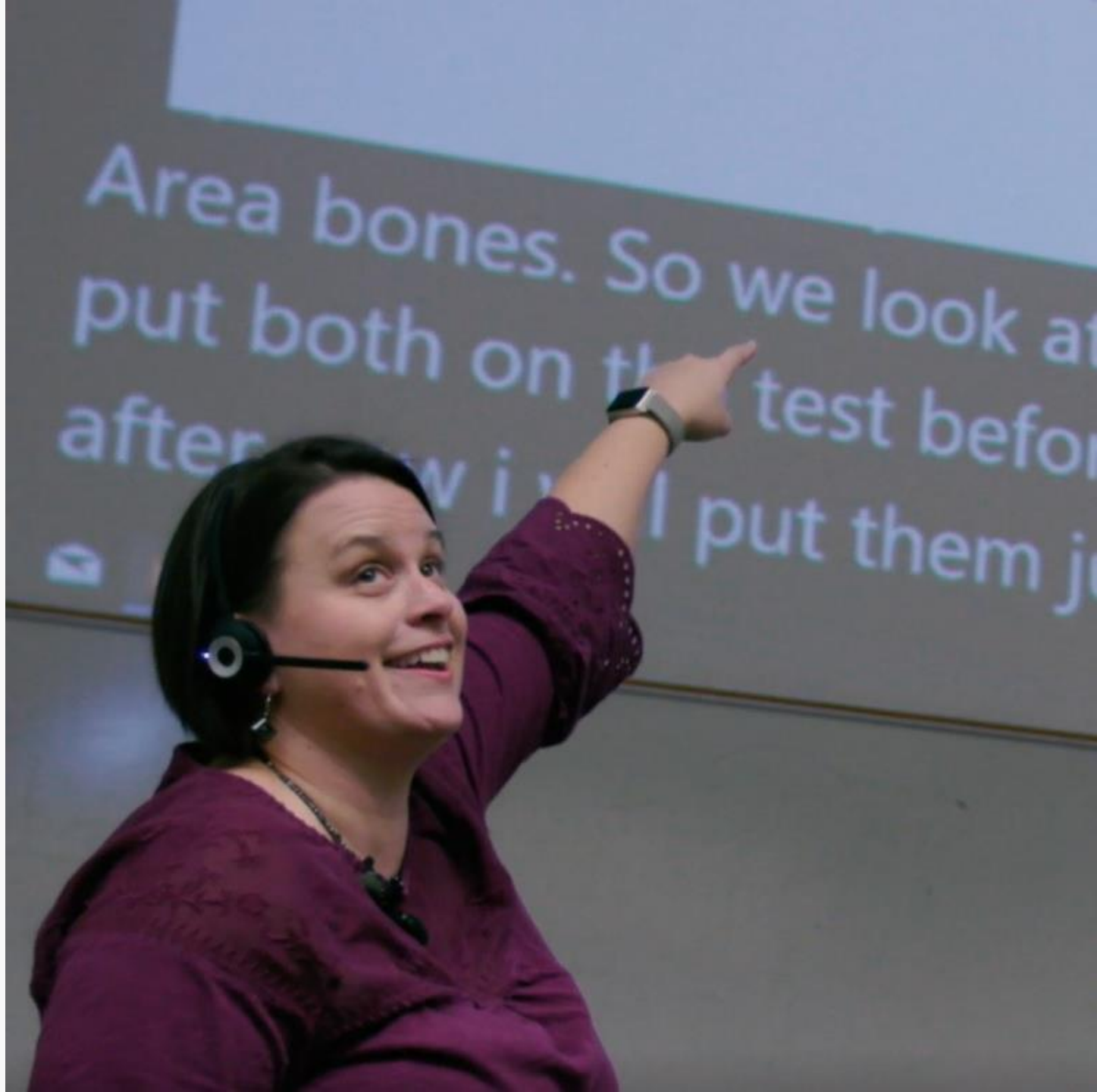
1. The AI behind Seeing AI.ipynb
2. Computer Vision API with R.ipynb

Microsoft Translator

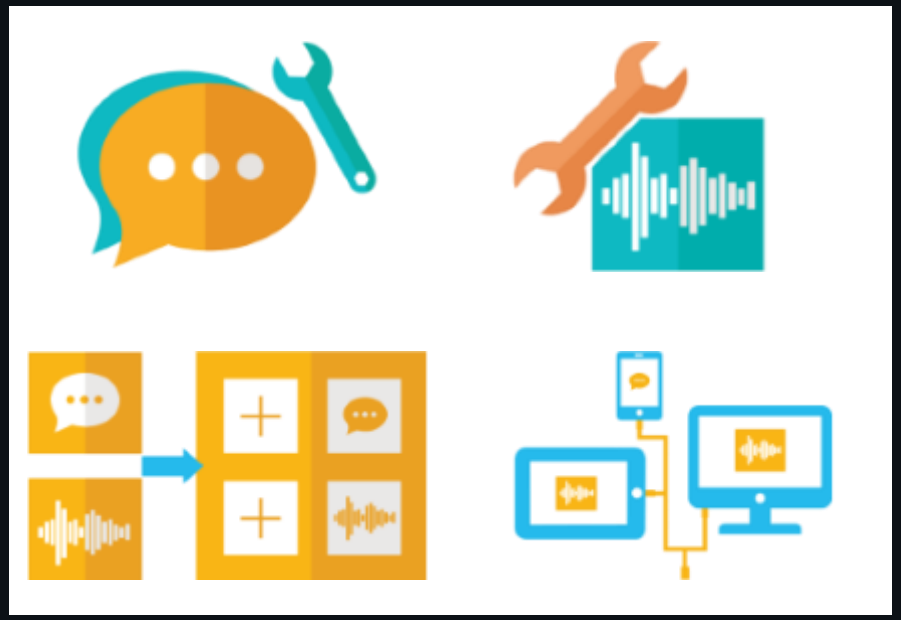
Breaking the language barrier at home, at work, anywhere.

Translated conversations across devices, for one-on-one chats and for larger group interactions.

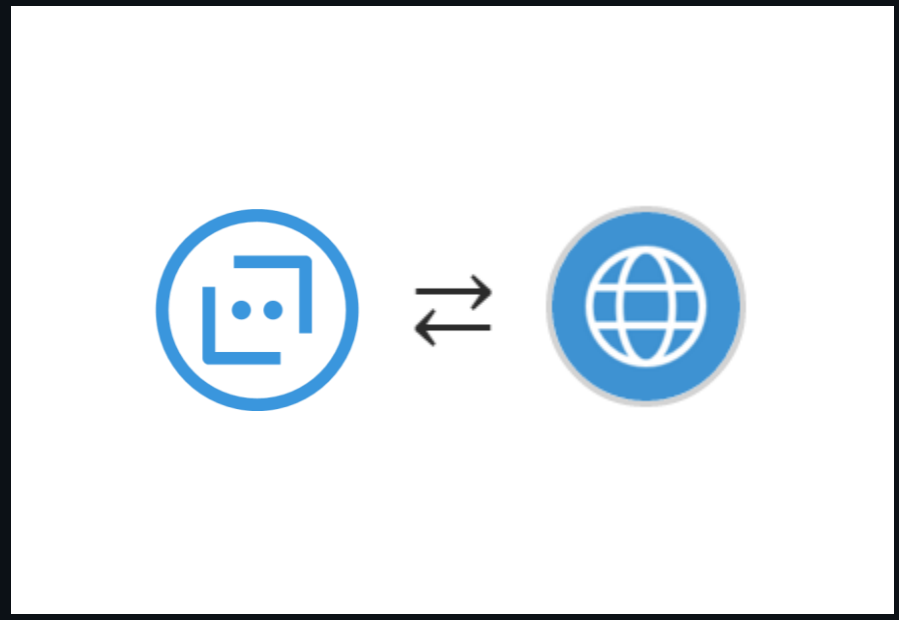
Designed for one audience, built for many.



Microsoft translator and custom speech



Custom Speech Model



Microsoft Translator

Presentation Translator demo: deaf voice adapted English-Chinese real-time speech translation

Brian Trager
Associate Director, Center on Access Technology
Assistant Professor, Information & Computing Studies
Rochester Institute of Technology
National Technical Institute for the Deaf
www.ntid.rit.edu

www.translate.it/JQPXD Mute •••

We collaborated with Microsoft and started using presentation translator last September.

Harry

Yes.
We've just seen exciting results in the video.

