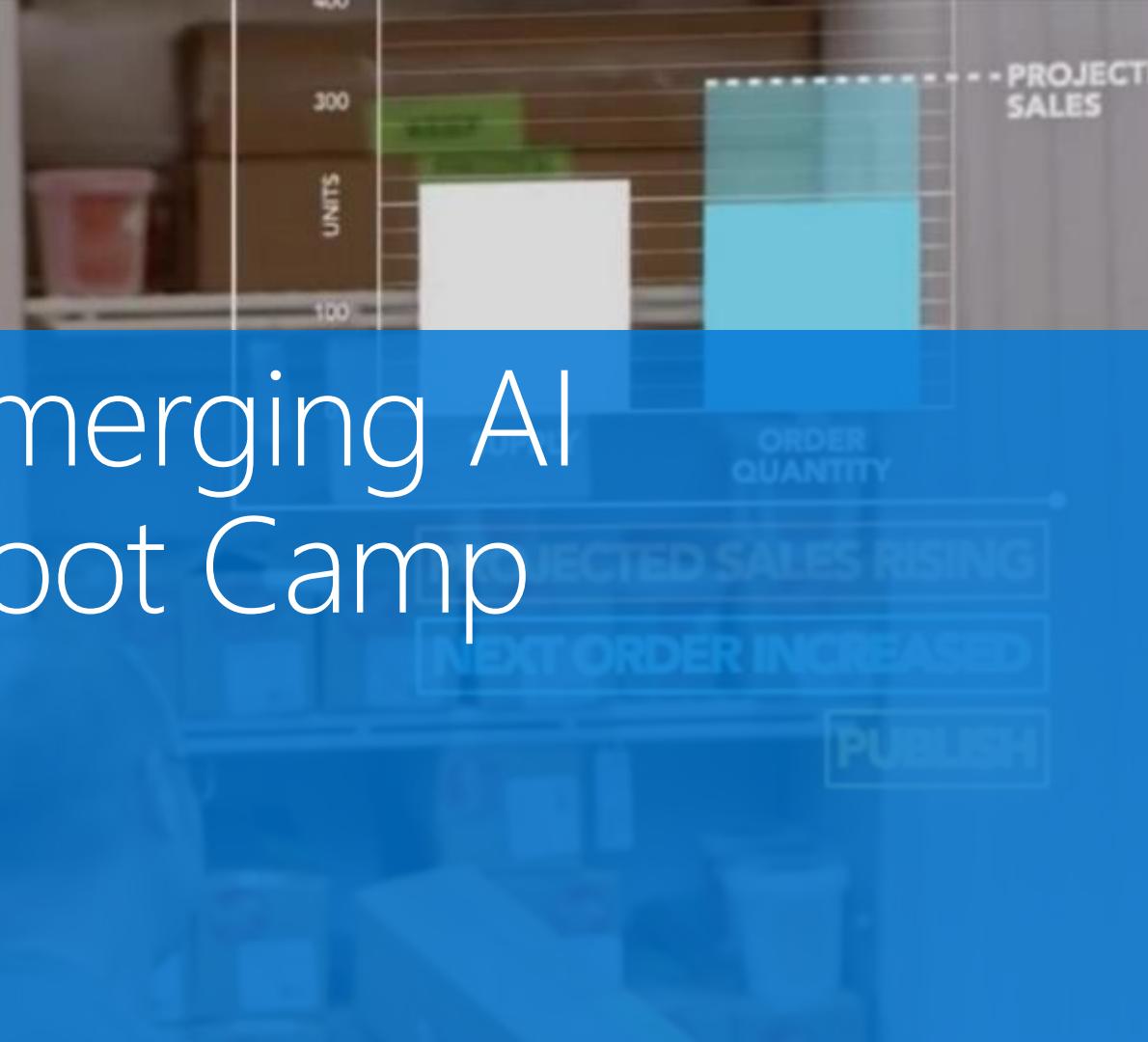


Emerging AI Boot Camp

Srikanth

Srinagar



Data & Artificial Intelligence

Looking for creating value for your **BUSINESS** that lies at the intersection of **HUMANS** and **INTELLIGENT MACHINES**?

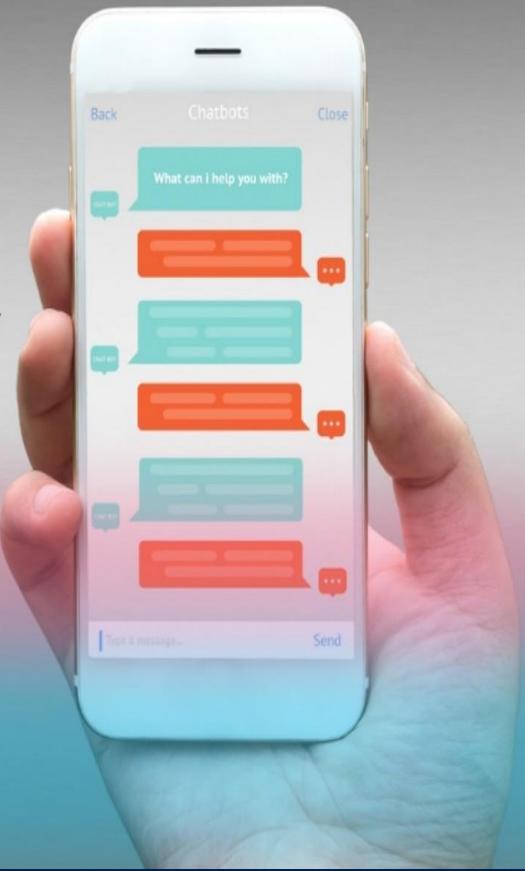
INTERNET OF THINGS

Not just **CUSTOMERS** but every " **THING** " around you is talking.
IOT enables innumerable applications ranging from the micro to macro and from the trivial to critical.



CHATBOTS

Bye-bye **E-Commerce!**
Welcome Conversational Commerce-A new ecosystem for Artificial Intelligence



A **Boutique Company** that provides Training and Consulting services on **Data + AI + IoT Workloads**



JUMP START NINJA
THE GROWTH HACKER FOR YOUR BUSINESS

Conversational Commerce - Practice Head

Known as "Bot Star" in Startup Ecosystem @ Chennai – Champion in building bot for brands in Retail, Government, Legal, Customer Care and Education. Training & Education the world in this nascent field of Conversational Commerce thro – Workshops, Seminars, Blogs and Consulting Engagements

Certified from MIT on “Data Science and Big Data Analytics: Making Data-Driven Decisions”

Awards

Microsoft Award Winner for his Contribution made to Dot Net User Group
<http://www.thehindubusinessline.com/2003/06/19/stories/2003061902141700.htm>

Microsoft Community Star

Role

Currently working as Chat Bot & Conversational Commerce Practice Head - Helping customers in building their brands using messaging apps in various industry groups.



Experience

18 years of experience on Microsoft Tech Stack. 8 Years of Experience with Architecting / Designing Enterprise solutions using Microsoft Tech stack. Very early adopter of Azure and Bot Framework + related components

Training

Expert **facilitator and corporate trainer** with 5 years of experience in designing programs, content development , Chat bot, Cognitive Services, Data Analytics and Machine Learning & AI .



JUMP START NINJA
THE GROWTH HACKER FOR YOUR BUSINESS

About Me

Advanced Analytics Specialist.

Certified from MIT on 'Advanced Analytics and Big Data Challenges'. Technology Enthusiast and Data Specialist.

Certifications

- Microsoft Certified Power BI Developer.
- Microsoft Certified Azure Machine Learning Developer from Microsoft Virtual Academy
- Certified on Practical Data Analytics with Microsoft Cortana Intelligence Suite.

Role

Currently working as Azure Data Specialist and Enterprise Trainer on Azure Data Analytics , Cortana Intelligence Suite and Cognitive Sciences



Sri Nag Sashank

Experience

7.5 years of total experience as Data Specialist and Data Engineer.

Training

Expert **facilitator and corporate behavioral trainer** with 5 years of experience in designing programs, content development , Data Analytics and Machine Learning.

- Hosted many webinars and corporate workshops on Azure Data Analytics & Machine Learning.



Agenda

- Hands on Oriented session on
 - Azure Cognitive Services
 - Azure Search
 - Azure Bot Service

Goals

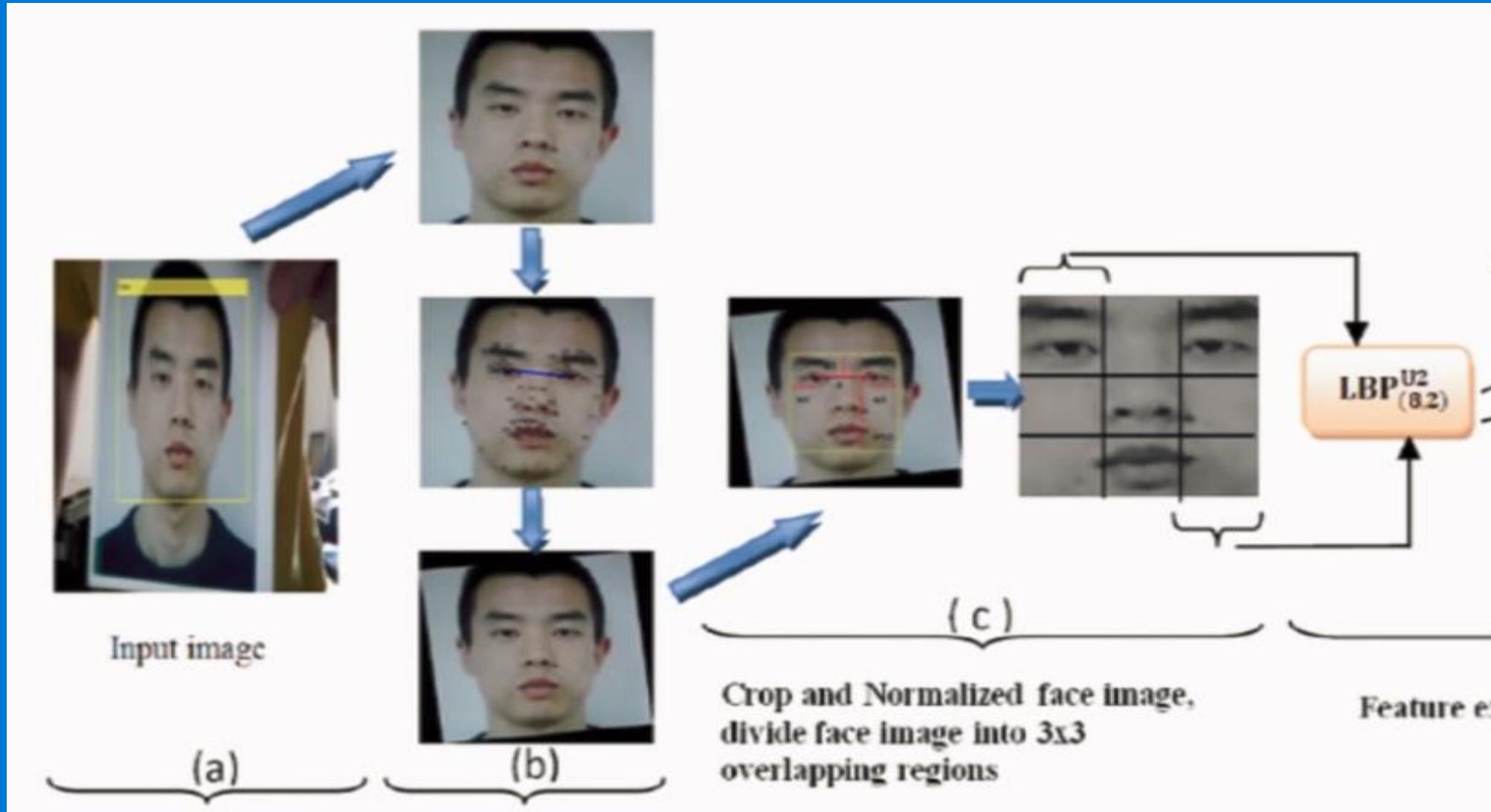
- Understand how to configure your apps to call Cognitive Services
- Build an application that calls various Cognitive Services APIs (specifically Computer Vision)
- Understand how to implement Azure Search features to provide a positive search experience inside applications
- Configure an Azure Search service to extend your data to enable full-text, language-aware search
- Build, train, and publish a LUIS model to help your bot communicate effectively
- Build an intelligent bot using Microsoft Bot Framework that leverages LUIS and Azure Search
- Effectively log chat conversations in your bot
- Perform rapid development/testing with Ngrok and test your bots with unit tests and direct bot communication
- Effectively leverage the custom vision service to create image classification services that can then be leveraged by an application

Image Analytics Before Azure:

Using Complex CNN Algorithms

Object Detection History

The first efficient Face Detector (Viola-Jones Algorithm, 2001)



Much more efficient detection technique
(Histograms of Oriented Gradients, 2005)

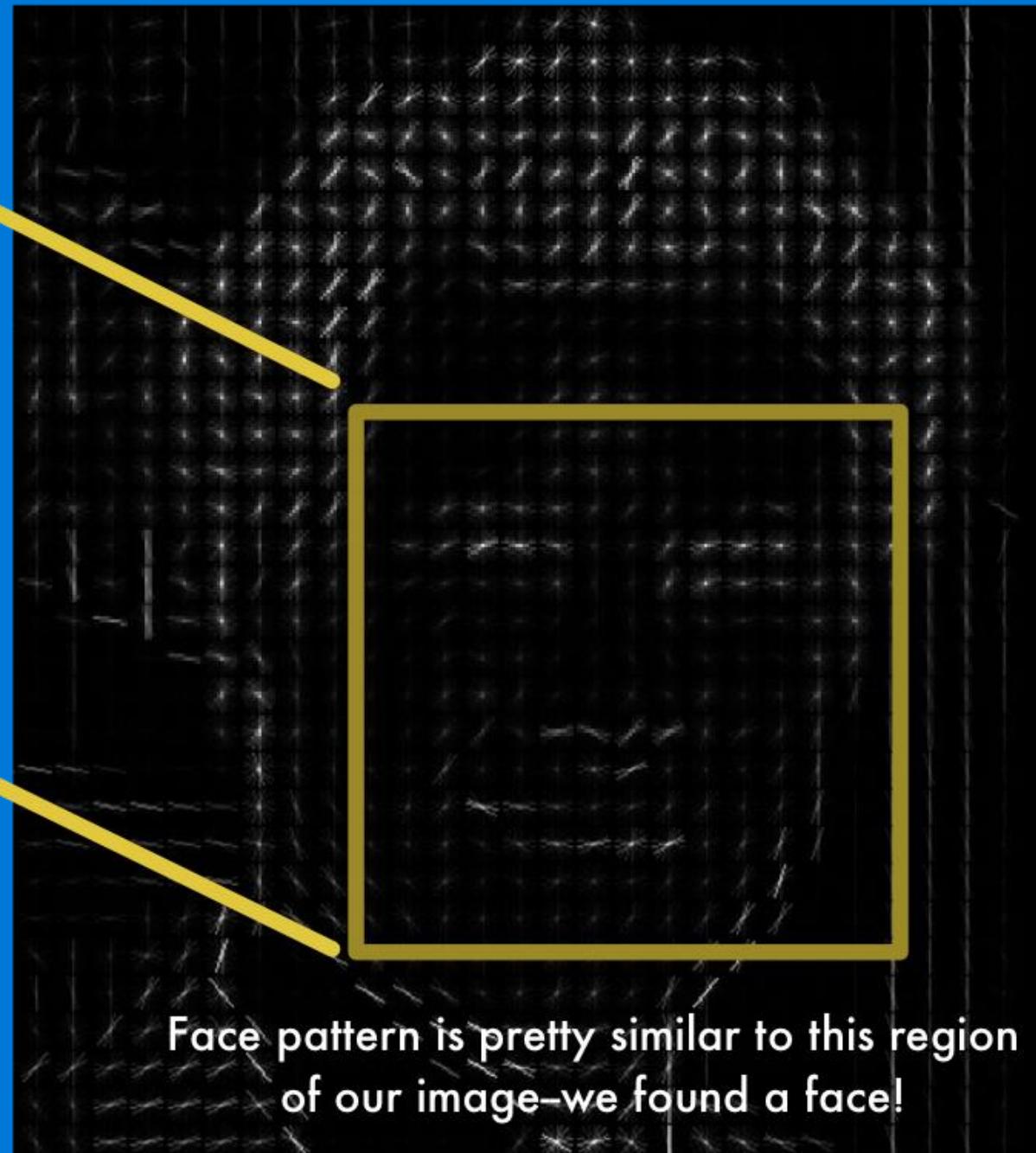
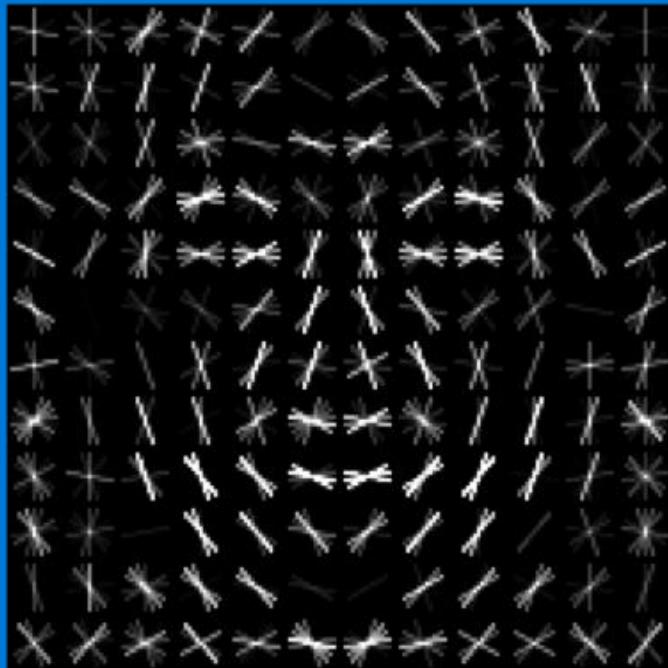






HOG version of our image

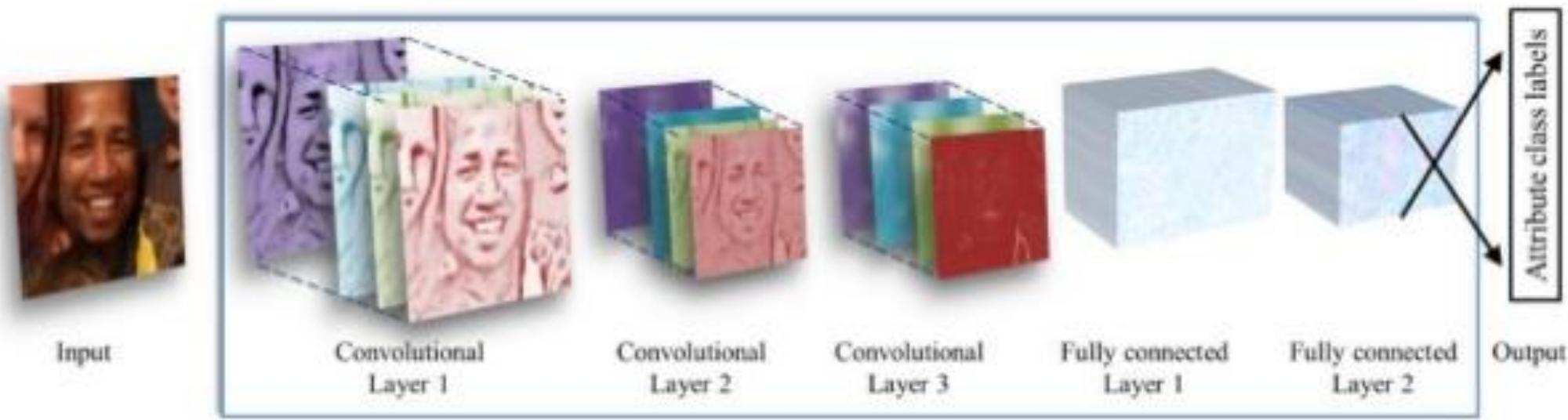
HOG face pattern generated
from lots of face images



Face pattern is pretty similar to this region
of our image—we found a face!