Brian

One half.
and the very, well, we focused on non deaf

Microsoft Build

May 7-9, 2018 // Seattle, WA

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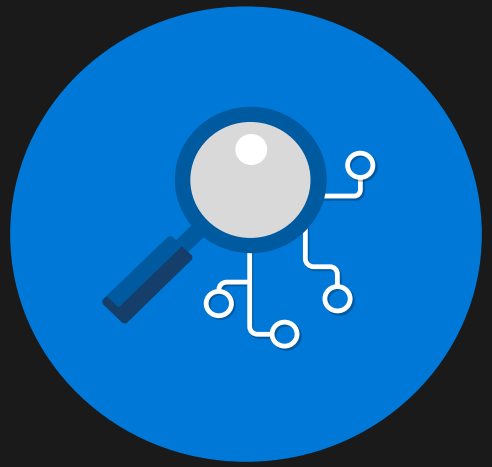


Pre-Trained models
Transfer Learning
Some training data

Bespoke AI

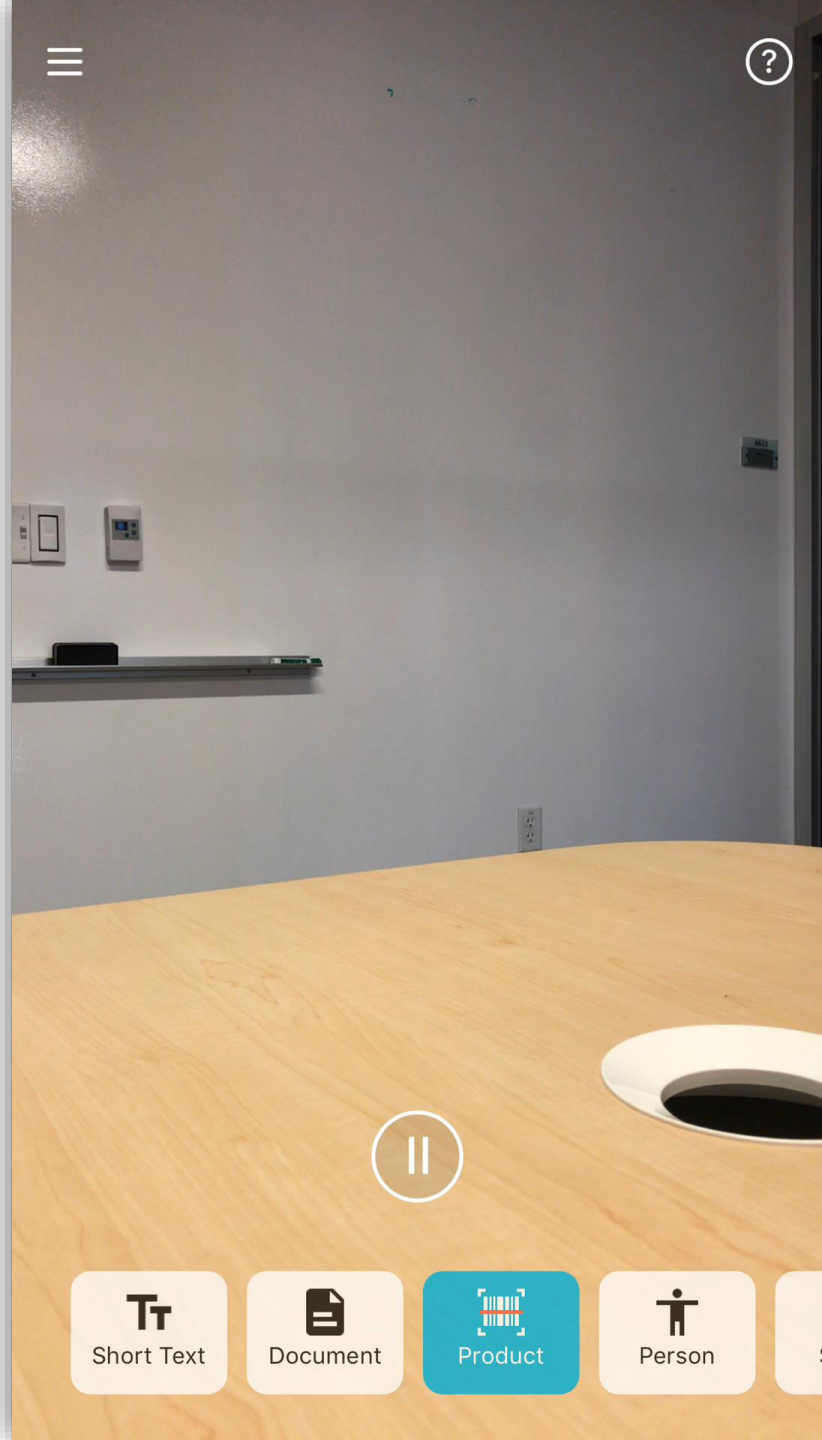
Developer Tools
Frameworks
Extensive training data

Barcode recognition from Seeing AI

Aim : Help blind users identify products using barcode

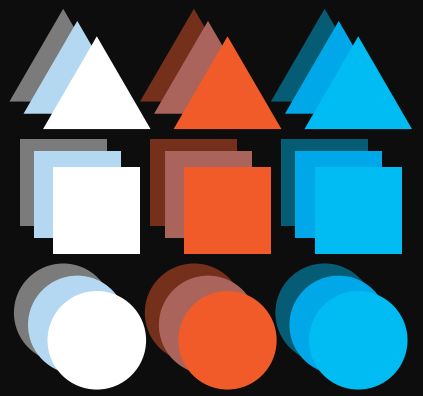
Issue : Blind users don't know where the barcode is

Live	Guide user in finding a barcode with audio cues
With Server	Decode barcode to identify product
Tech	MPSCNN running on coreML + barcode library
Metrics	40 FPS (~25 ms) on iPhone 7



Bespoke AI

Building your own AI models for Transforming Data into Intelligence



Prepare Data

Build & Train

Deploy

Building and Train your own AI models

Azure Machine Learning

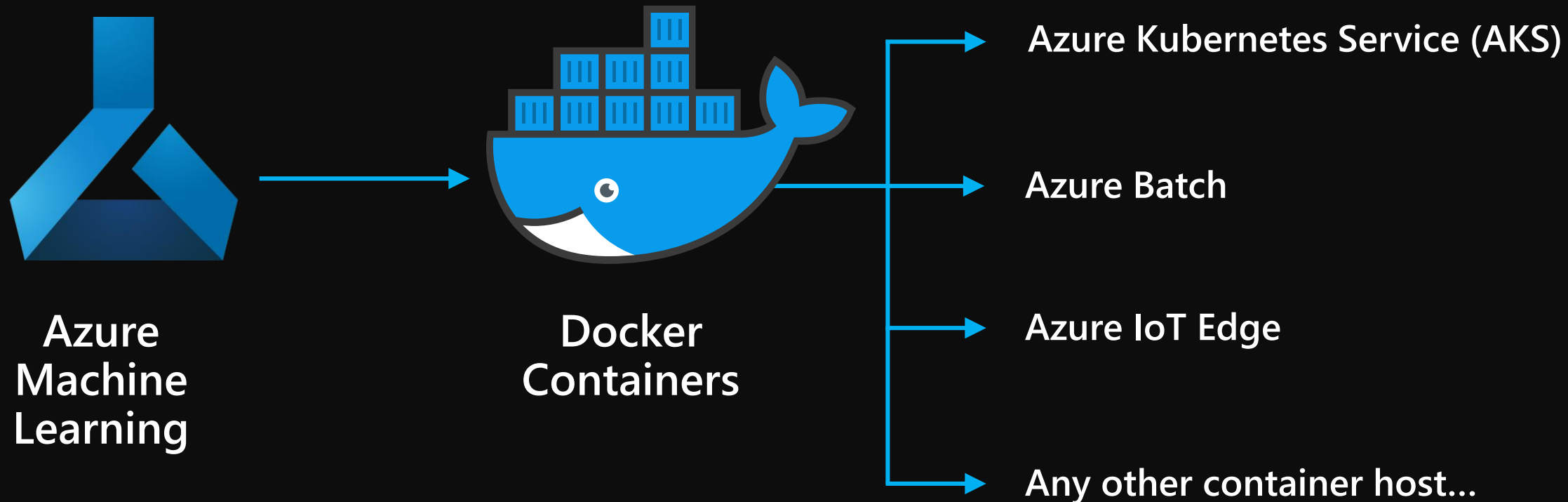
Broad frameworks and tools support:
→ TensorFlow, Cognitive Toolkit, Caffe2, Keras, MxNET, PyTorch

Scale training from 1 → 100,000's of servers

Azure ML Python SDK

Azure ML packages:
→ Computer Vision, Text, Forecasting

Deploying your own AI models



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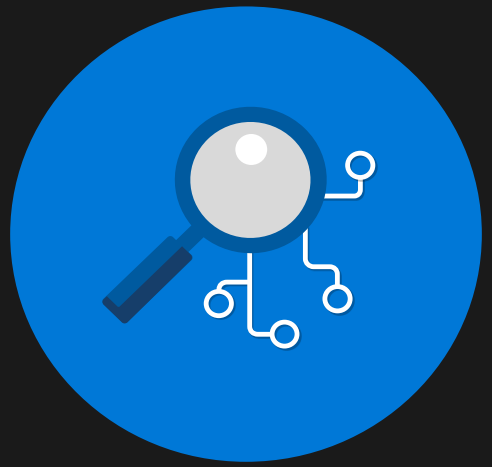

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Announcing AI for Humanitarian Action

AI for Humanitarian Action leverages AI to support disaster recovery, address the needs of children, protect displaced people, and promote human rights.

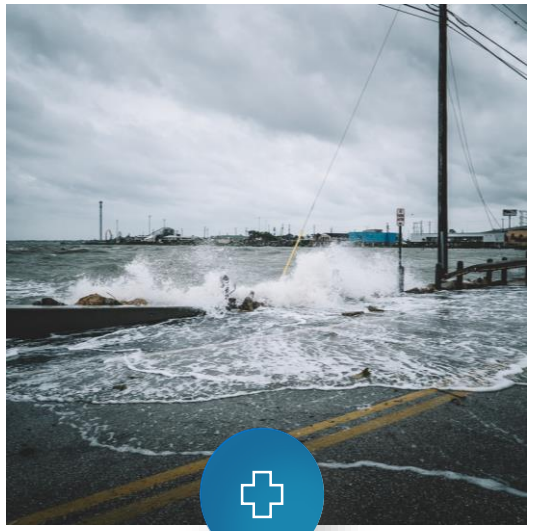
▷ Watch AI in action

AI for Humanitarian Action

Disaster relief

Improve resiliency, response, and recovery programs designed for those affected by humanitarian emergencies.

- Forecast and detect early signs of coming disasters,
- Help responders better target their aid, and
- Engage beneficiaries at time of crisis.



Needs of children

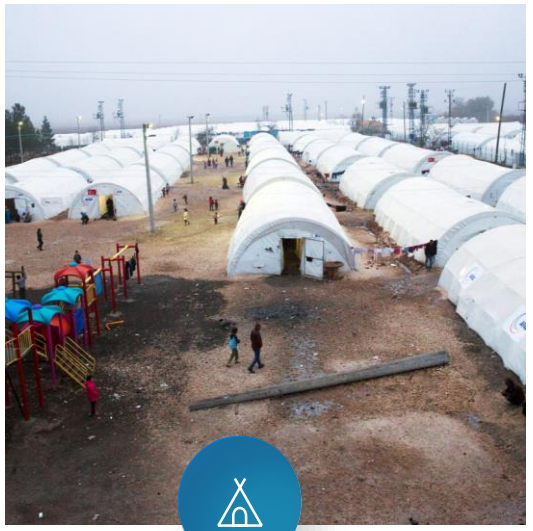
Equip organizations to ensure the safety and wellbeing of children around the world.

- Identification and support services
- Provision of basic health and nutritional services
- Enhancement of educational opportunities

Protecting refugees & displaced people

Optimize the delivery of aid, supplies and services to refugees and displaced persons as well as scale an organization's ability to communicate and understand needs.

- Livelihoods support
- Family reunification
- Monitoring and detection of needs

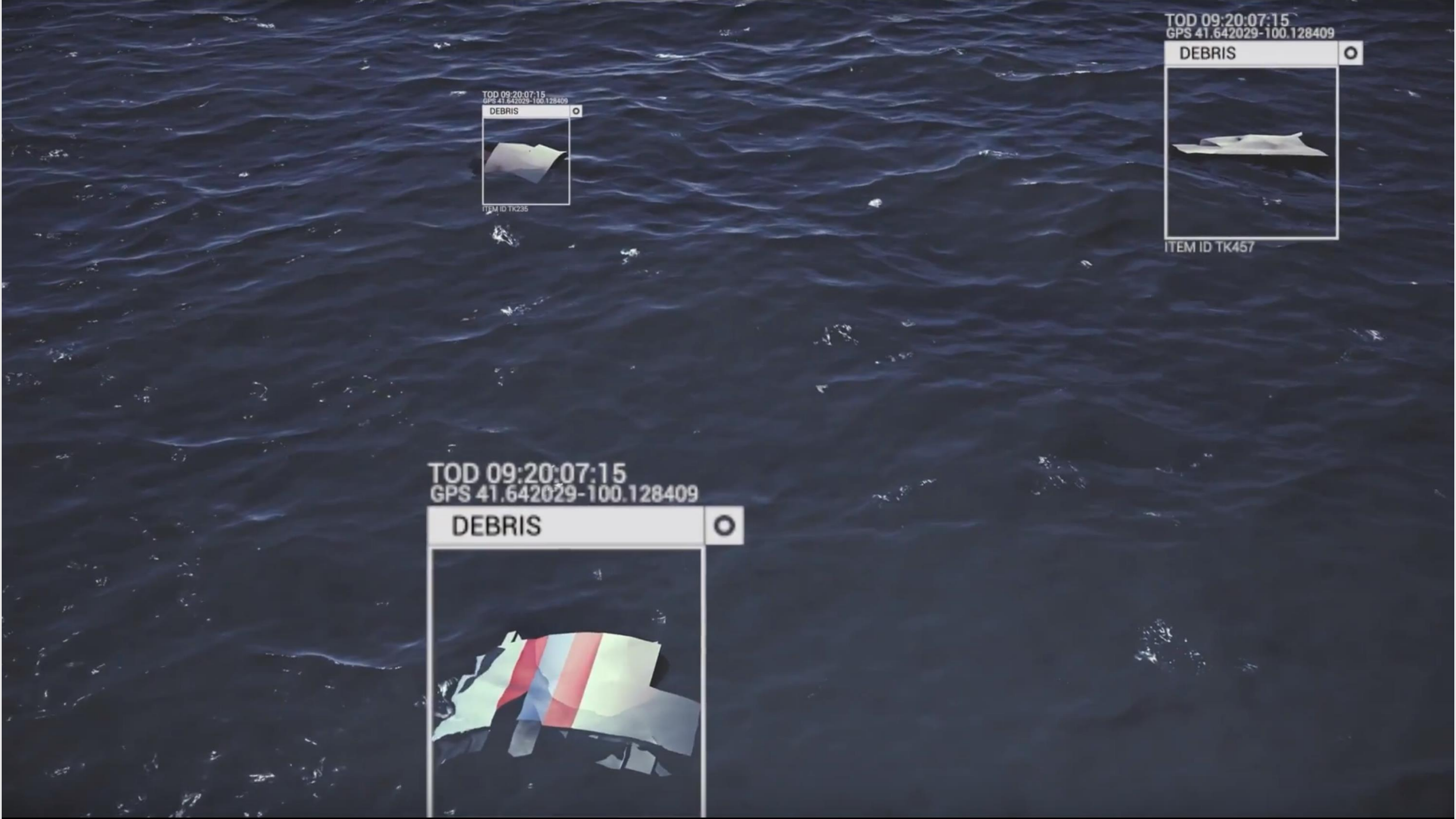


Promoting respect for human rights

Accelerate breakthrough solutions to help monitor, detect and prevent human rights abuses.