The Deep Learning Era begins (2012)

Network Architecture



All 3 RGB channels
First, resized to 256×256 , then cropped to 227×227

96 filters size $3 \times 7 \times 7$
256 filters size $96 \times 5 \times 5$
384 filters size $256 \times 3 \times 3$
Each convolutional layer is followed by rectified linear operator (ReLU), max pooling layer of 3×3 regions with 2-pixel strides and a local normalization layer

Both fully connected layers contain 512 neurons followed by ReLU and dropout layer

Output to class labels (age / gender)

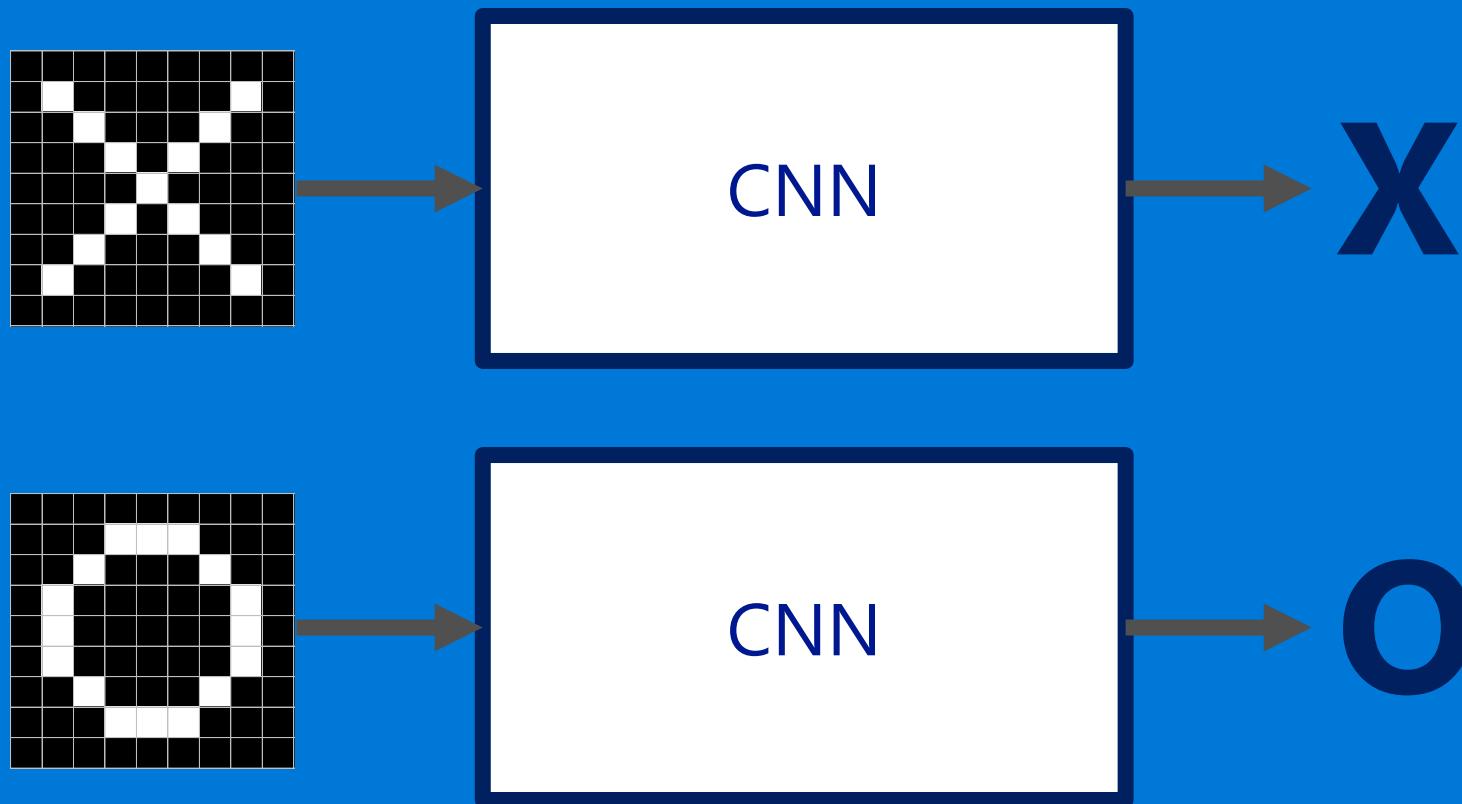
A toy ConvNet: X's and O's

- Says whether a picture is of an X or an O

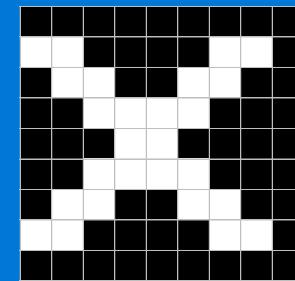
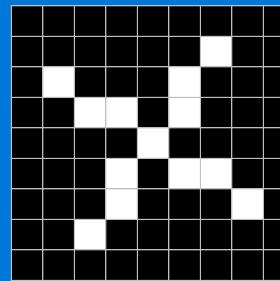
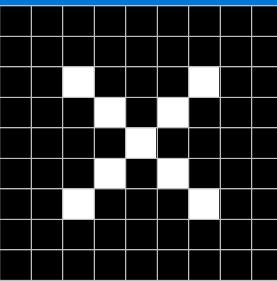
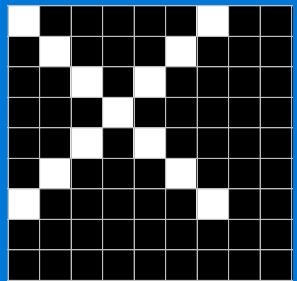
A two-dimensional
array of pixels



For example



Trickier cases

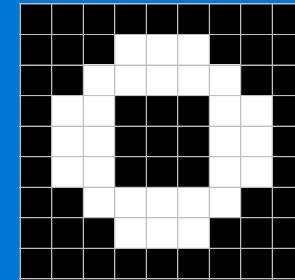
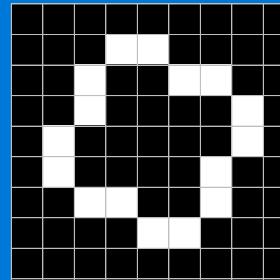
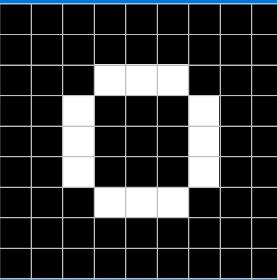
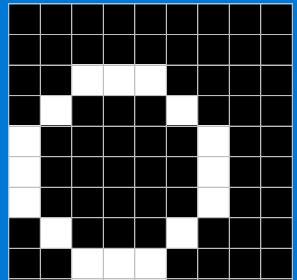


translation

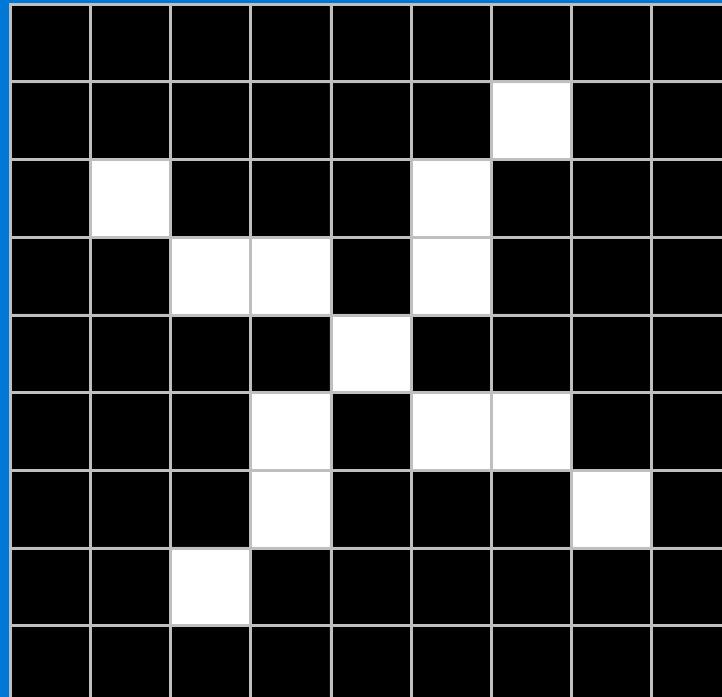
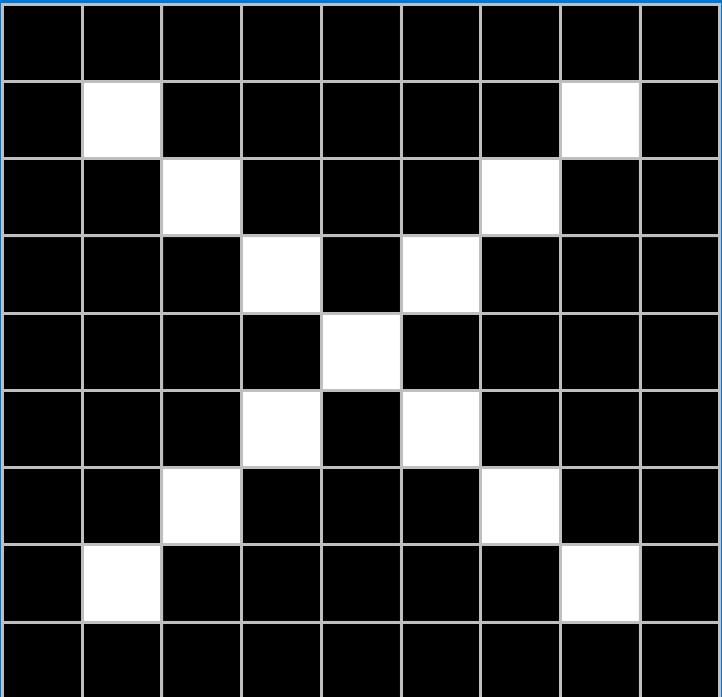
scaling

rotation

weight



Deciding is hard



What computers see

[View Details](#)

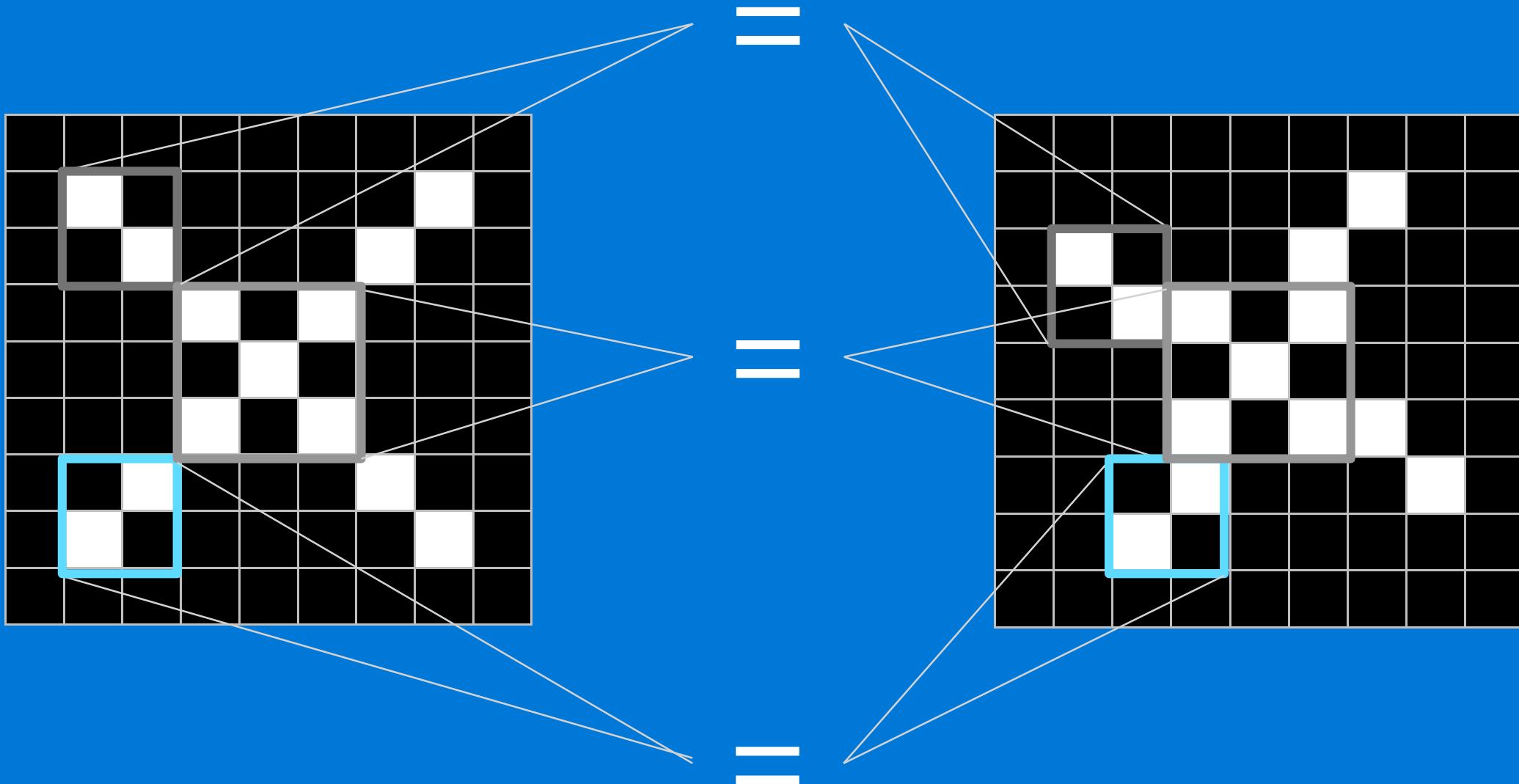
[View Details](#)