- Human trafficking
- War crimes identification
- Right to fair trial

Disaster Search and Rescue: AirSim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DEBRIS
ITEM ID TK235
TOD 09:20:07:15
GPS 41.642029-100.128409
DEBRIS
ITEM ID TK457
TOD 09:20:07:15
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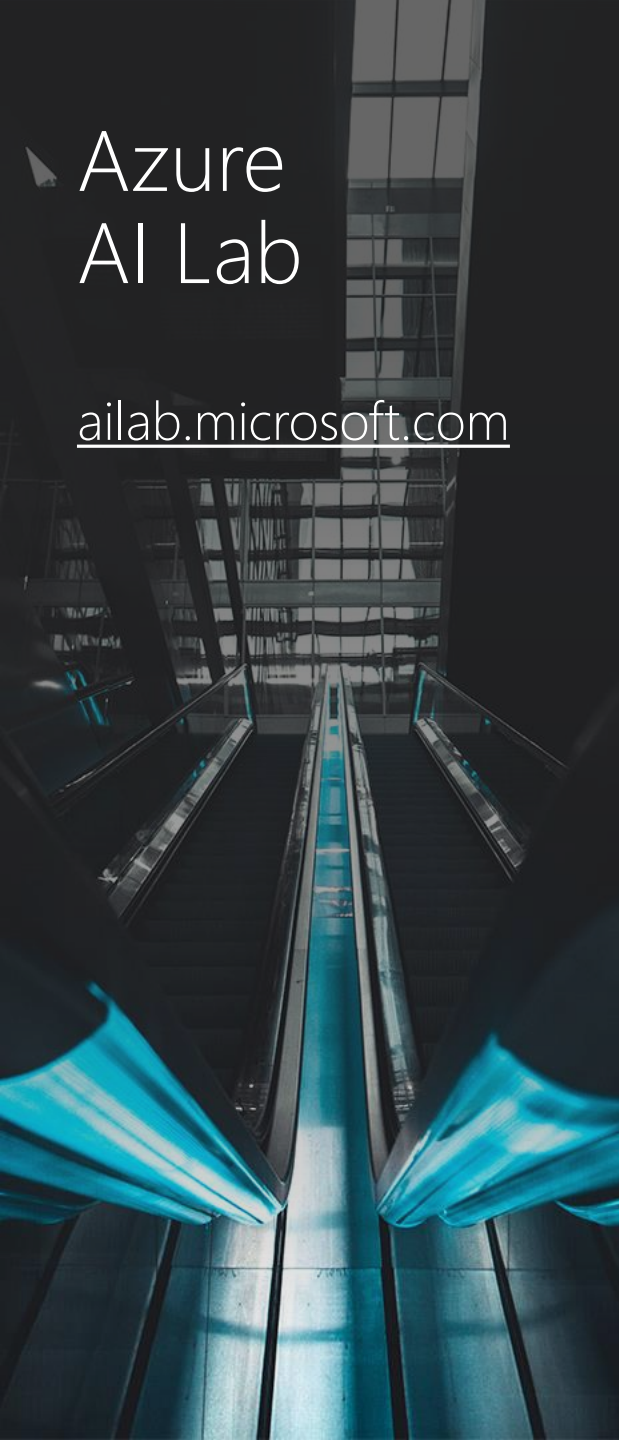
DEBRIS


GAULOISES



Azure
AI Lab

ailab.microsoft.com

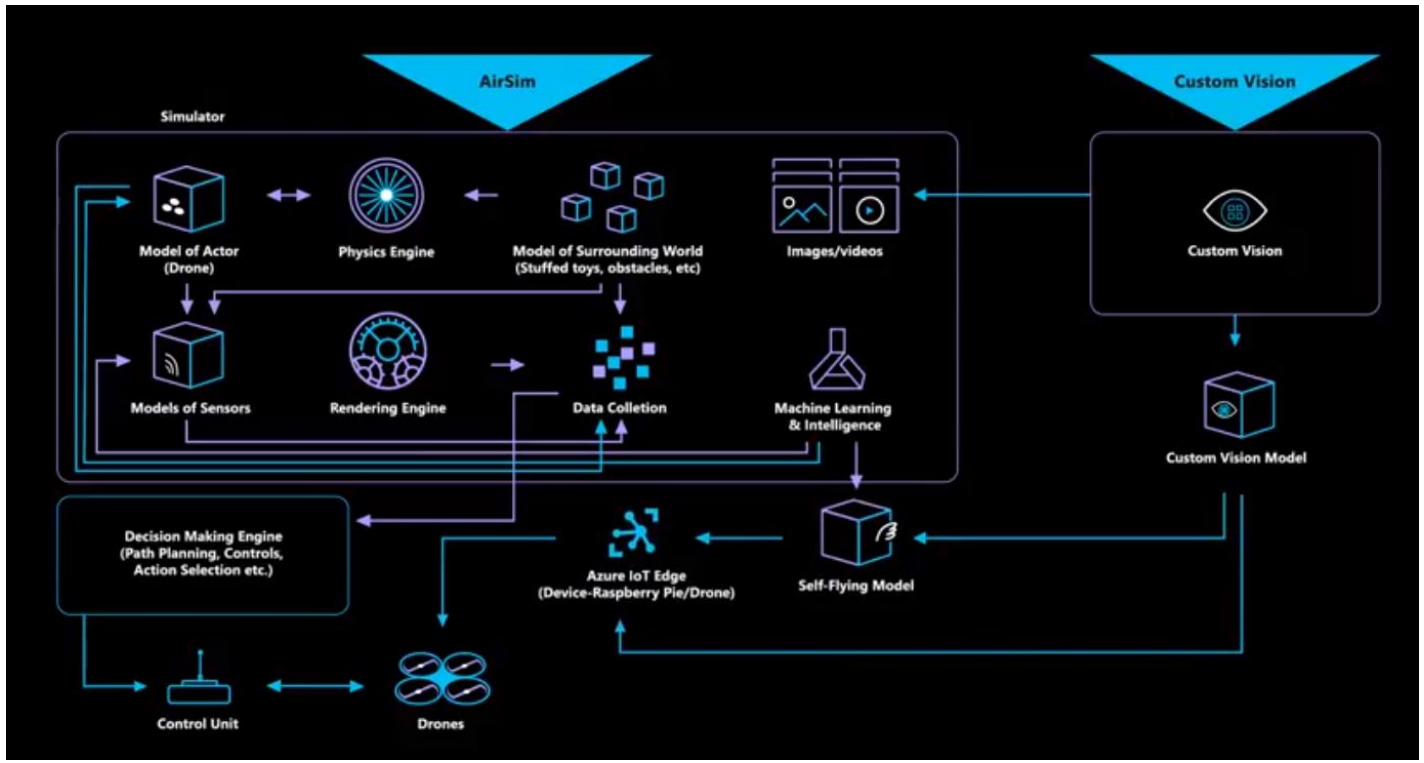
Drones: Search and Rescue training with AirSim

Goal: train AI-powered drones to recognize targets for search-and-rescue.

Train recognizer using real objects in controlled environment with Custom Vision.

Simulate training data for drone control with AirSim (simulator based on Unreal).

https://github.com/Microsoft/AirSim



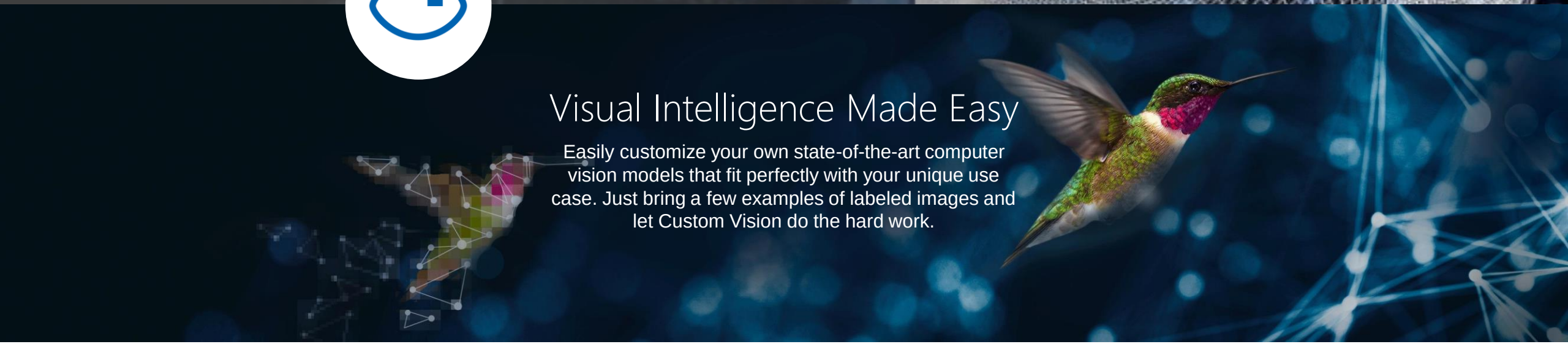
Microsoft

Transfer Learning

customvision.ai

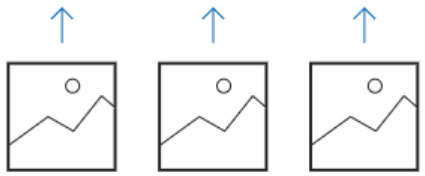
Microsoft Cognitive Services

Custom Vision



Visual Intelligence Made Easy

Easily customize your own state-of-the-art computer vision models that fit perfectly with your unique use case. Just bring a few examples of labeled images and let Custom Vision do the hard work.

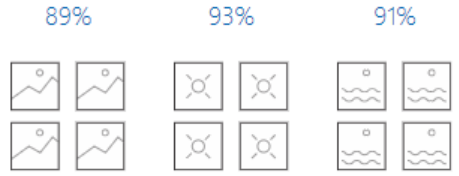


Upload Images

Bring your own labeled images, or use Custom Vision to quickly add tags to any unlabeled images.

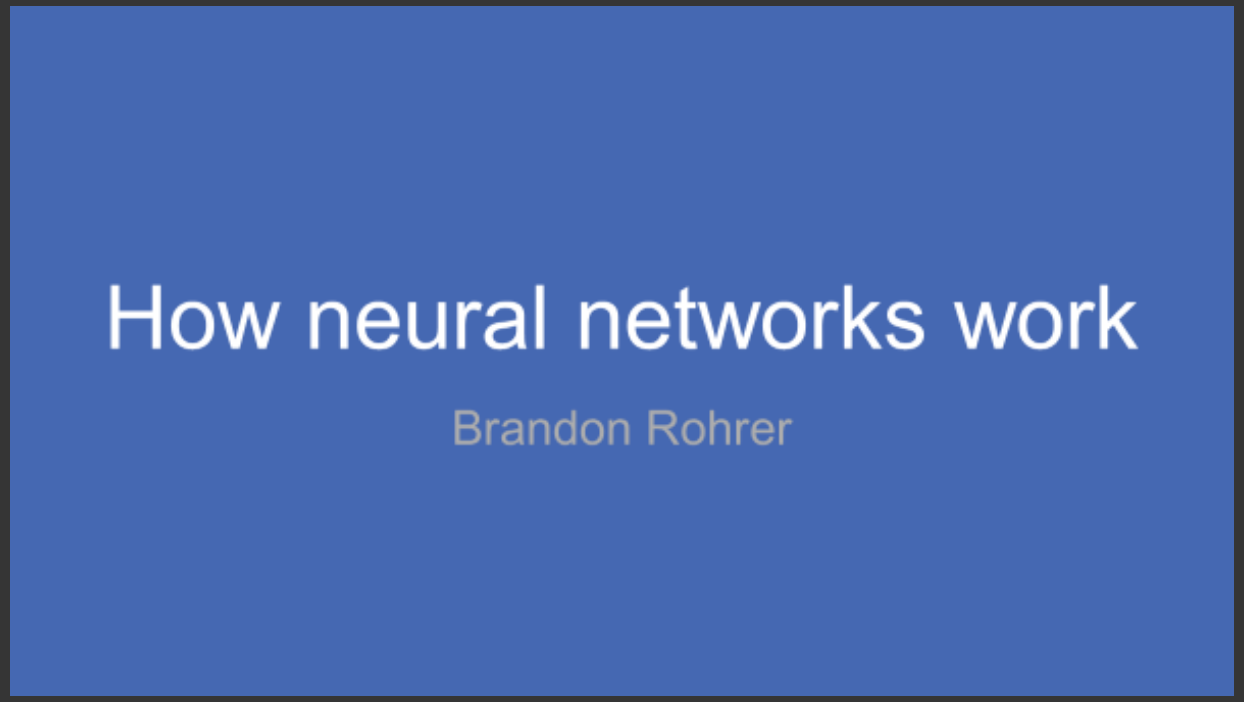
Train

Use your labeled images to teach Custom Vision the concepts you care about.



Evaluate

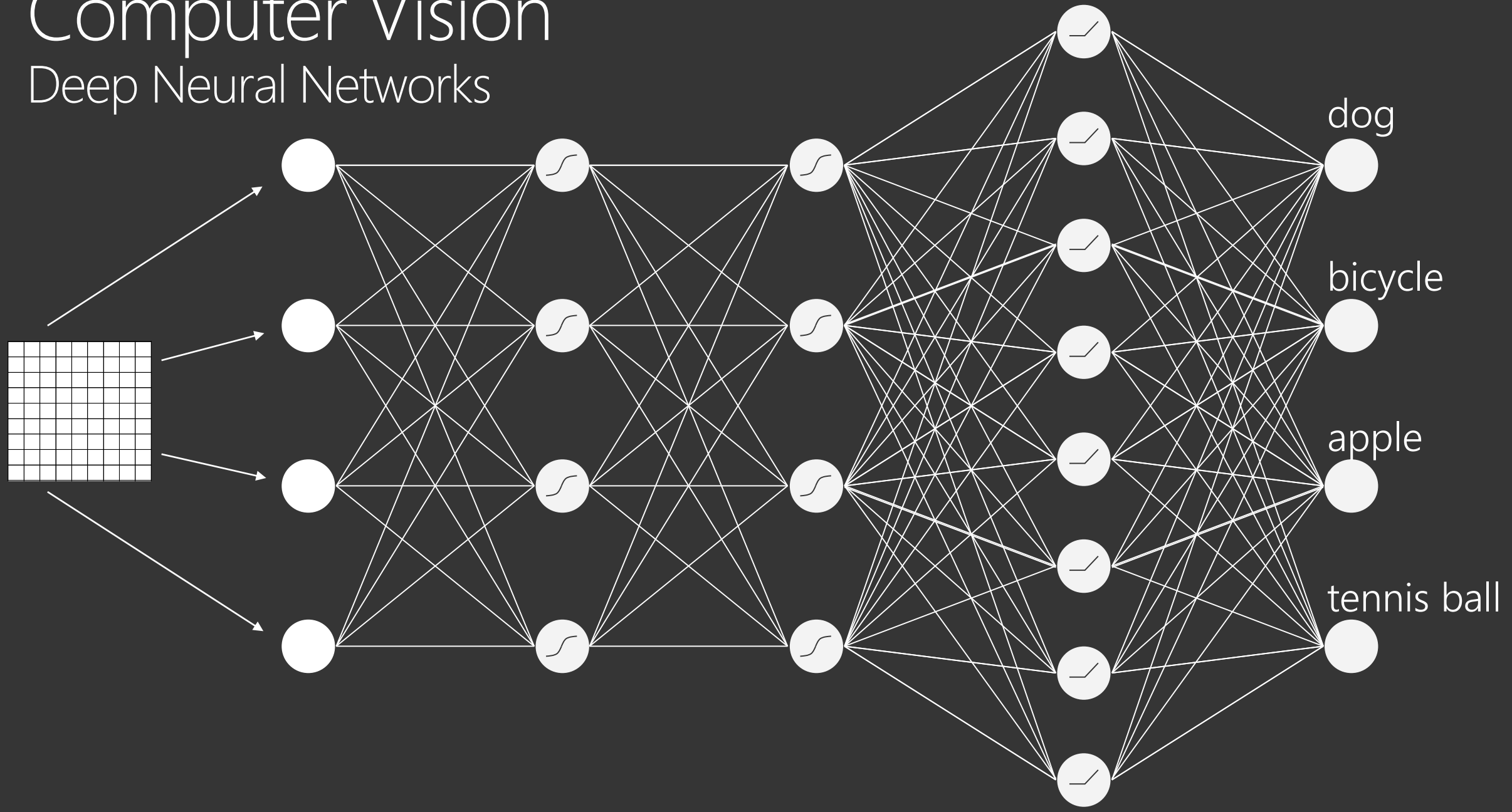
Use simple REST API calls to quickly tag images with your new custom computer vision model.