What computers see

Computers are literal



ConvNets match pieces of the image



Features match pieces of the image

1	-1	-1
-1	1	-1
-1	-1	1

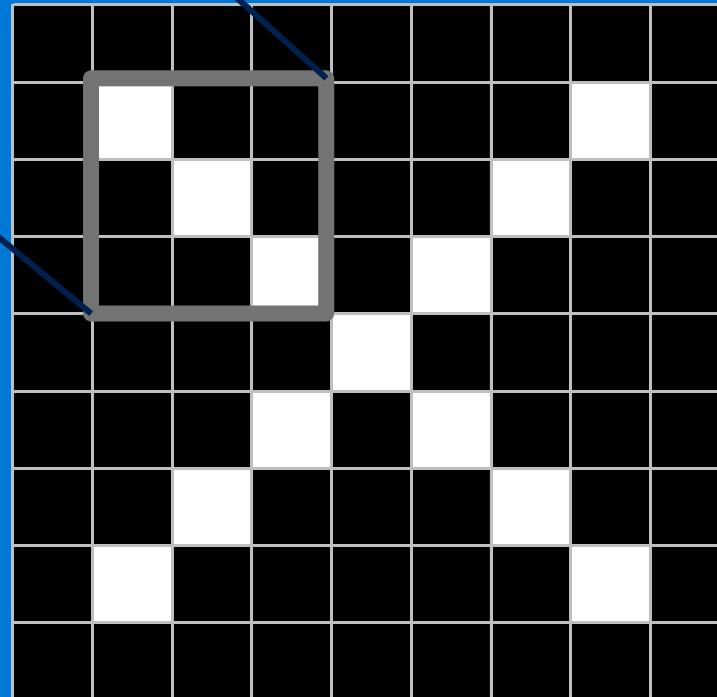
1	-1	1
-1	1	-1
1	-1	1

-1	-1	1
-1	1	-1
1	-1	-1

1	-1	-1
-1	1	-1
-1	-1	1

1	-1	1
-1	1	-1
1	-1	1

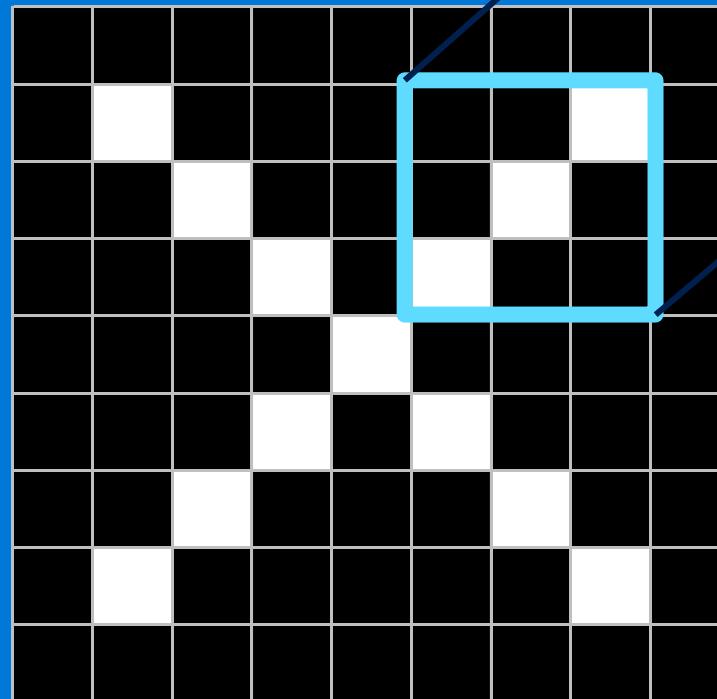
-1	-1	1
-1	1	-1
1	-1	-1



1	-1	-1
-1	1	-1
-1	-1	1

1	-1	1
-1	1	-1
1	-1	1

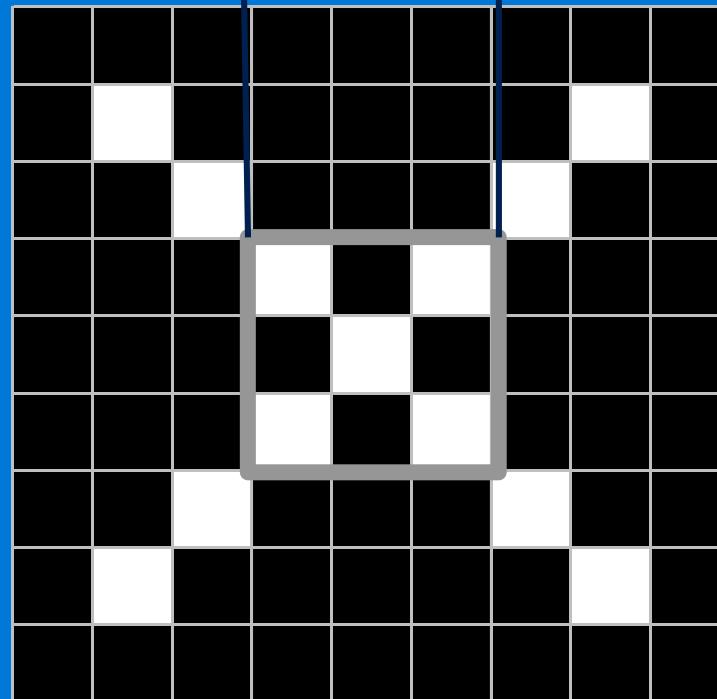
-1	-1	1
-1	1	-1
1	-1	-1



1	-1	-1
-1	1	-1
-1	-1	1

1	-1	1
-1	1	-1
1	-1	1

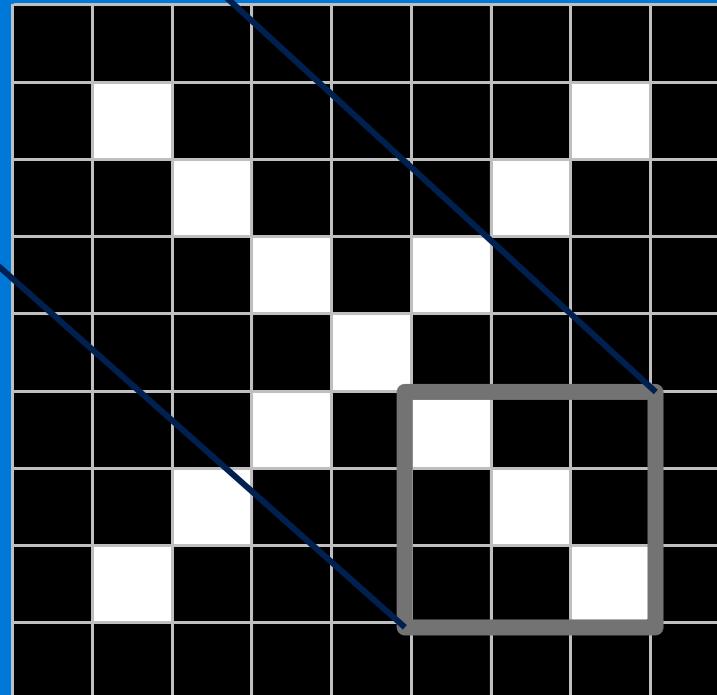
-1	-1	1
-1	1	-1
1	-1	-1



1	-1	-1
-1	1	-1
-1	-1	1

1	-1	1
-1	1	-1
1	-1	1

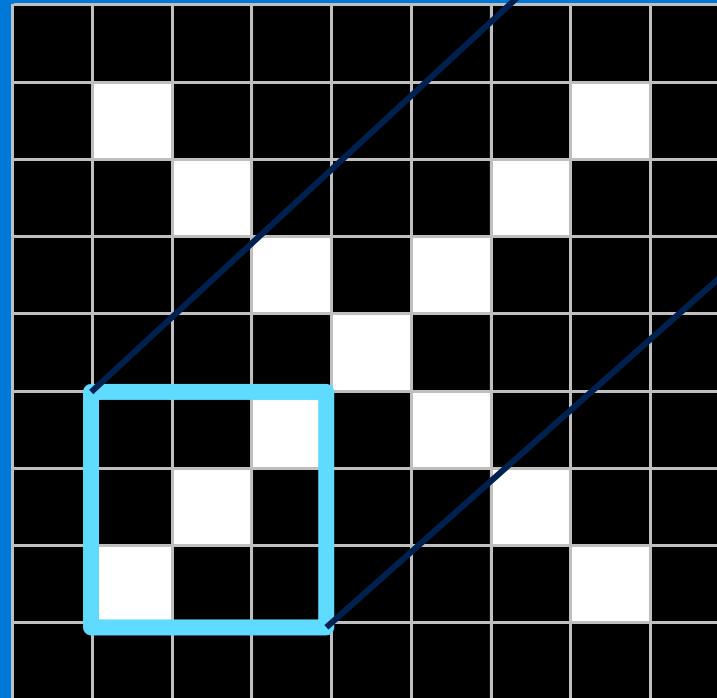
-1	-1	1
-1	1	-1
1	-1	-1



1	-1	-1
-1	1	-1
-1	-1	1

1	-1	1
-1	1	-1
1	-1	1

-1	-1	1
-1	1	-1
1	-1	-1



Filtering: The math behind the match

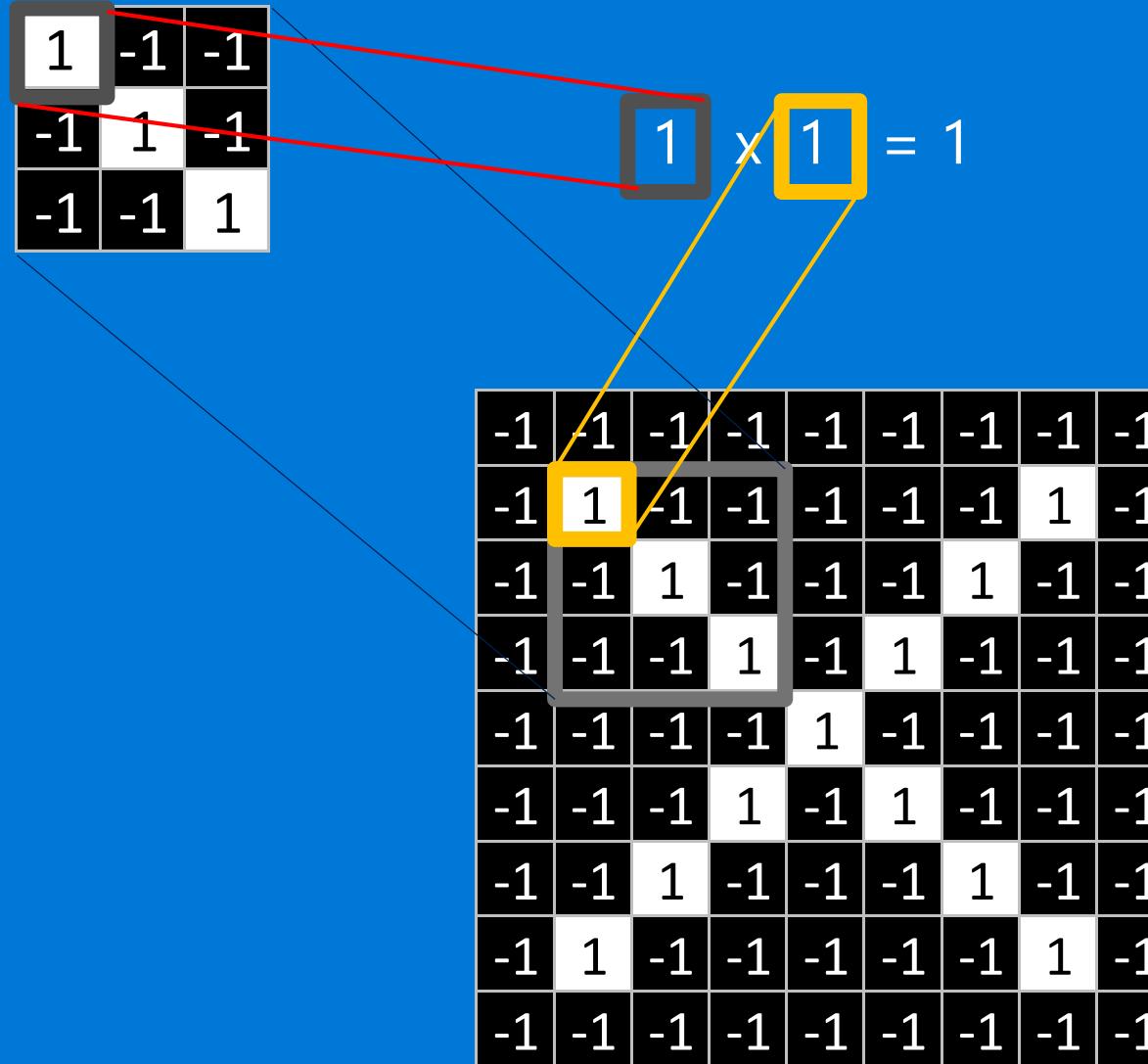
1	-1	-1
-1	1	-1
-1	-1	1

**DON'T
PANIC**

Filtering: The math behind the match

1. Line up the feature and the image patch.
2. Multiply each image pixel by the corresponding feature pixel.
3. Add them up.
4. Divide by the total number of pixels in the feature.

Filtering: The math behind the match



Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

$$1 \times 1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



Filtering: The math behind the match

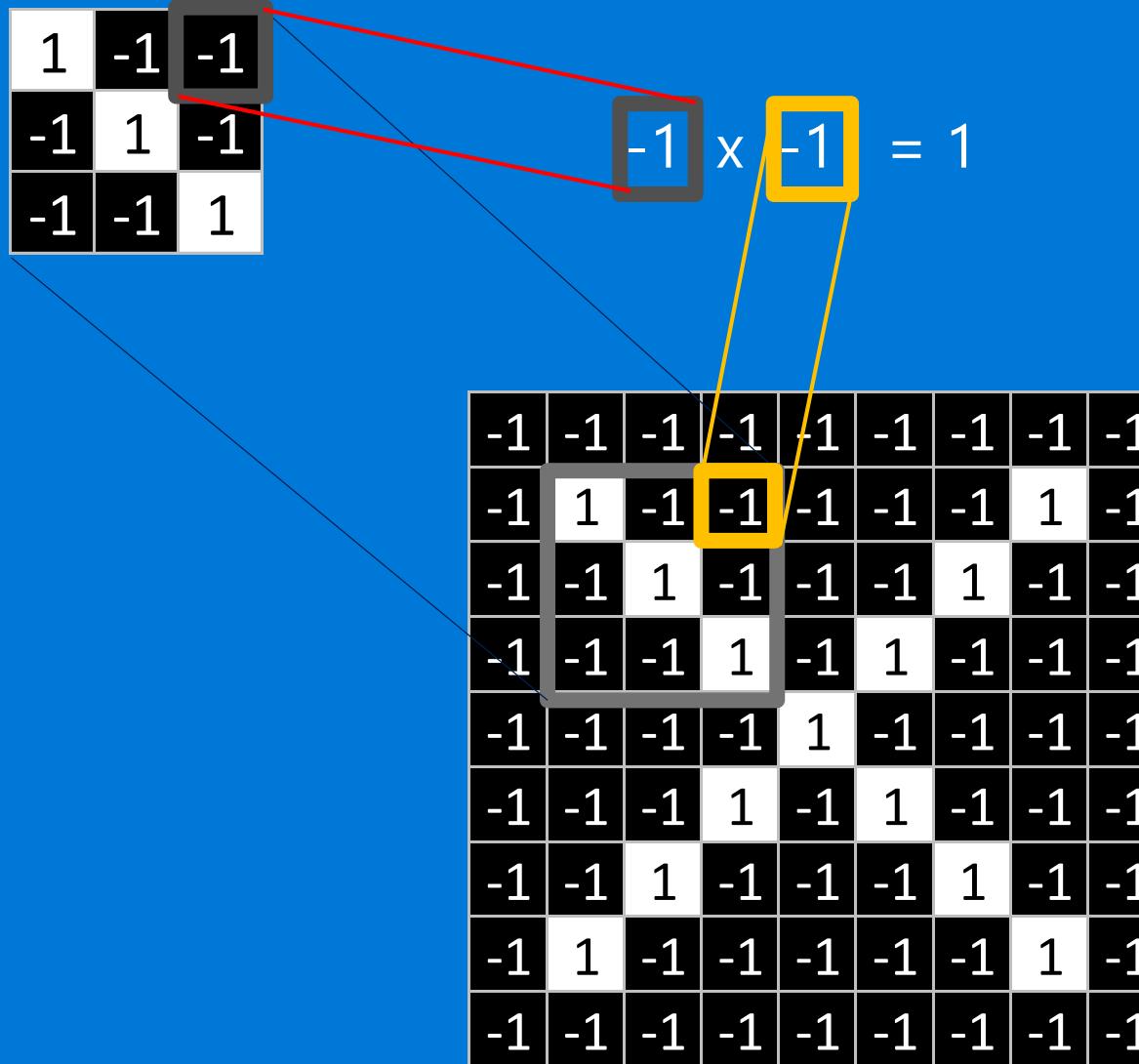
1	-1	-1
-1	1	-1
-1	-1	1

$$-1 \times -1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1

Filtering: The math behind the match



Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

$$-1 \times -1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1	1
1		

Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

$$1 \times 1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1	1
1	1	

Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

$$-1 \times -1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1	1
1	1	1

Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

$$-1 \times -1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	-1	1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1	1
1	1	1
1		

Filtering: The math behind the match

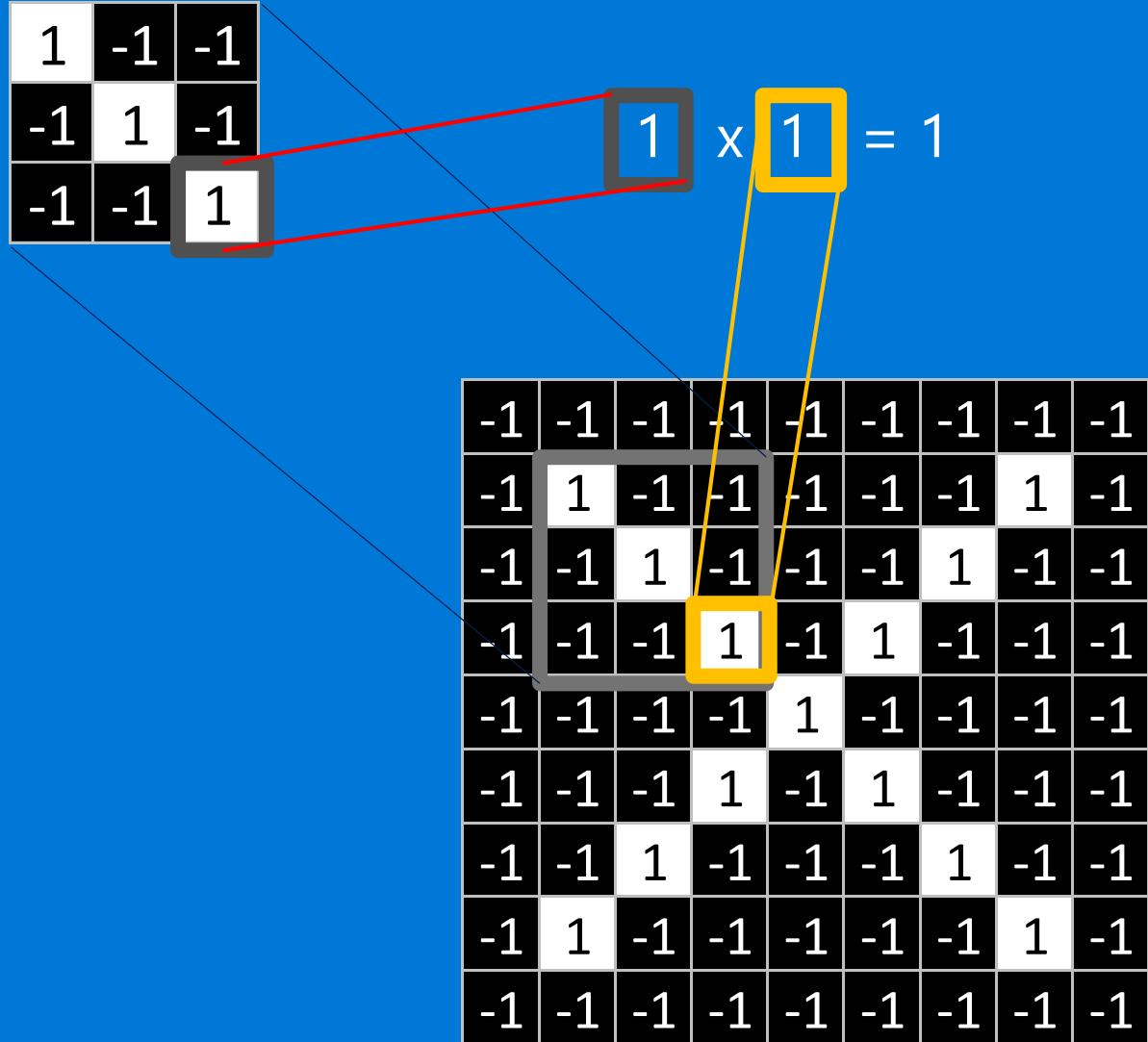
1	-1	-1
-1	1	-1
-1	-1	1

$$-1 \times -1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	-1	1	-1	1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1	1
1	1	1
1	1	

Filtering: The math behind the match



1	1	1
1	1	1
1	1	1

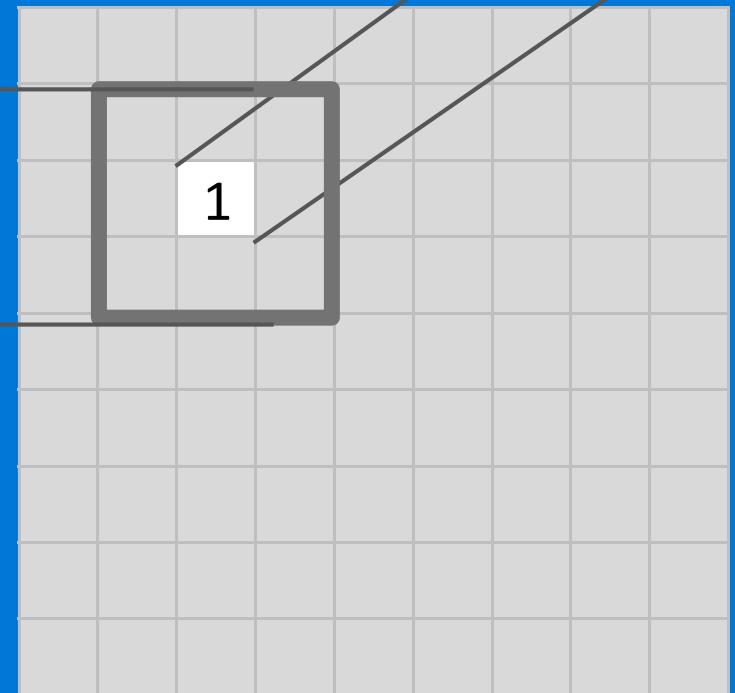
Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

1	1	1
1	1	1
1	1	1

$$\frac{1 + 1 + 1 + 1 + 1 + 1 + 1 + 1}{9} = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



Filtering: The math behind the match

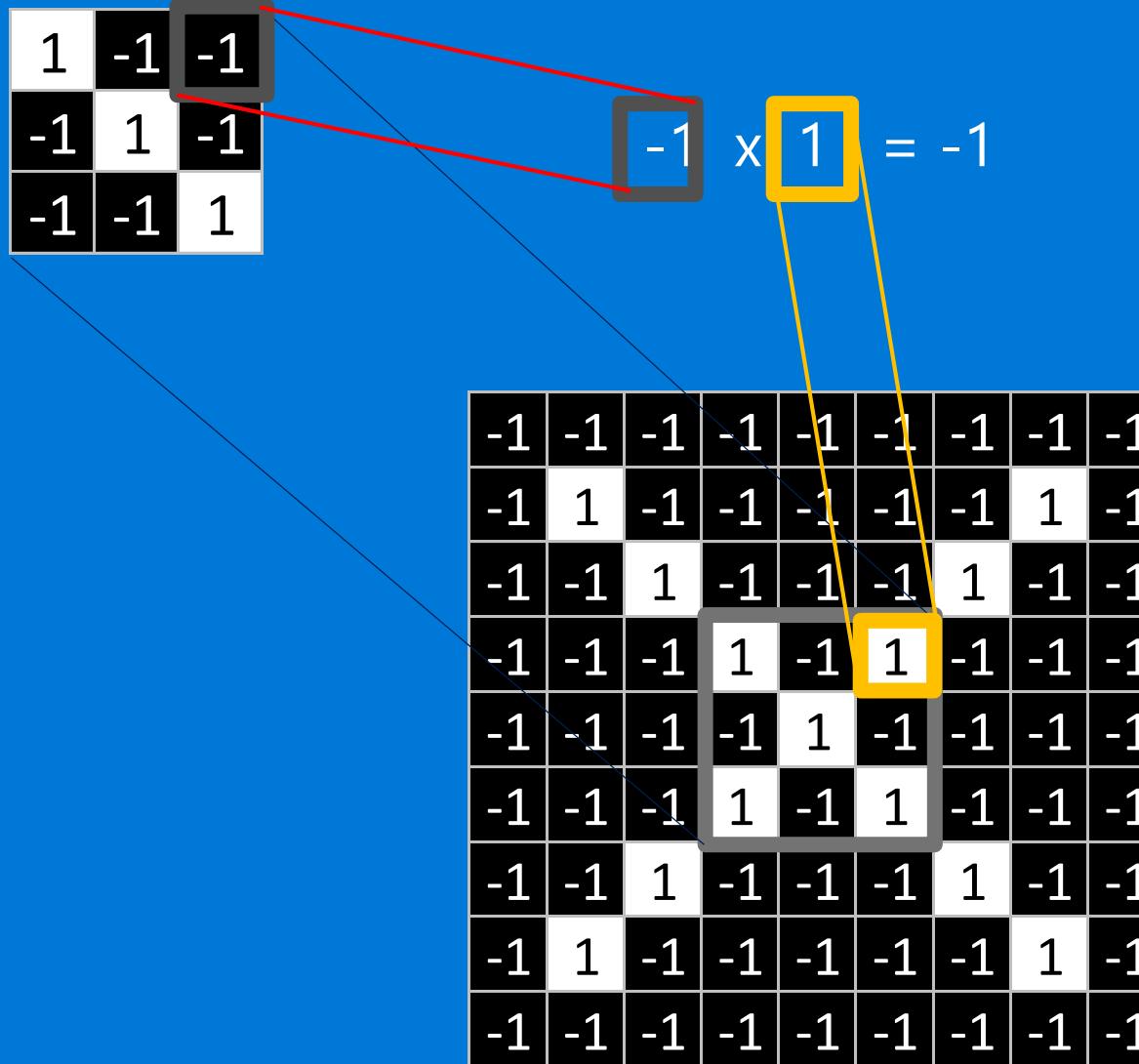
1	-1	-1
-1	1	-1
-1	-1	1

$$1 \times 1 = 1$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1		

Filtering: The math behind the match



Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1

1	1	-1
1	1	1
-1	1	1

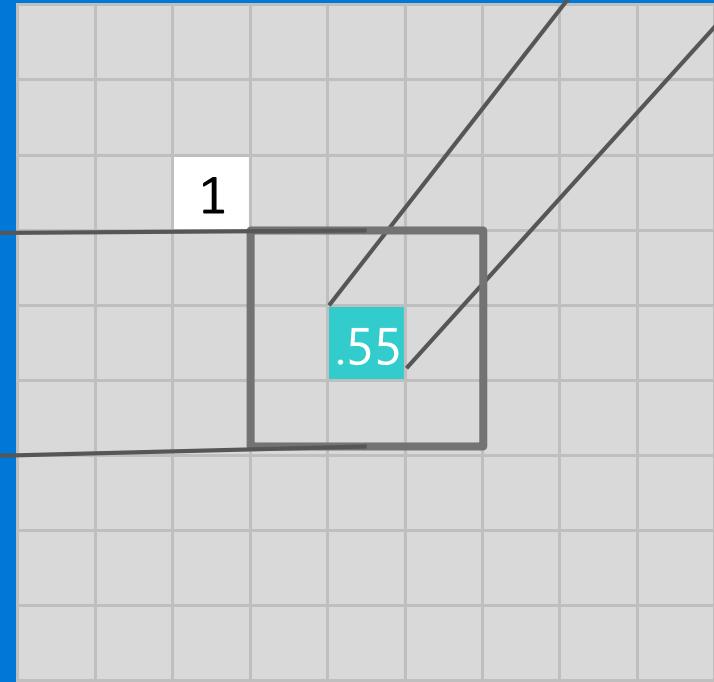
Filtering: The math behind the match

1	-1	-1
-1	1	-1
-1	-1	1

1	1	-1
1	1	1
-1	1	1

$$\frac{1 + 1 - 1 + 1 + 1 + 1 - 1 + 1 + 1}{9} = .55$$

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



Convolution: Trying every possible match

1	-1	-1
-1	1	-1
-1	-1	1

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

Convolution: Trying every possible match

-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	
-1	-1	1	-1	-1	-1	1	-1	-1	
-1	-1	-1	1	-1	1	-1	-1	-1	
-1	-1	-1	-1	1	-1	-1	-1	-1	
-1	-1	-1	-1	1	-1	-1	-1	-1	
-1	-1	-1	1	-1	1	-1	-1	-1	
-1	-1	1	-1	-1	-1	1	-1	-1	
-1	1	-1	-1	-1	-1	-1	1	-1	
-1	-1	-1	-1	-1	-1	-1	-1	-1	



1	-1	-1
-1	1	-1
-1	-1	1

=

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



$$\begin{matrix} 1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & 1 \end{matrix}$$

=

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



$$\begin{matrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{matrix}$$

=

0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.11	0.33	-0.77	1.00	-0.77	0.33	-0.11
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33

-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1
-1	1	-1	-1	-1	-1	1	1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1



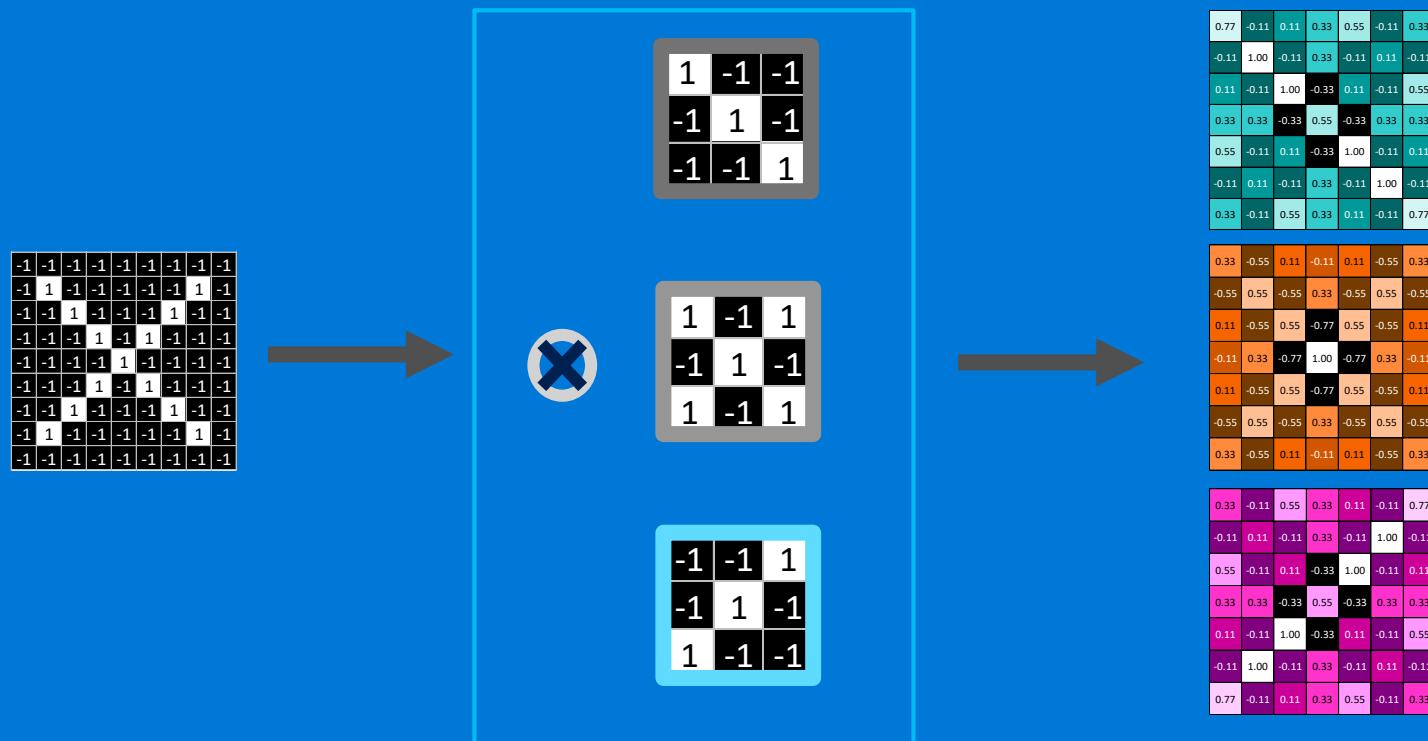
$$\begin{matrix} -1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{matrix}$$

=

0.33	-0.11	0.55	0.33	0.11	-0.11	0.77
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.77	-0.11	0.11	0.33	0.55	-0.11	0.33

Convolution layer

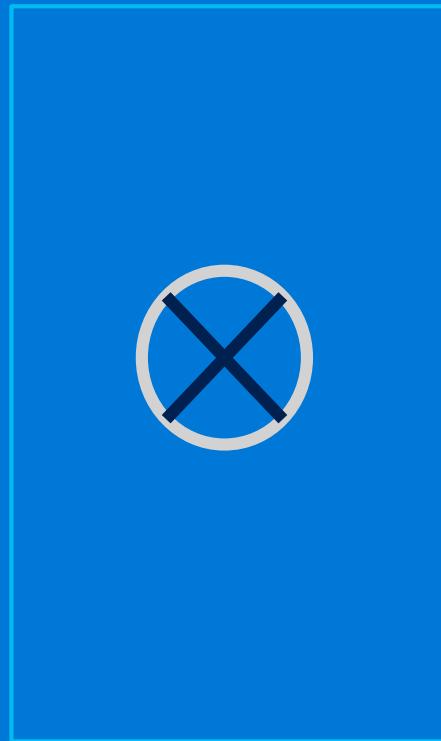
- One image becomes a stack of filtered images



Convolution layer

- One image becomes a stack of filtered images

-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	
-1	1	-1	-1	-1	-1	1	-1	-1	
-1	-1	1	-1	1	-1	-1	-1	-1	
-1	-1	-1	1	-1	1	-1	-1	-1	
-1	-1	-1	-1	1	-1	-1	-1	-1	
-1	-1	-1	-1	-1	1	-1	-1	-1	
-1	1	-1	-1	-1	-1	1	-1	-1	
-1	-1	-1	-1	-1	-1	-1	1	-1	
-1	-1	-1	-1	-1	-1	-1	-1	1	



0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

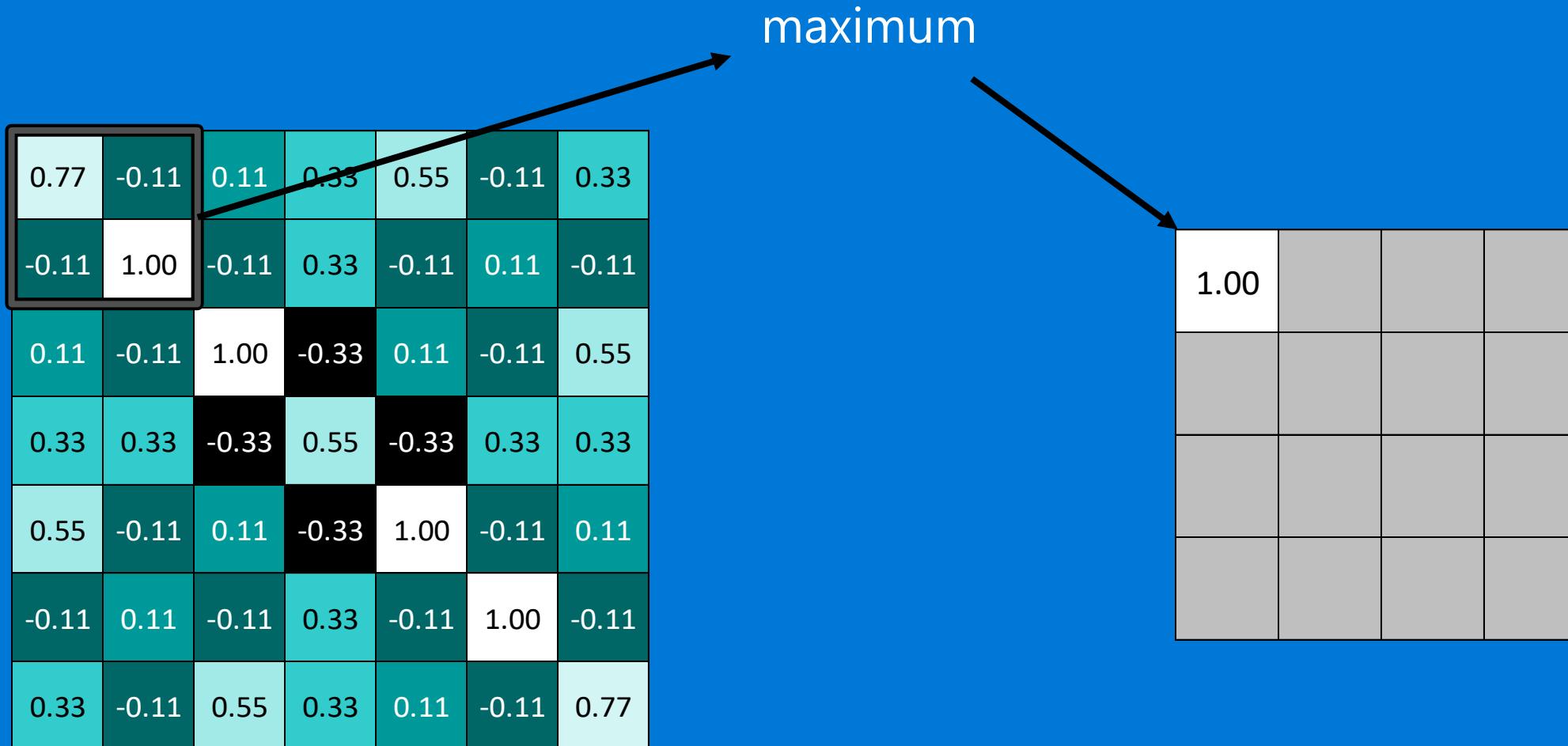
0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.11	0.33	-0.77	1.00	-0.77	0.33	-0.11
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33

0.33	-0.11	0.55	0.33	0.11	-0.11	0.77
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.77	-0.11	0.11	0.33	0.55	-0.11	0.33

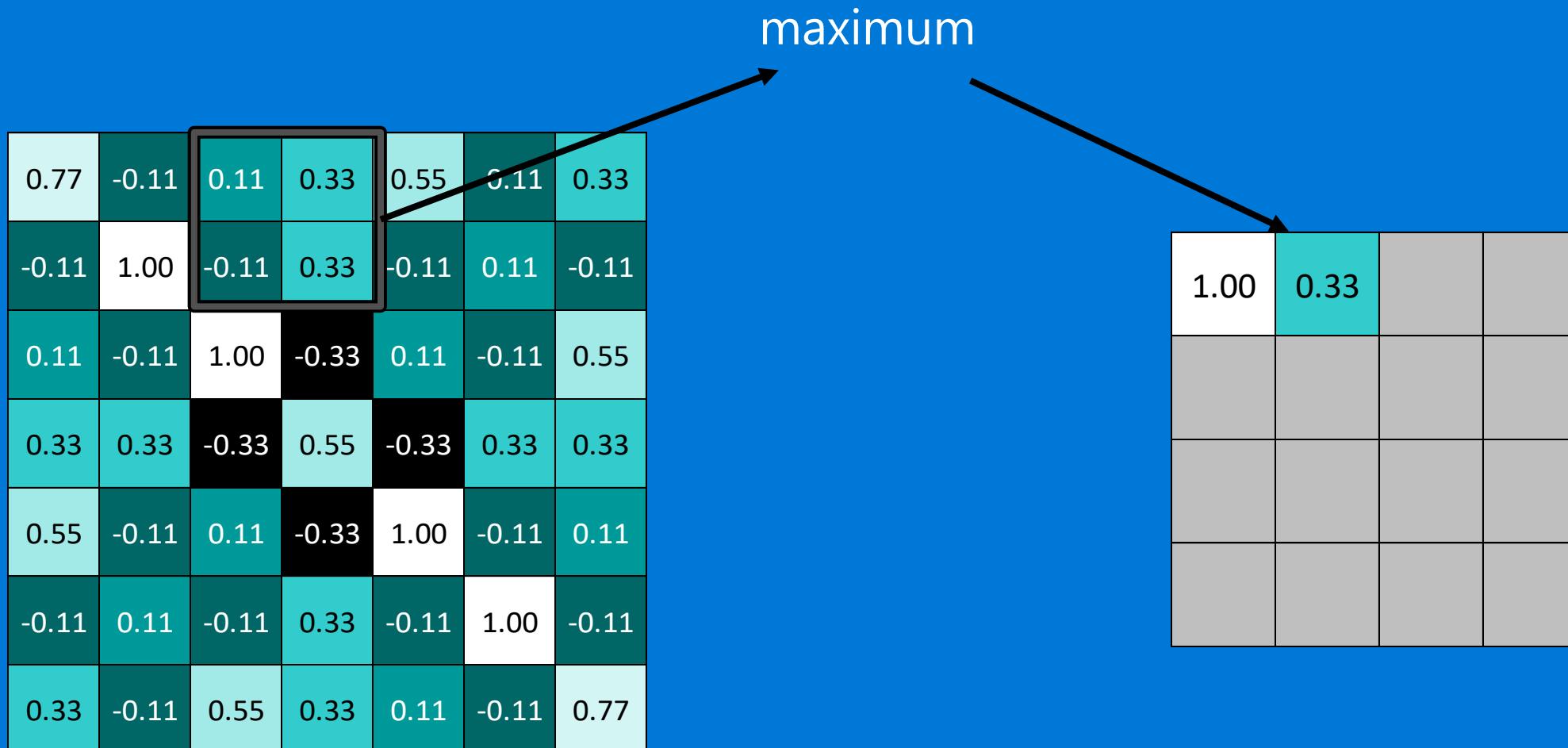
Pooling: Shrinking the image stack

1. Pick a window size (usually 2 or 3).
2. Pick a stride (usually 2).
3. Walk your window across your filtered images.
4. From each window, take the maximum value.