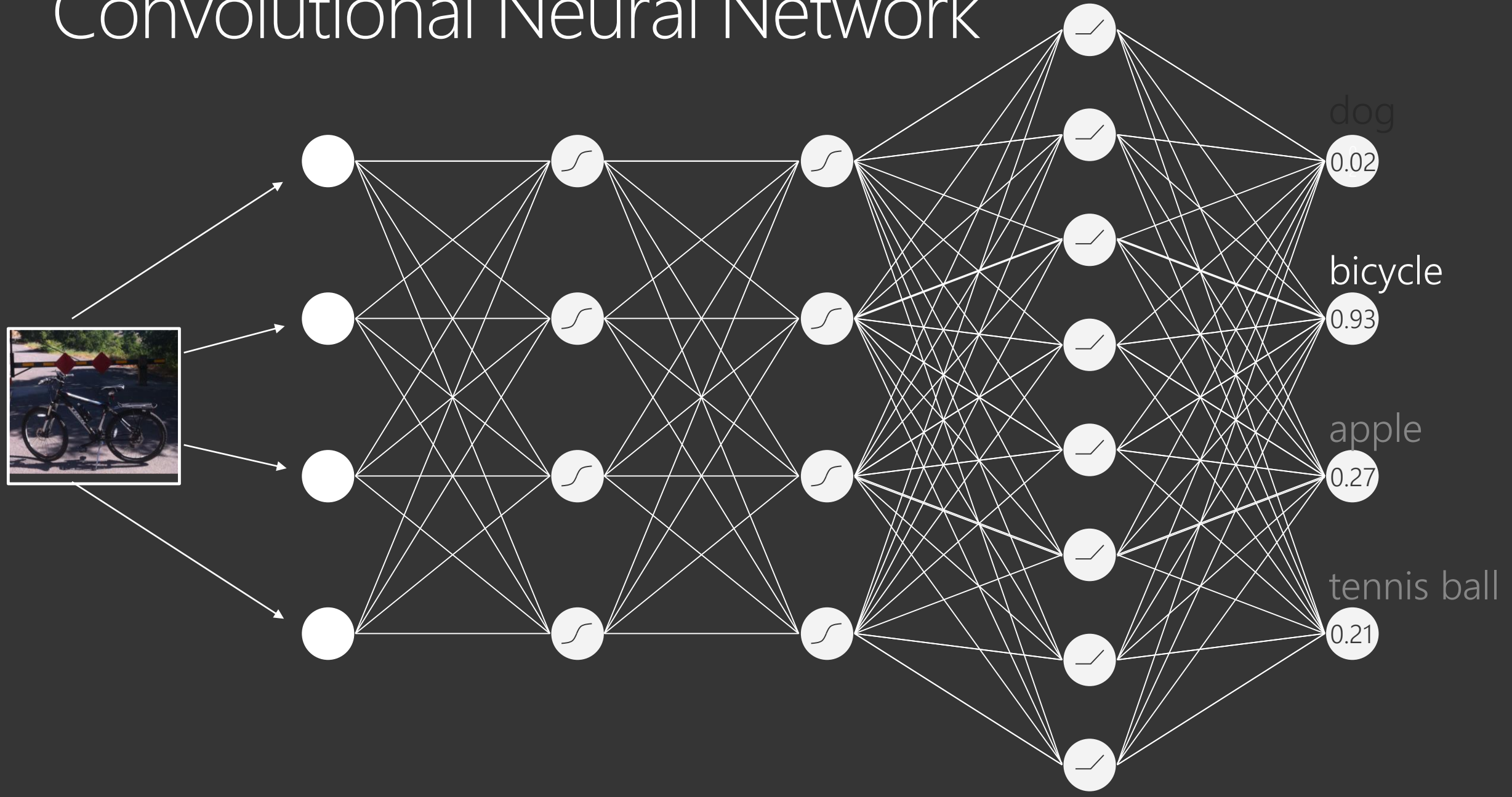
brohrer.github.io/blog.html

Computer Vision

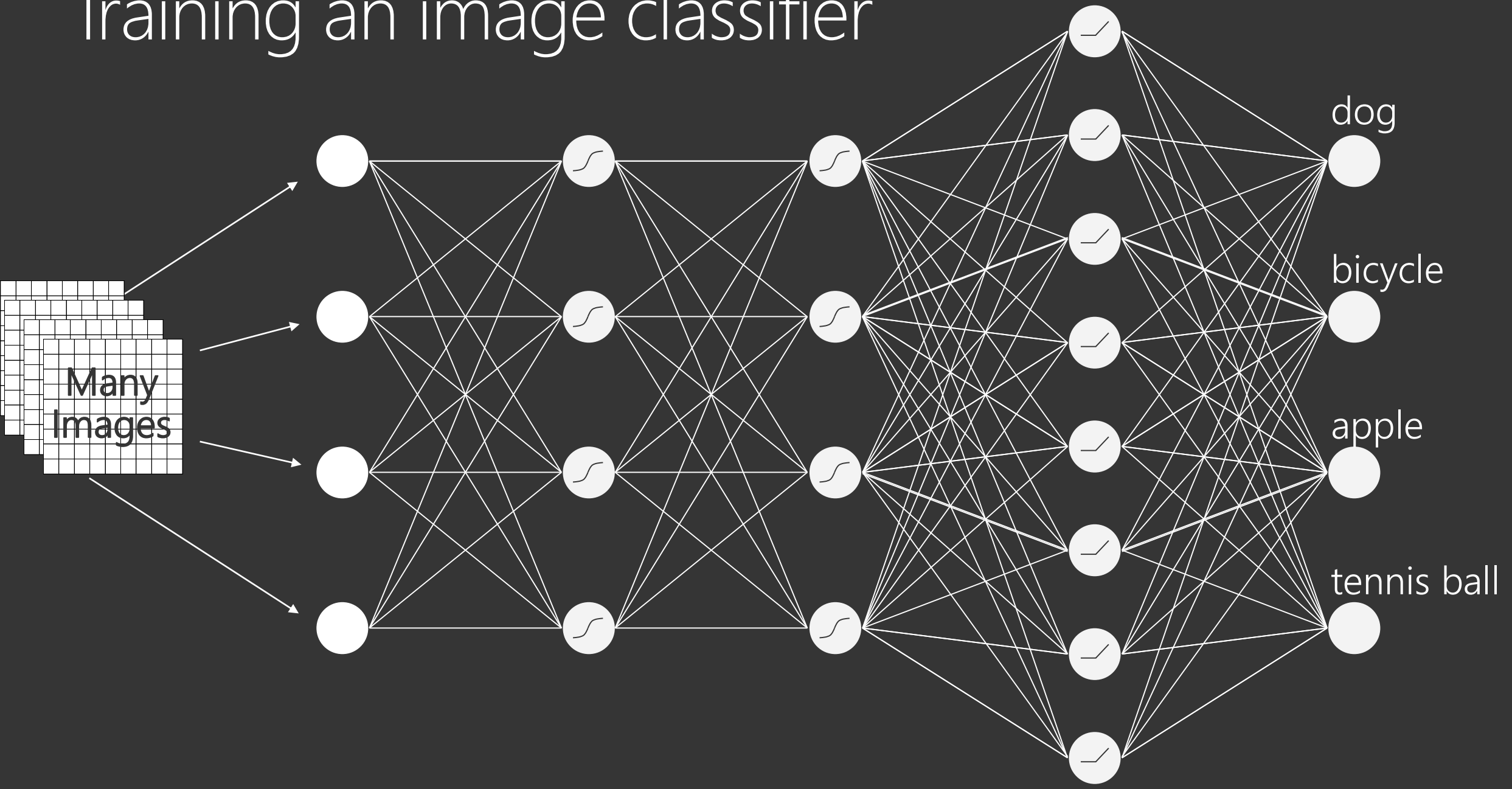
Deep Neural Networks



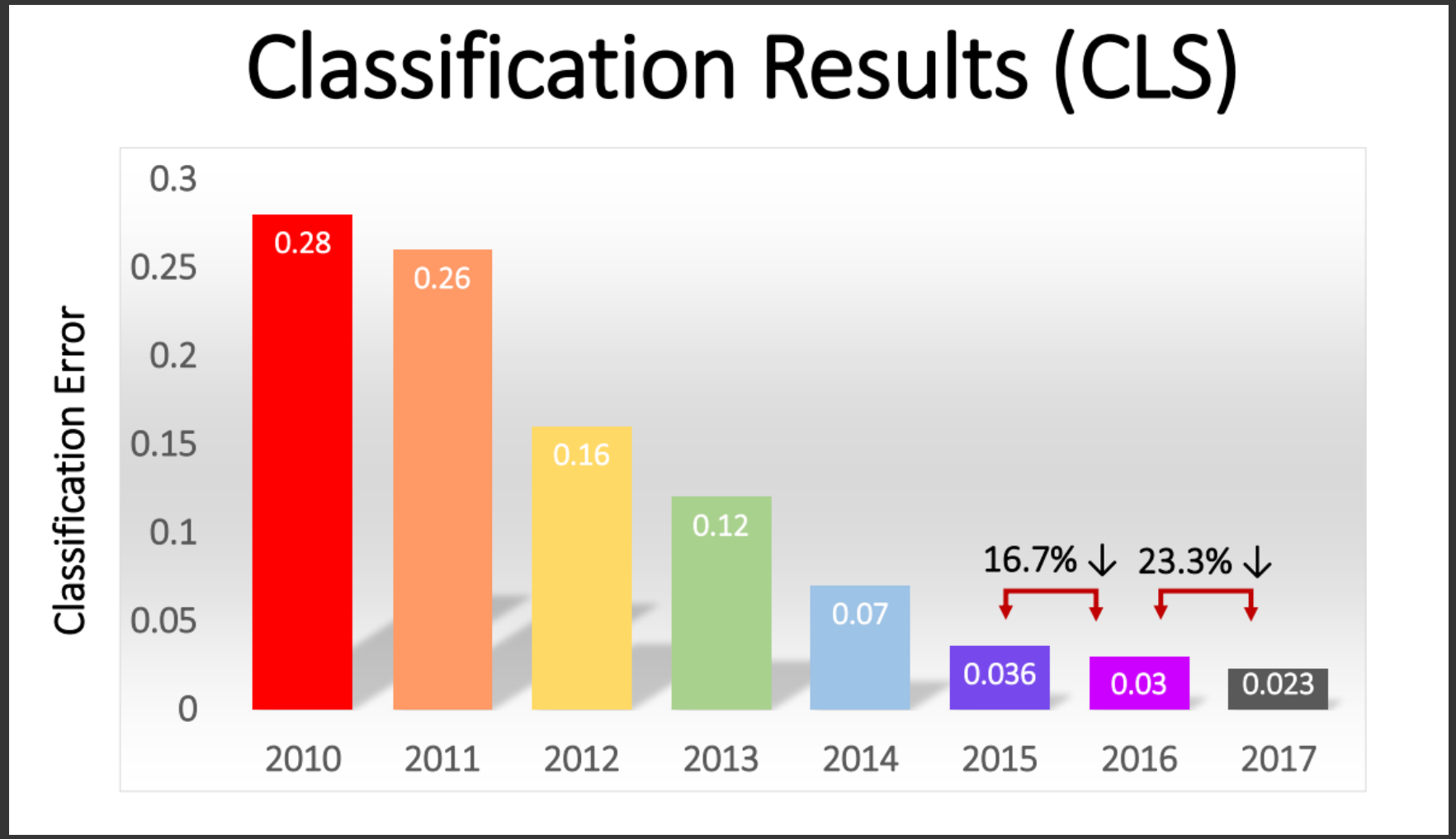
Convolutional Neural Network



Training an image classifier

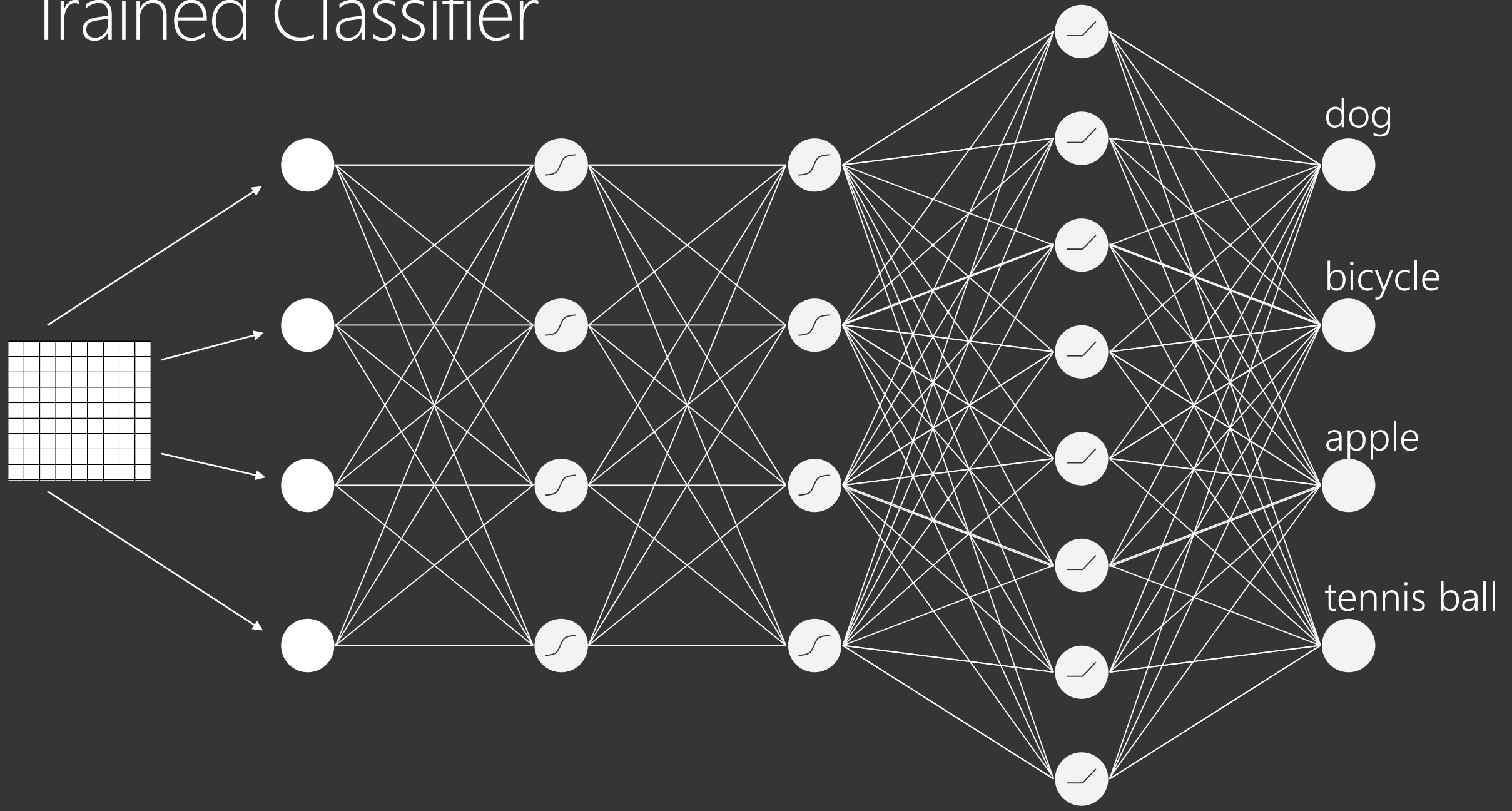


ImageNet Challenge Winners

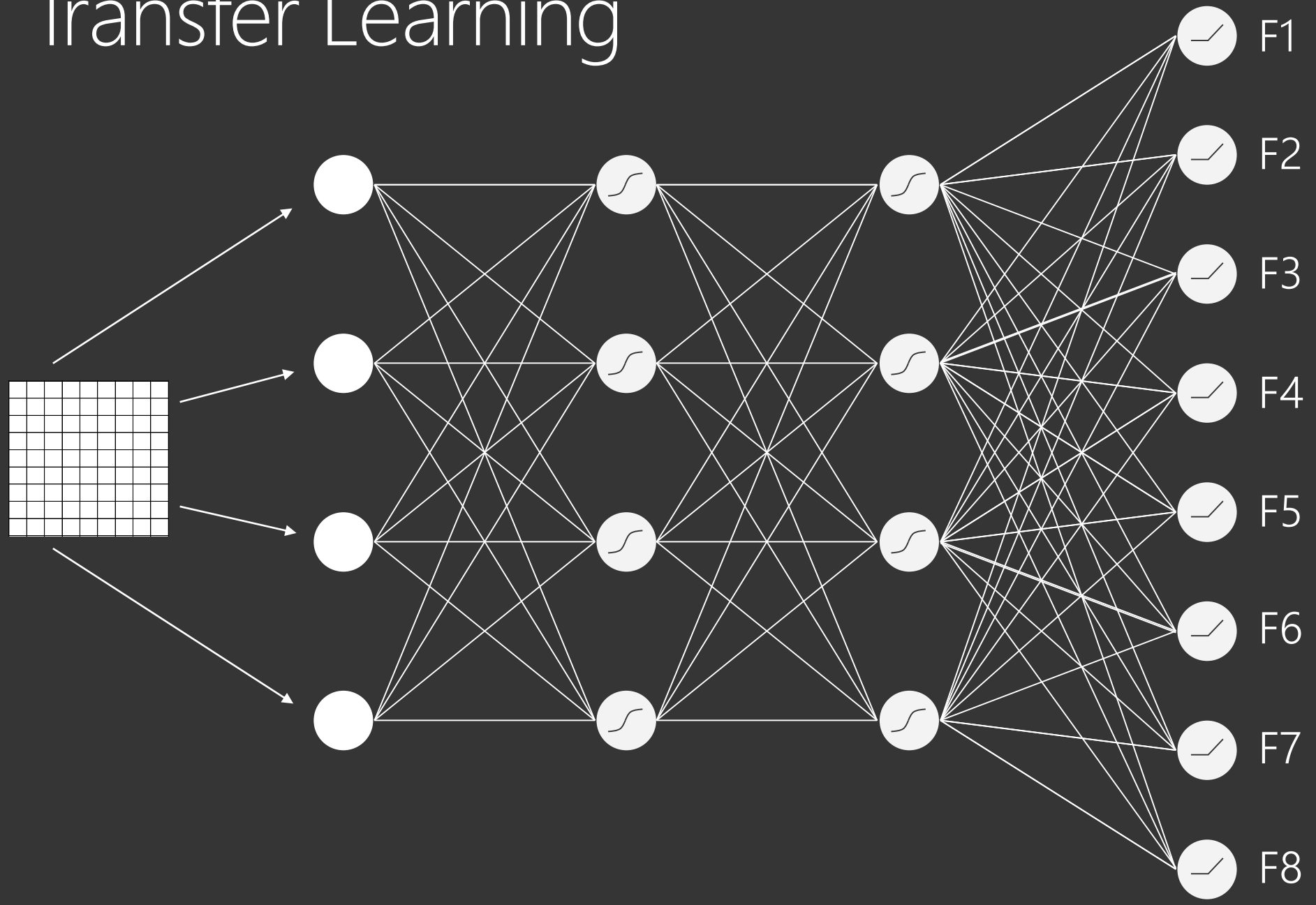


Park et al, ILSVRC 2017

Trained Classifier



Transfer Learning



Transfer Learning

customvision.ai

F1

F2

F3

F4

F5

F6

F7

F8

wave

0

wreckage

1

Transfer Learning

customvision.ai

F1

F2

F3

F4

F5

F6

F7

F8

wave

0.10

wreckage

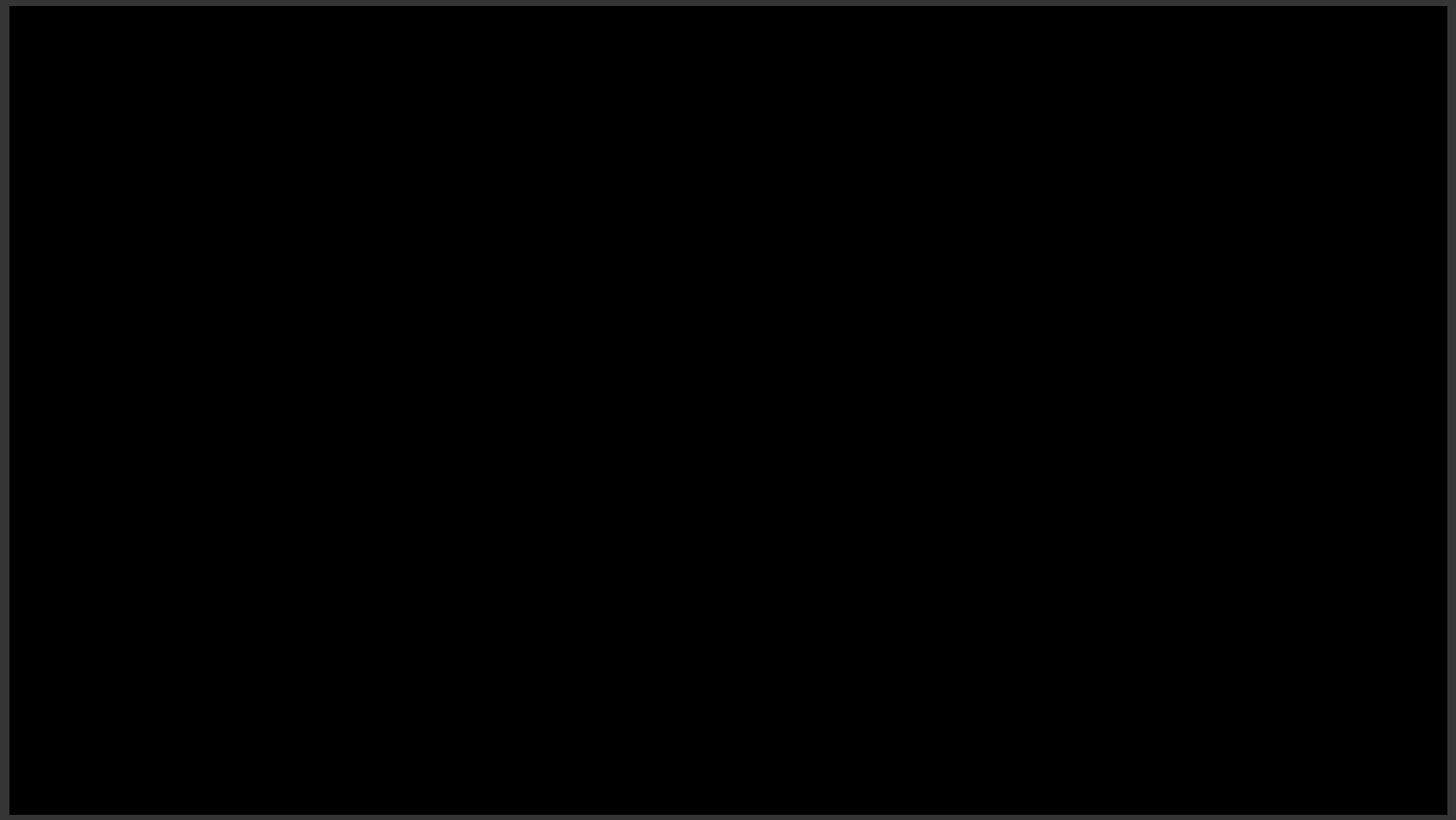
0.87

“Not Hotdog” custom image recognizer

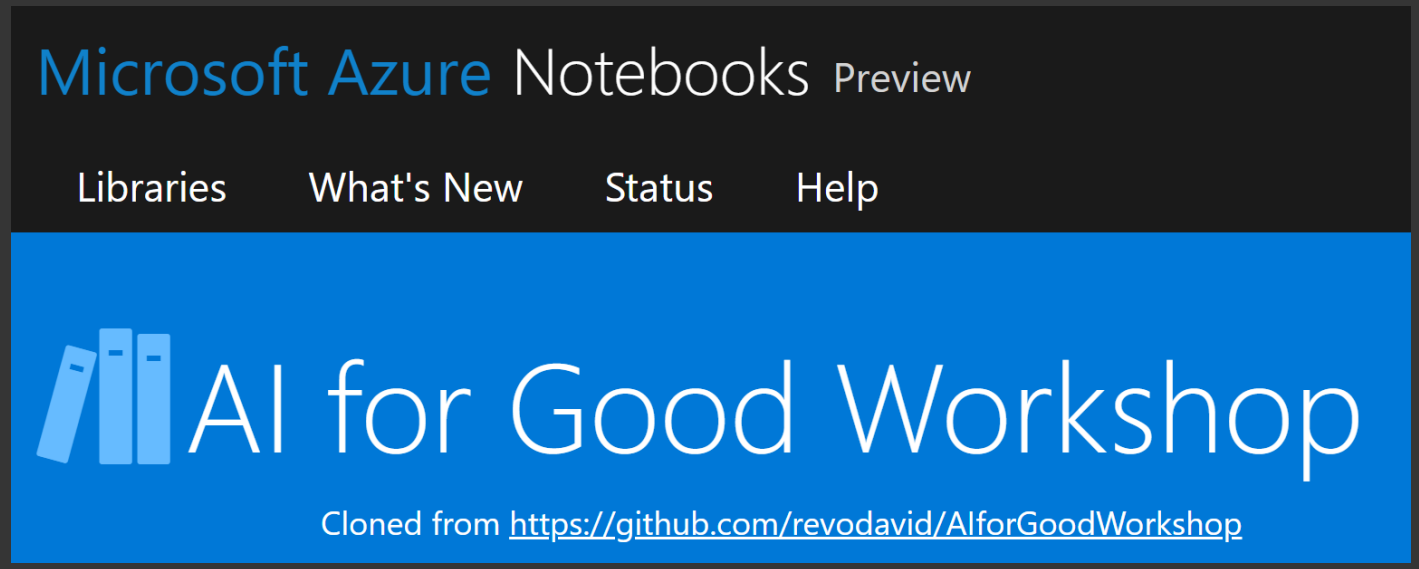
- Collect images of hotdogs
  - ImageNet
- Train image recognizer
  - Transfer learning