Pooling



Pooling



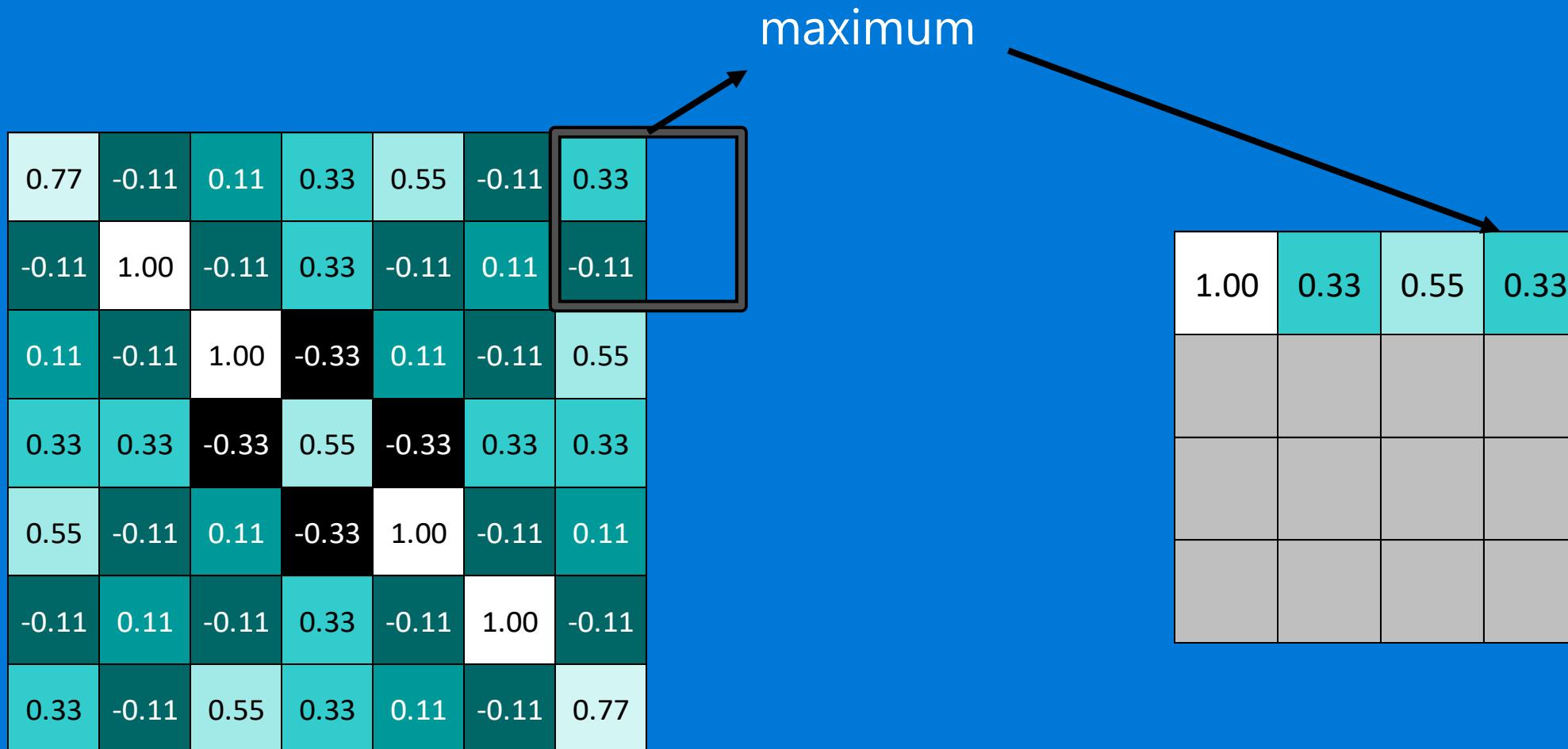
Pooling

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33	
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11	
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55	
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33	
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11	
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11	
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77	

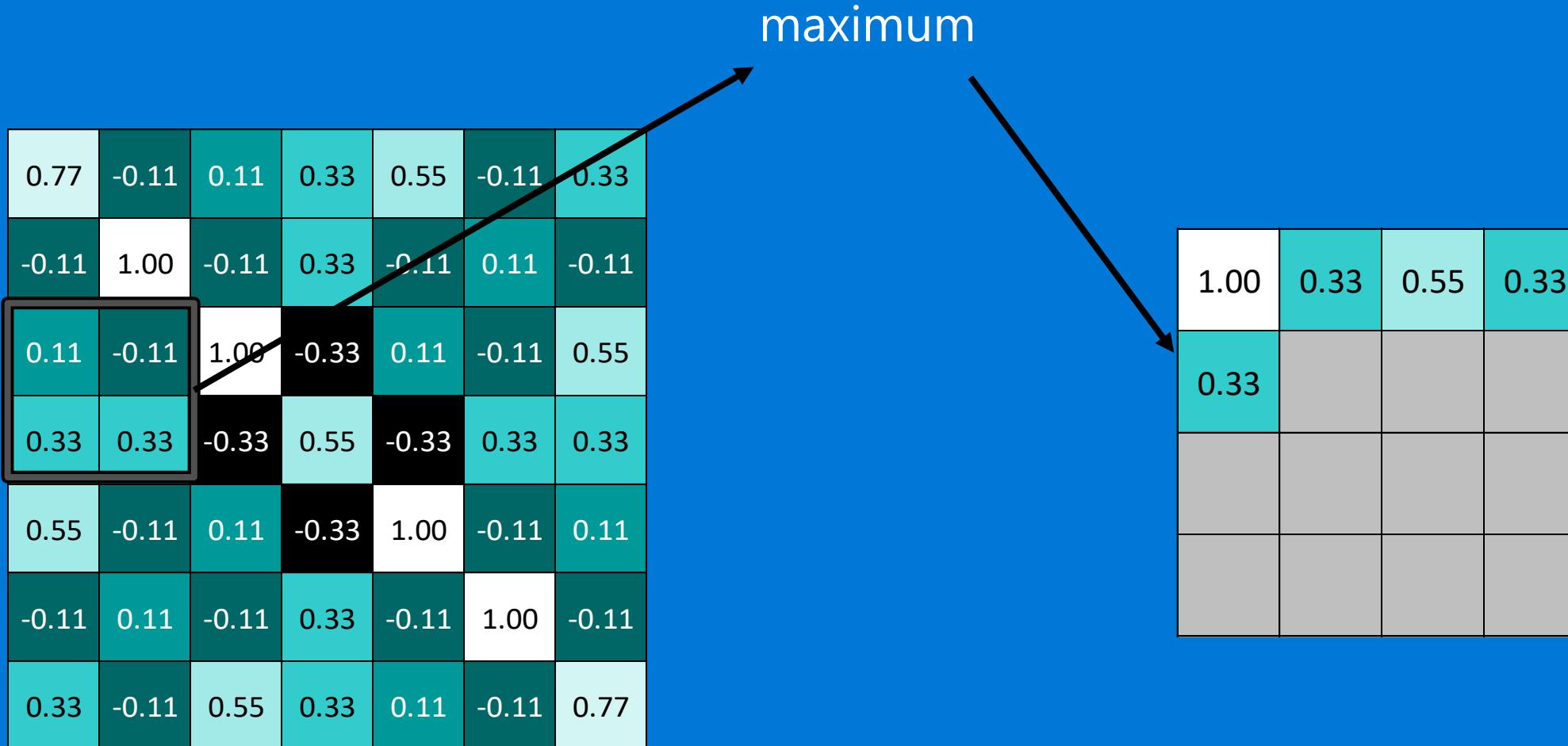
maximum

1.00	0.33	0.55	

Pooling



Pooling



Pooling

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

max pooling

1.00	0.33	0.55	0.33
0.33	1.00	0.33	0.55
0.55	0.33	1.00	0.11
0.33	0.55	0.11	0.77

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77



1.00	0.33	0.55	0.33
0.33	1.00	0.33	0.55
0.55	0.33	1.00	0.11
0.33	0.55	0.11	0.77

0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.11	0.33	-0.77	1.00	-0.77	0.33	-0.11
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33



0.55	0.33	0.55	0.33
0.33	1.00	0.55	0.11
0.55	0.55	0.55	0.11
0.33	0.11	0.11	0.33

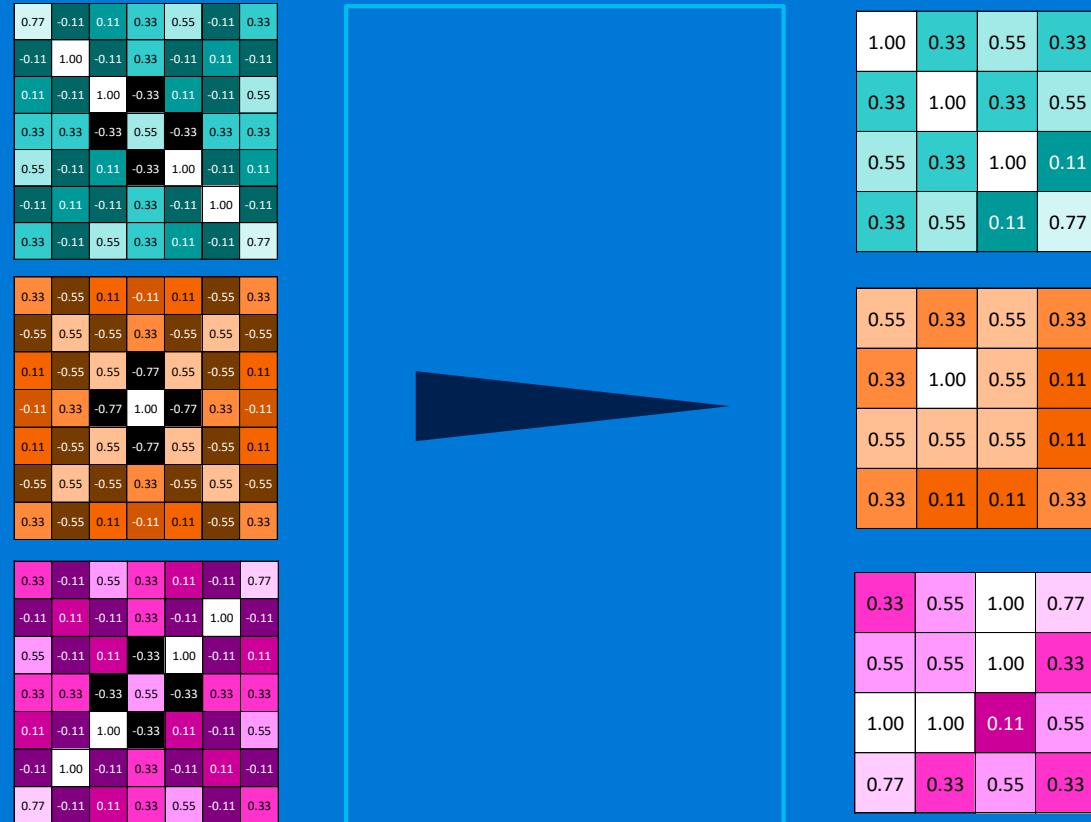
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.77	-0.11	0.11	0.33	0.55	-0.11	0.33



0.33	0.55	1.00	0.77
0.55	0.55	1.00	0.33
1.00	1.00	0.11	0.55
0.77	0.33	0.55	0.33

Pooling layer

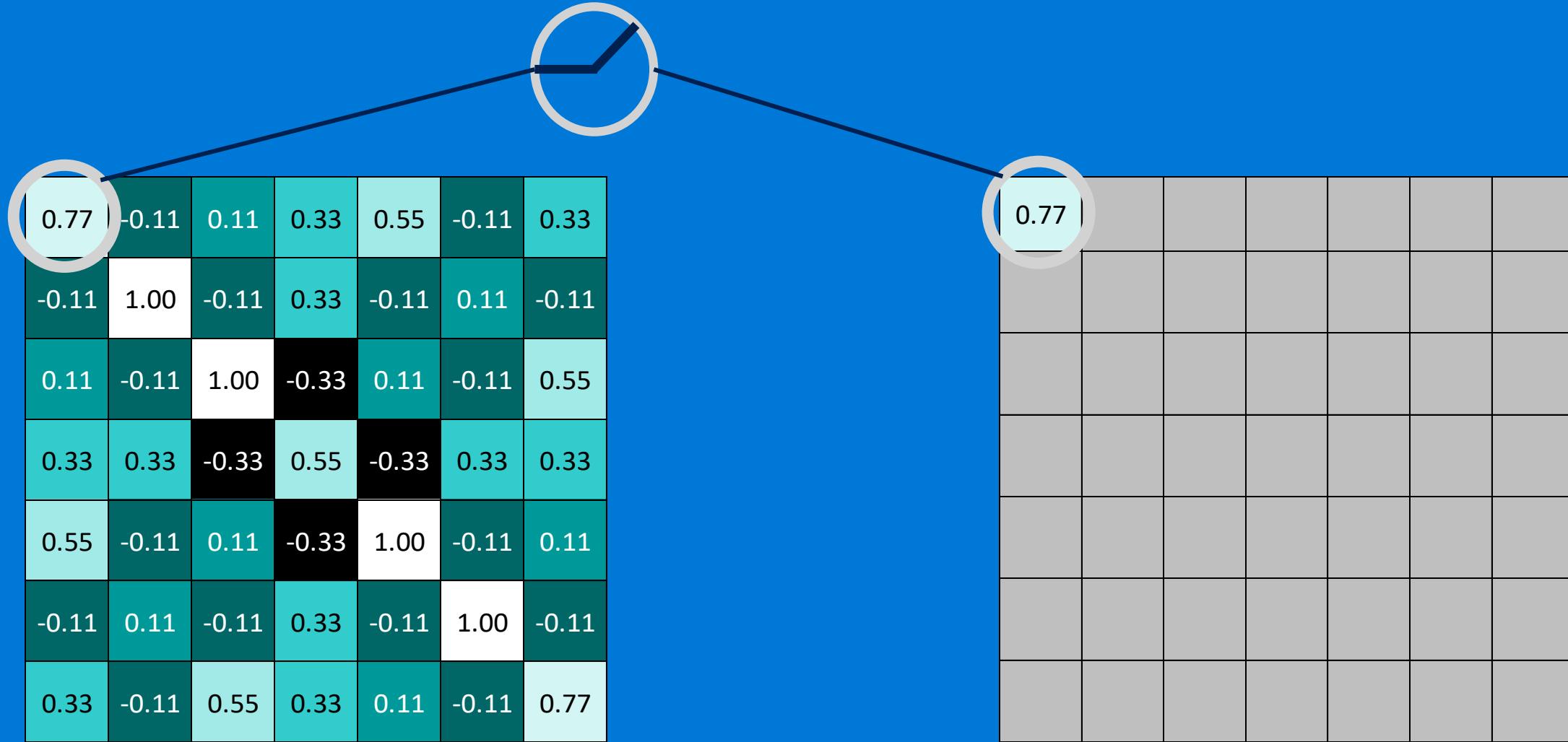
- A stack of images becomes a stack of smaller images.