- Classify new images
  - Shiny app

“Hotdog”

“Not Hotdog”



Silicon Valley Season 4, Episode 4. © HBO



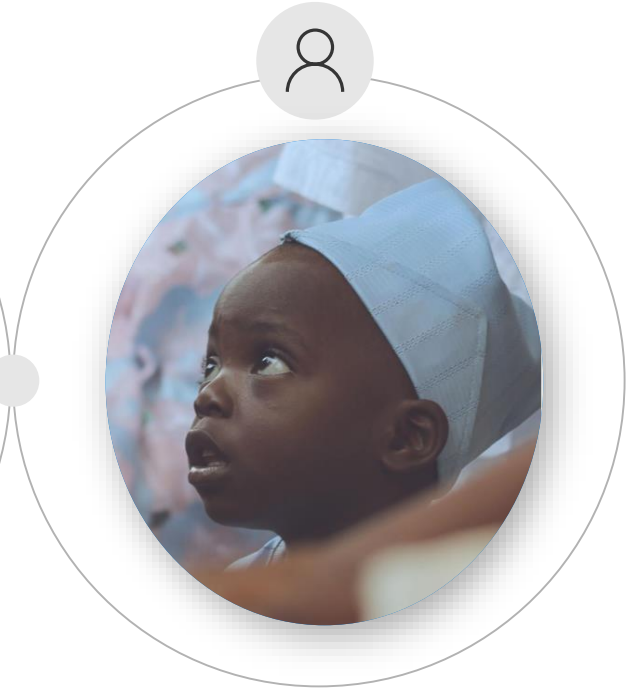
notebooks.azure.com/davidsmi/libraries/aiforgood

3. Custom Vision with R.ipynb

AI for Good

AI for Earth

AI for Accessibility



AI for
Humanitarian Action

www.microsoft.com/en-us/ai/ai-for-good

Microsoft

Thank you

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