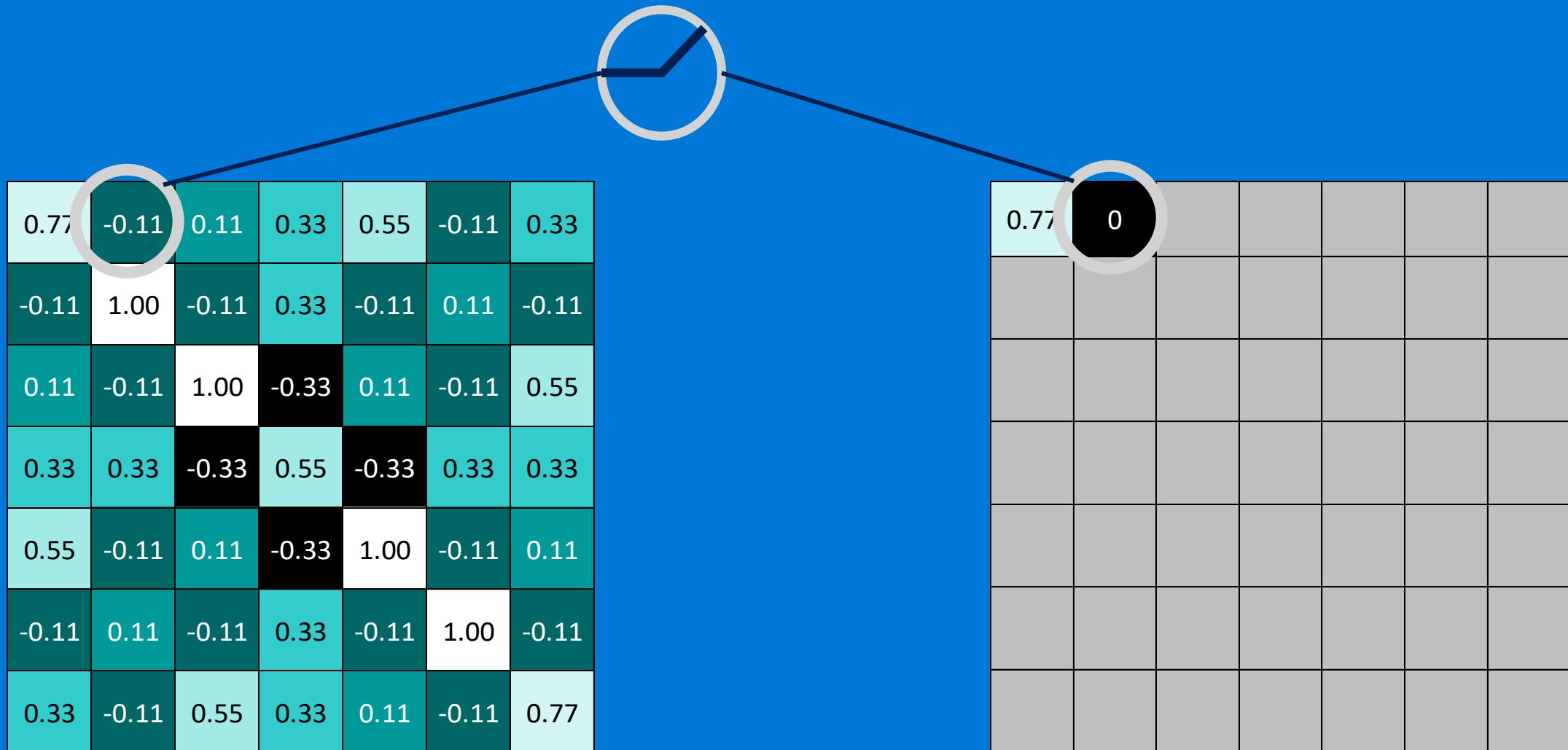
Normalization

- Keep the math from breaking by tweaking each of the values just a bit.
- Change everything negative to zero.

Rectified Linear Units (ReLUs)



Rectified Linear Units (ReLUs)



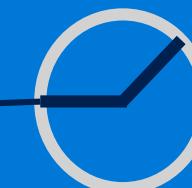
Rectified Linear Units (ReLUs)

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

0.77	0	0.11	0.33	0.55	0	0.33

Rectified Linear Units (ReLUs)

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77



0.77	0	0.11	0.33	0.55	0	0.33
0	1.00	0	0.33	0	0.11	0
0.11	0	1.00	0	0.11	0	0.55
0.33	0.33	0	0.55	0	0.33	0.33
0.55	0	0.11	0	1.00	0	0.11
0	0.11	0	0.33	0	1.00	0
0.33	0	0.55	0.33	0.11	0	0.77

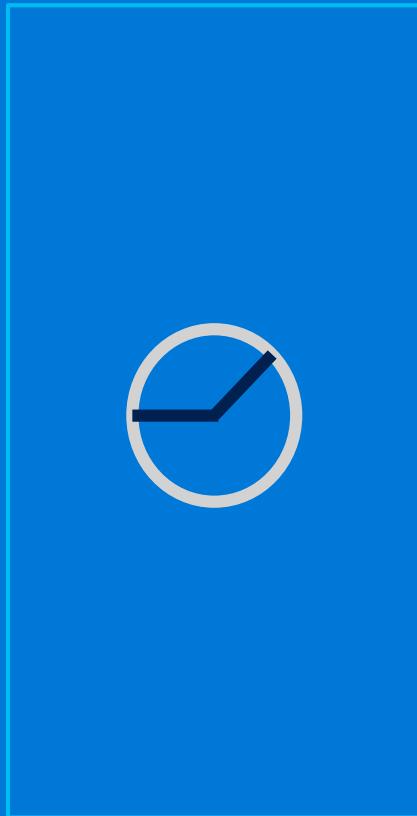
ReLU layer

- A stack of images becomes a stack of images with no negative values.

0.77	-0.11	0.11	0.33	0.55	-0.11	0.33
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.33	-0.11	0.55	0.33	0.11	-0.11	0.77

0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33
-0.55	0.55	-0.55	0.33	-0.55	0.55	-0.55
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.11	0.33	-0.77	1.00	-0.77	0.33	-0.11
0.11	-0.55	0.55	-0.77	0.55	-0.55	0.11
-0.55	0.55	-0.55	0.33	-0.55	0.55	0.55
0.33	-0.55	0.11	-0.11	0.11	-0.55	0.33

0.33	-0.11	0.55	0.33	0.11	-0.11	0.77
-0.11	0.11	-0.11	0.33	-0.11	1.00	-0.11
0.55	-0.11	0.11	-0.33	1.00	-0.11	0.11
0.33	0.33	-0.33	0.55	-0.33	0.33	0.33
0.11	-0.11	1.00	-0.33	0.11	-0.11	0.55
-0.11	1.00	-0.11	0.33	-0.11	0.11	-0.11
0.77	-0.11	0.11	0.33	0.55	-0.11	0.33



0.77	0	0.11	0.33	0.55	0	0.33
0	1.00	0	0.33	0	0.11	0
0.11	0	1.00	0	0.11	0	0.55
0.33	0.33	0	0.55	0	0.33	0.33
0.55	0	0.11	0	1.00	0	0.11
0	0.11	0	0.33	0	1.00	0
0.33	0	0.55	0.33	0.11	0	0.77

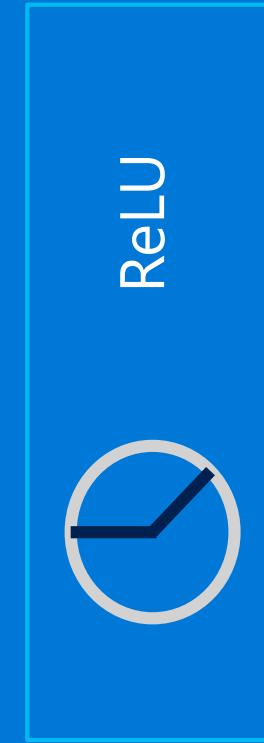
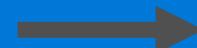
0.33	0	0.11	0	0.11	0	0.33
0	0.55	0	0.33	0	0.55	0
0.11	0	0.55	0	0.55	0	0.11
0	0.33	0	1.00	0	0.33	0
0.11	0	0.55	0	0.55	0	0.11
0	0.55	0	0.33	0	0.55	0
0.33	0	0.11	0	0.11	0	0.33

0.33	0	0.55	0.33	0.11	0	0.77
0	0.11	0	0.33	0	1.00	0
0.55	0	0.11	0	1.00	0	0.11
0.33	0.33	0	0.55	0	0.33	0.33
0.11	0	1.00	0	0.11	0	0.55
0	1.00	0	0.33	0	0.11	0
0.77	0	0.11	0.33	0.55	0	0.33

Layers get stacked

- The output of one becomes the input of the next.

-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1



1.00	0.33	0.55	0.33
0.33	1.00	0.33	0.55
0.55	0.33	1.00	0.11
0.33	0.55	0.11	0.77

0.55	0.33	0.55	0.33
0.33	1.00	0.55	0.11
0.55	0.55	0.55	0.11
0.33	0.11	0.11	0.33

0.33	0.55	1.00	0.77
0.55	0.55	1.00	0.33
1.00	1.00	0.11	0.55
0.77	0.33	0.55	0.33

Deep stacking

- Layers can be repeated several (or many) times.

-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1



ReLU



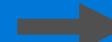
ReLU



Convolution

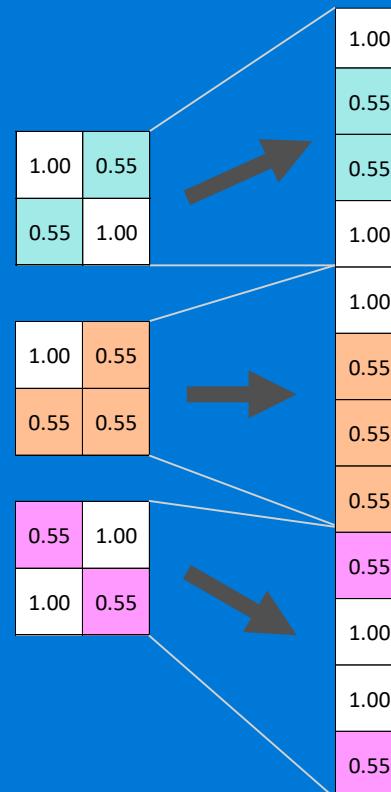


1.00	0.55
0.55	1.00
1.00	0.55
0.55	0.55
0.55	1.00
1.00	0.55



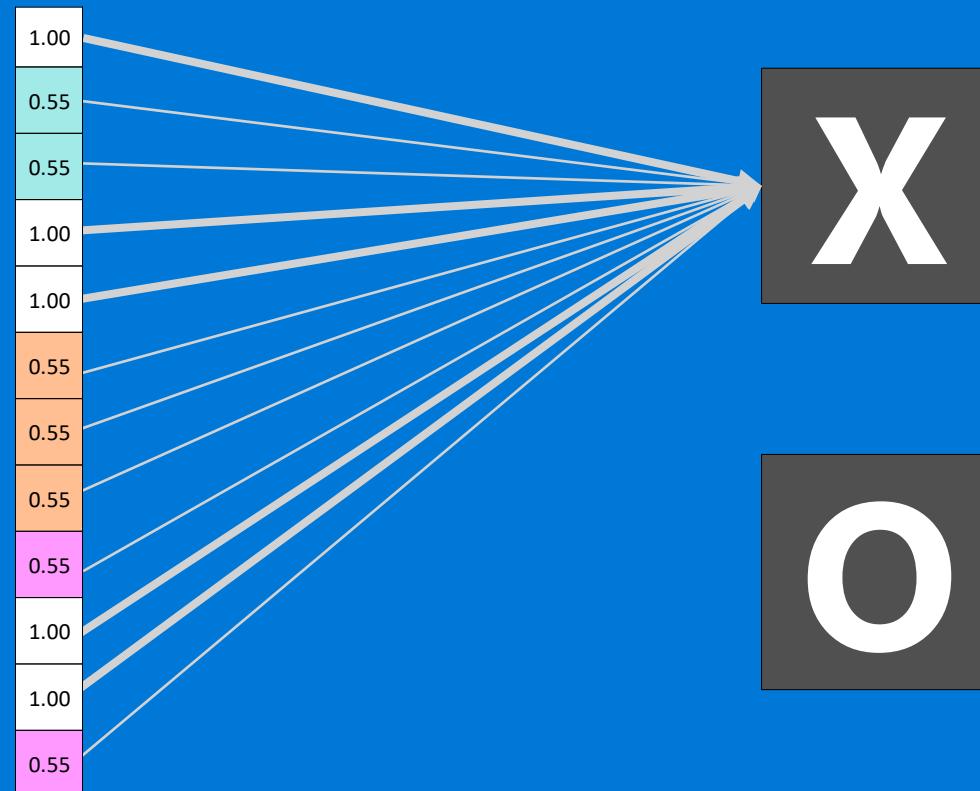
Fully connected layer

- Every value gets a vote



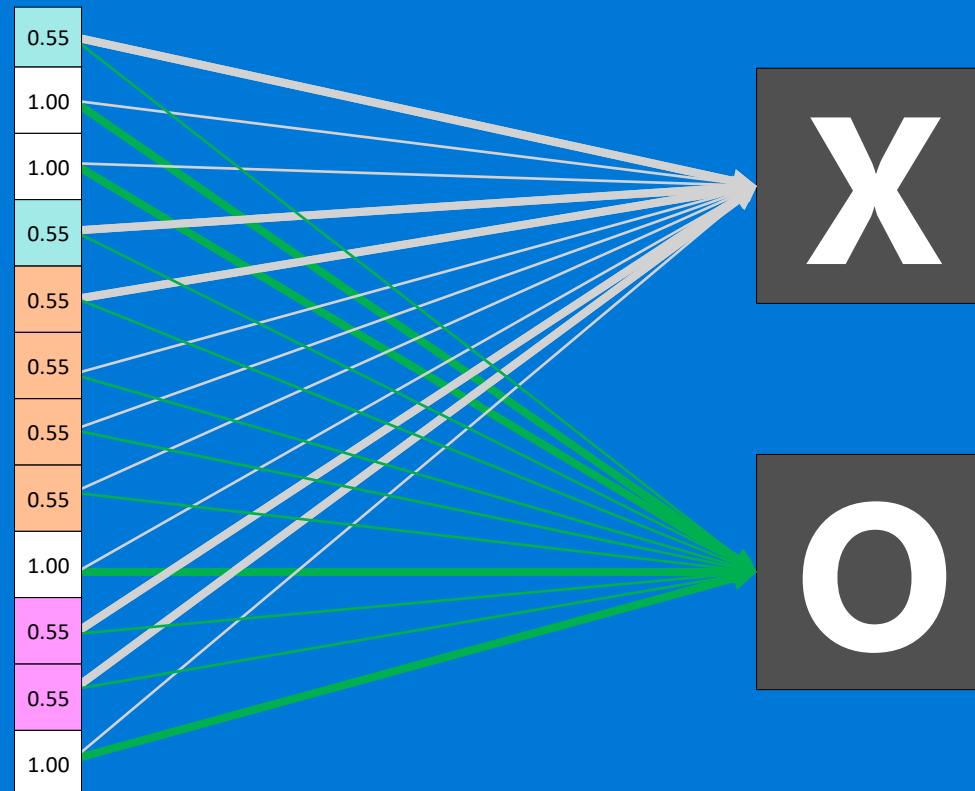
Fully connected layer

- Vote depends on how strongly a value predicts X or O



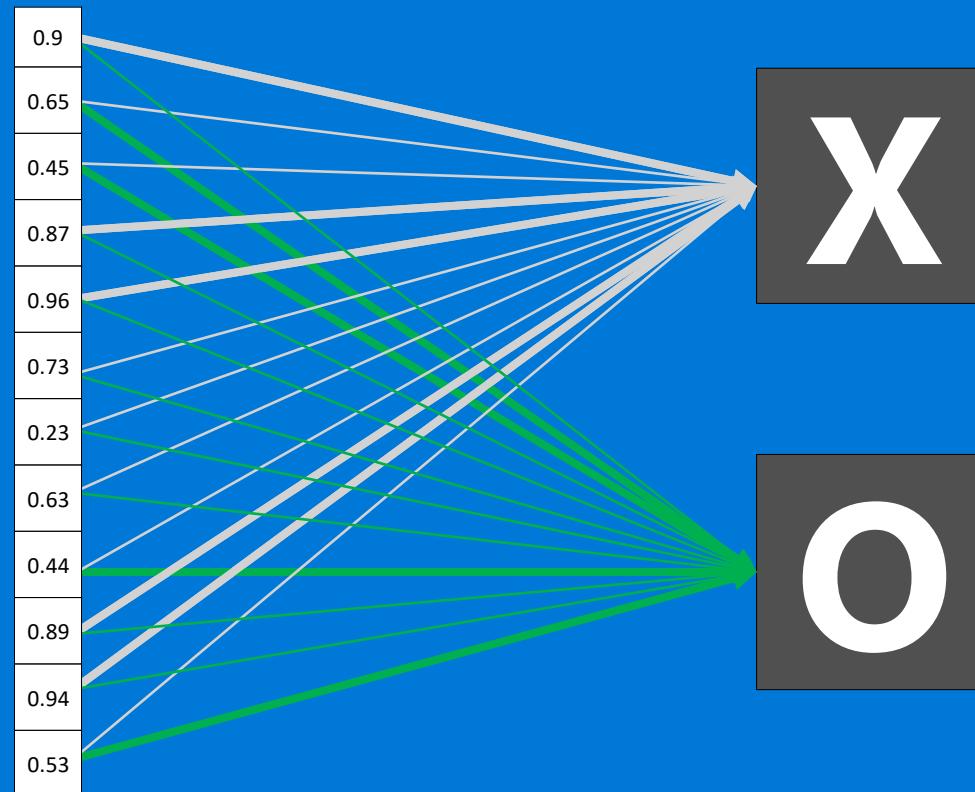
Fully connected layer

- Vote depends on how strongly a value predicts X or O



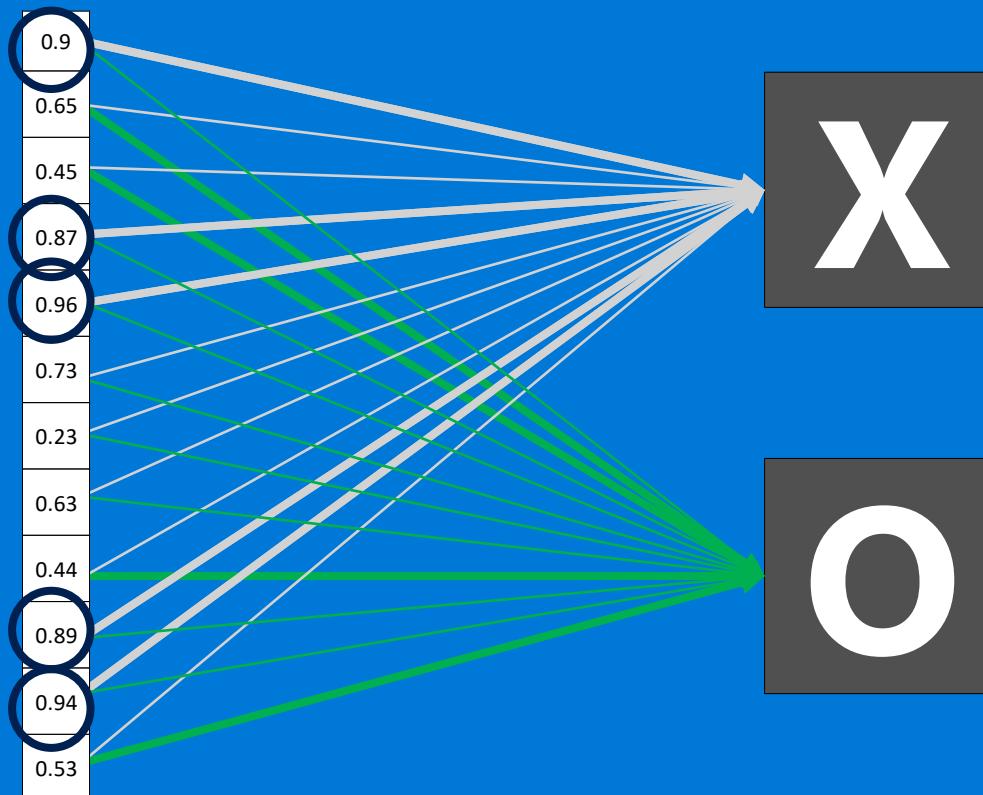
Fully connected layer

- Future values vote on X or O



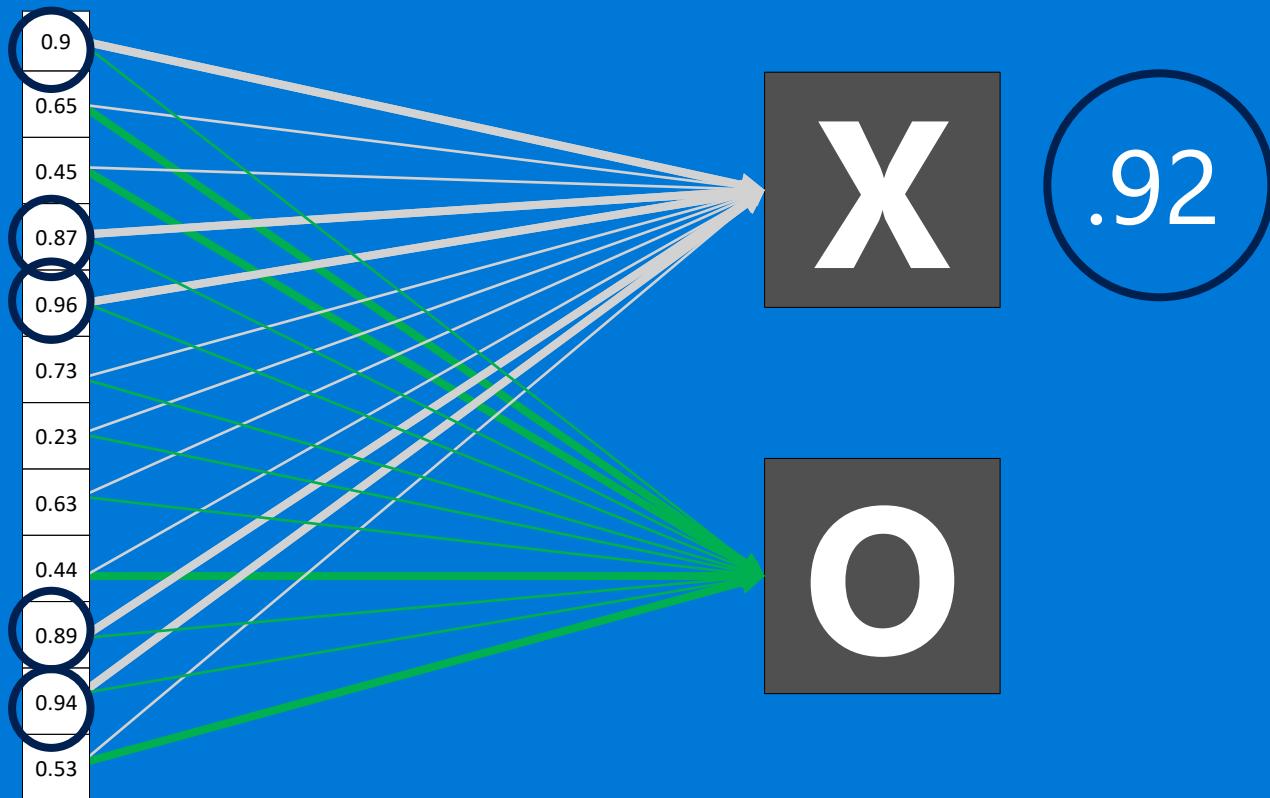
Fully connected layer

- Future values vote on X or O



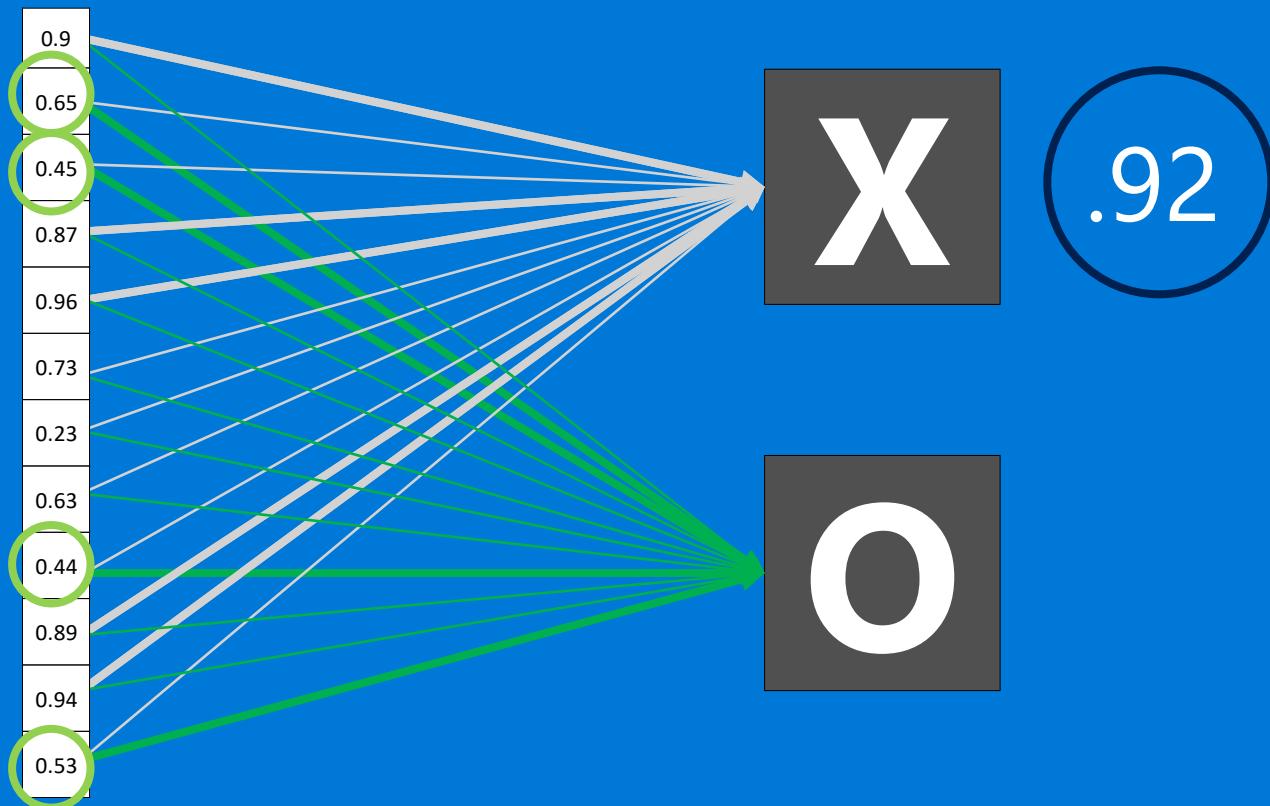
Fully connected layer

- Future values vote on X or O



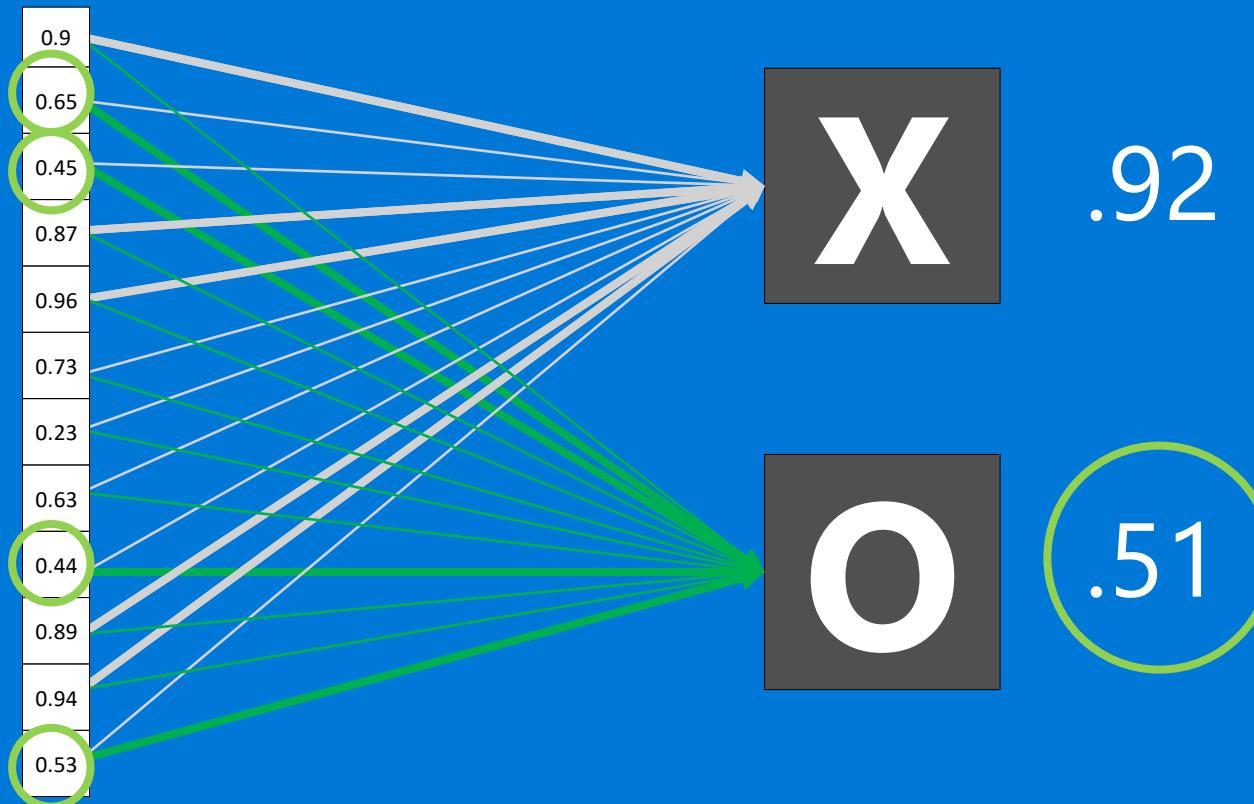
Fully connected layer

- Future values vote on X or O



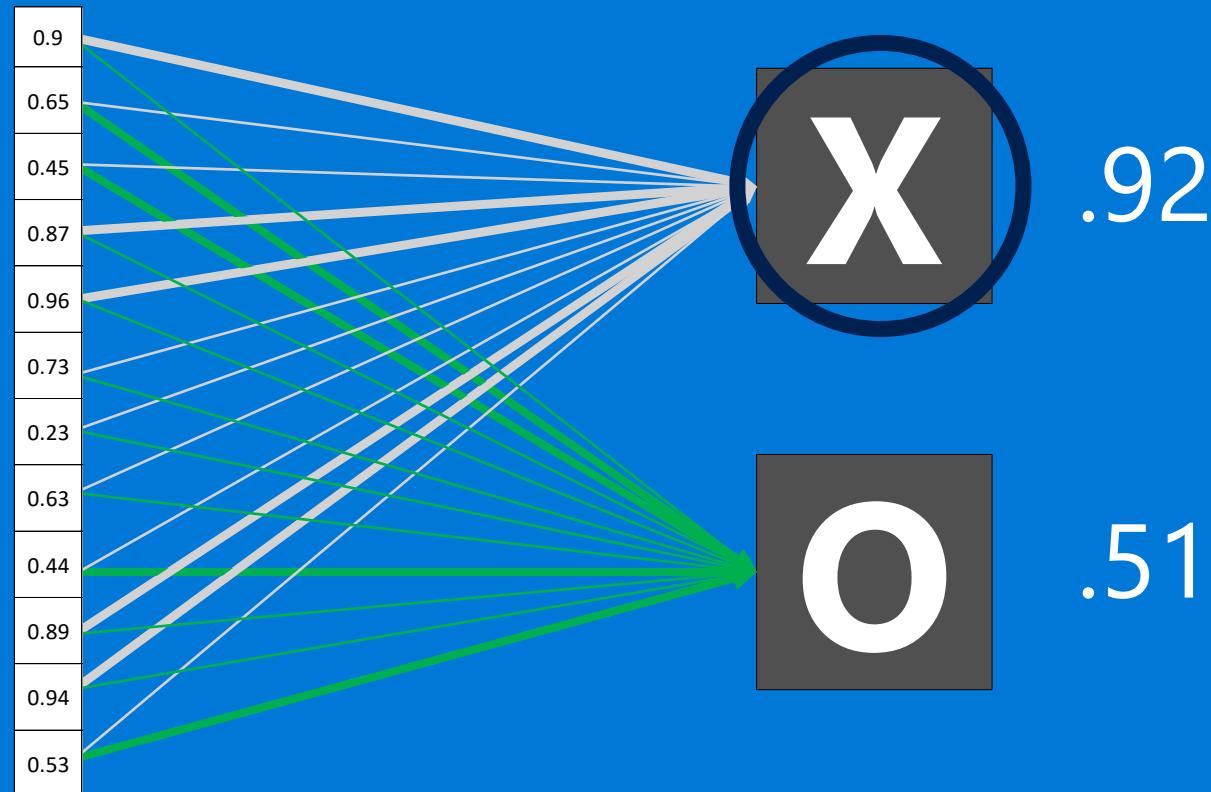
Fully connected layer

- Future values vote on X or O



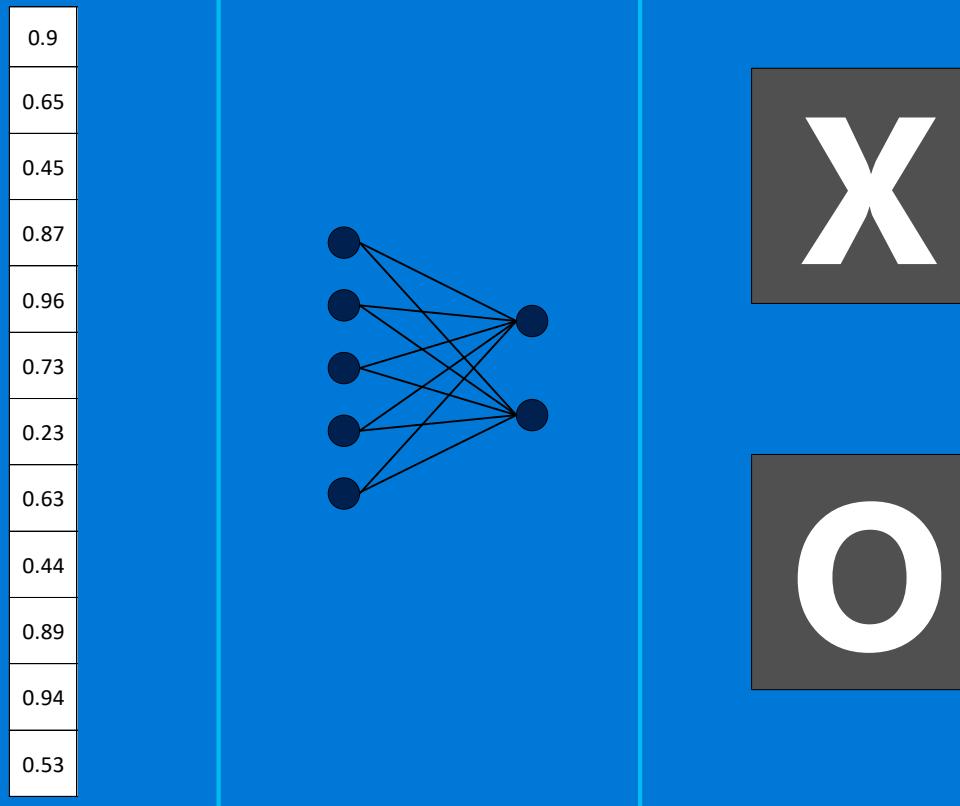
Fully connected layer

- Future values vote on X or O



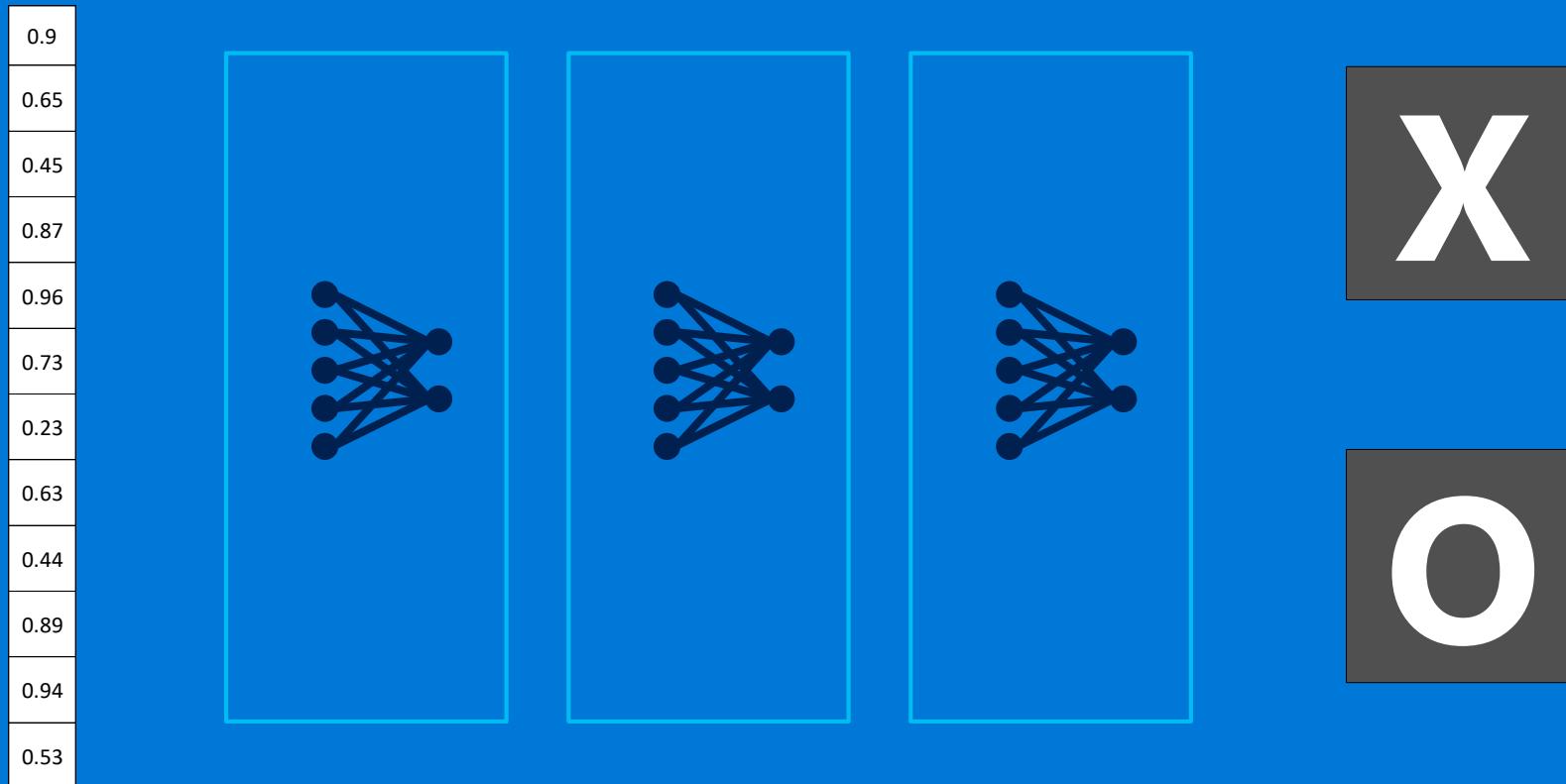
Fully connected layer

- A list of feature values becomes a list of votes.



Fully connected layer

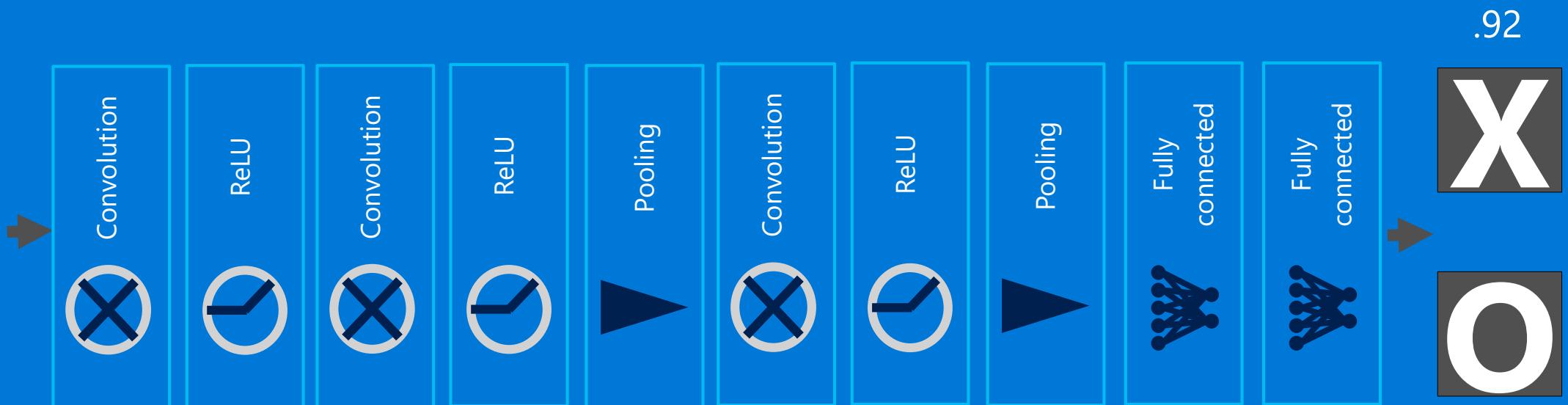
- These can also be stacked.



Putting it all together

- A set of pixels becomes a set of votes.

-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1



.92

.51

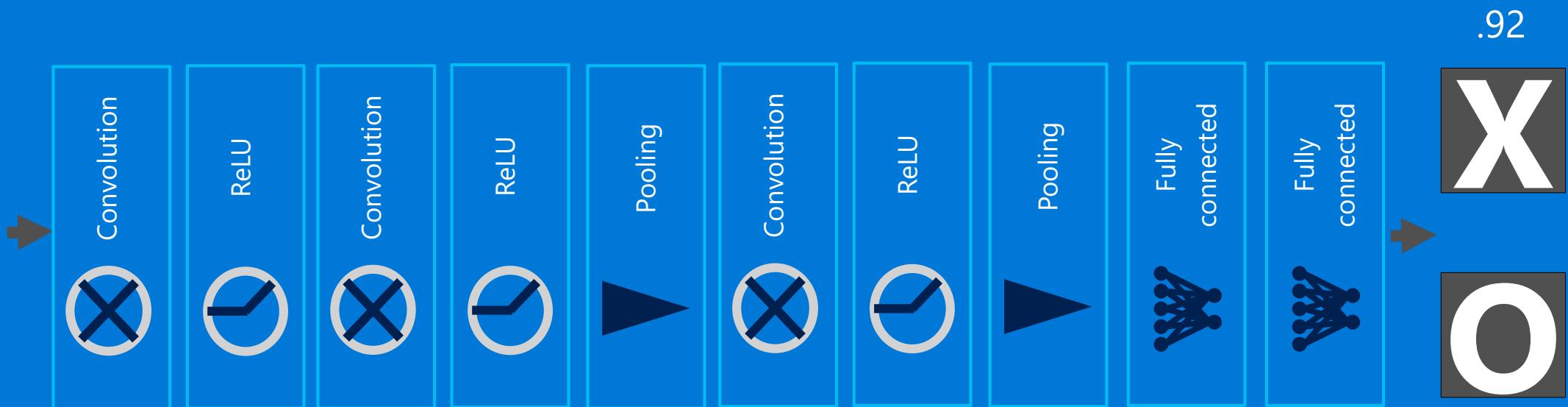
Learning

- Q: Where do all the magic numbers come from?
 - Features in convolutional layers
 - Voting weights in fully connected layers
- A: Backpropagation

Backprop

- Error = right answer – actual answer

-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1	-1
-1	-1	-1	1	-1	1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

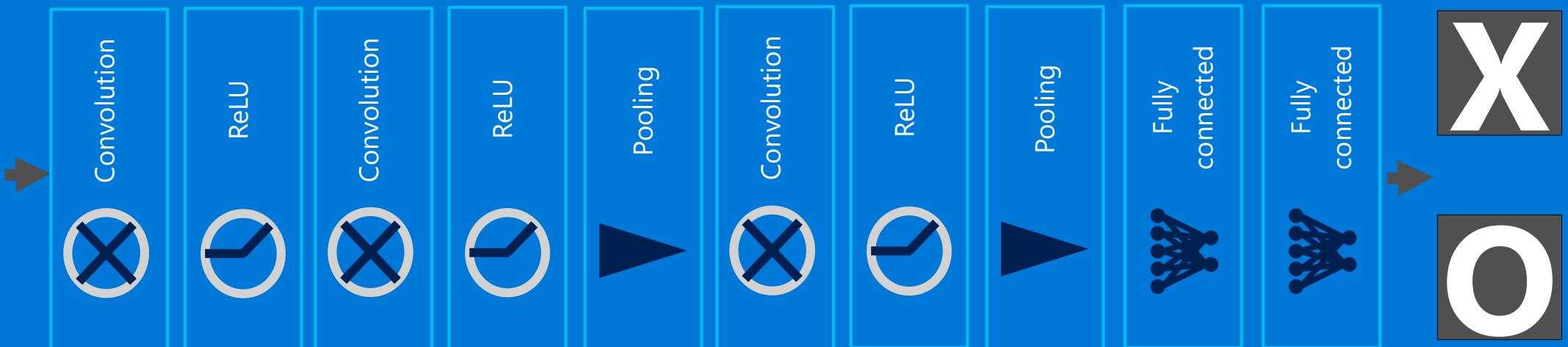


Backprop

	Right answer	Actual answer	Error
X	1		
O			

.92

-1 -1 -1 -1 -1 -1 -1 -1 -1
-1 1 -1 -1 -1 -1 -1 1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 1 -1 -1 -1 -1 1 1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1

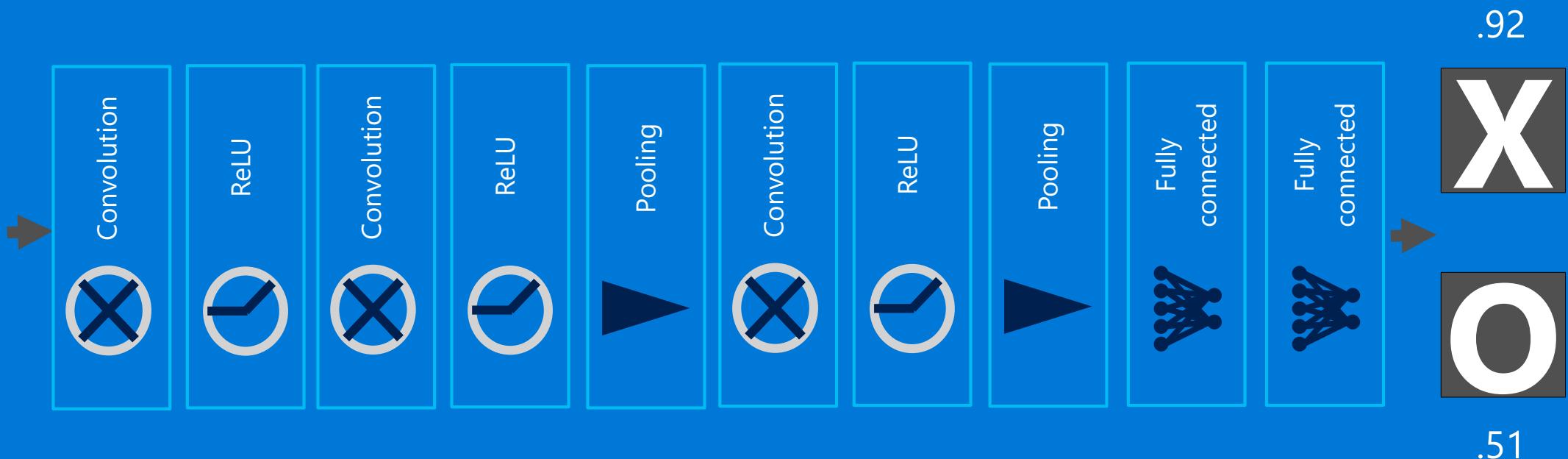


.51

Backprop

	Right answer	Actual answer	Error
X	1	0.92	
O			

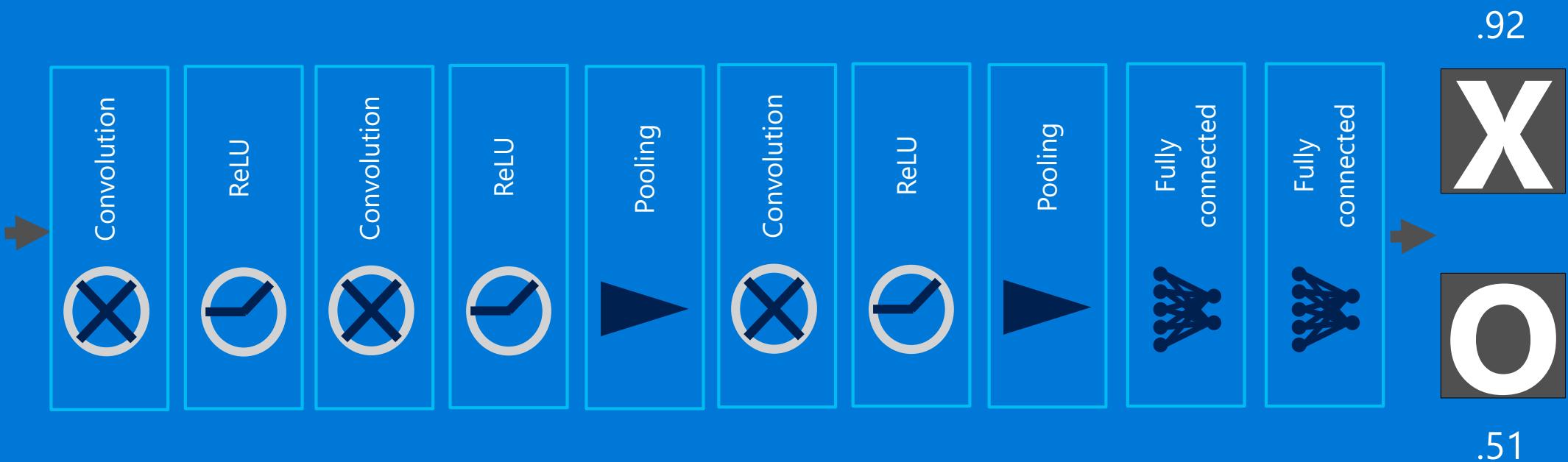
-1 -1 -1 -1 -1 -1 -1 -1 -1
-1 1 -1 -1 -1 -1 -1 1 -1
-1 -1 1 -1 -1 1 -1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 1 -1 -1 -1 -1 1 1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1



Backprop

	Right answer	Actual answer	Error
X	1	0.92	0.08
O			

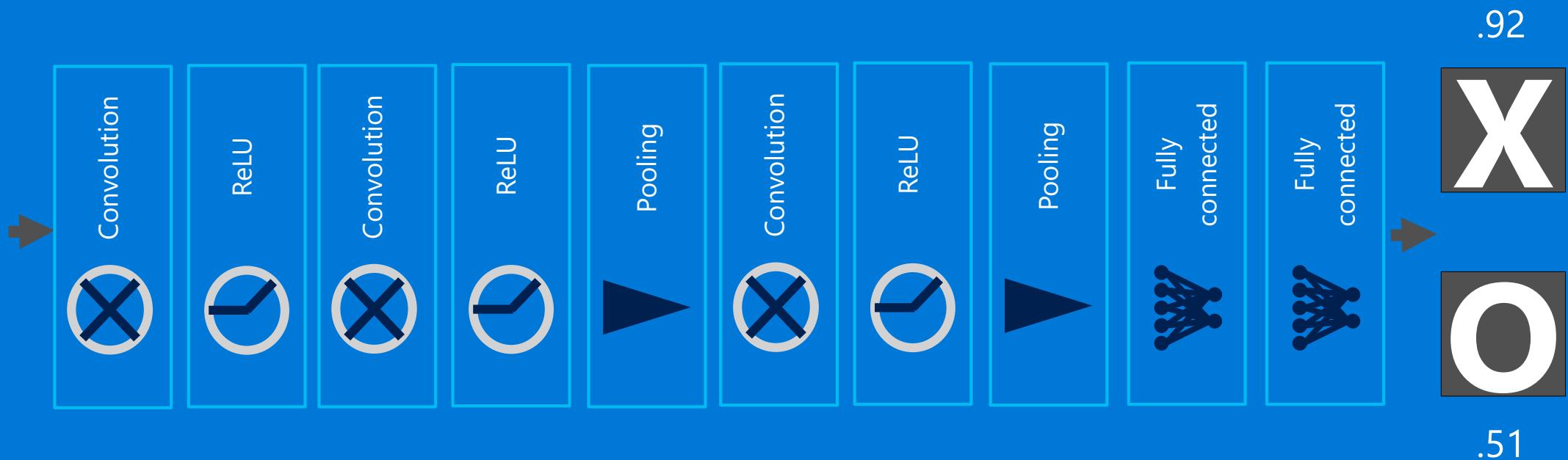
-1 -1 -1 -1 -1 -1 -1 -1 -1
-1 1 -1 -1 -1 -1 -1 1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 1 -1 -1 -1 -1 1 1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1



Backprop

	Right answer	Actual answer	Error
X	1	0.92	0.08
O	0	0.51	0.49

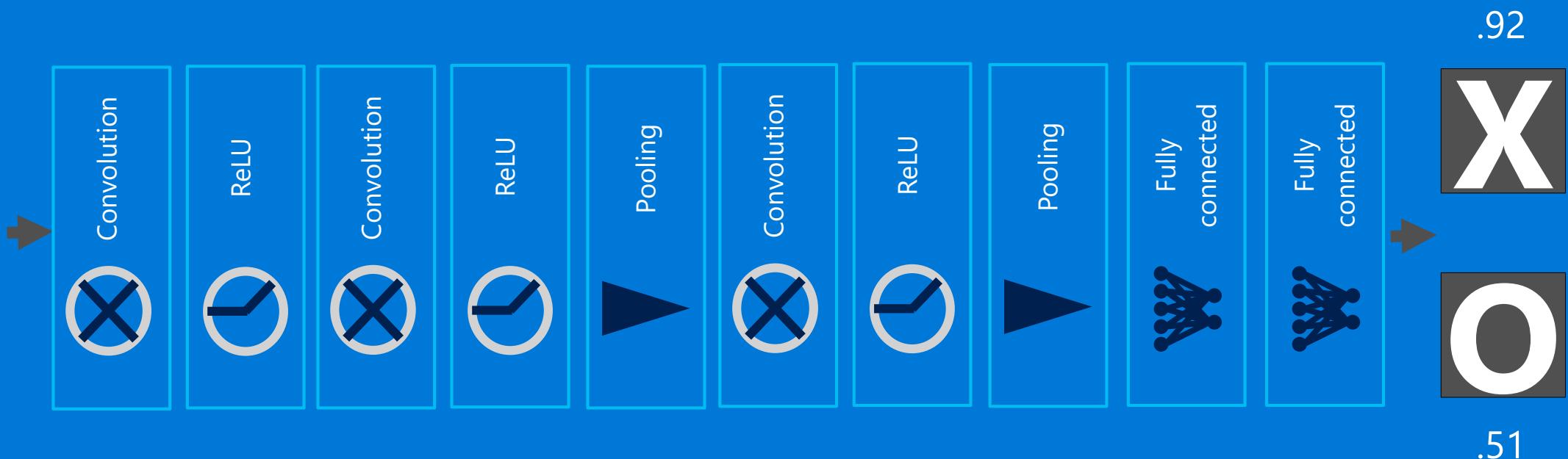
-1 -1 -1 -1 -1 -1 -1 -1 -1
-1 1 -1 -1 -1 -1 -1 1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 1 -1 -1 -1 -1 1 1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1



Backprop

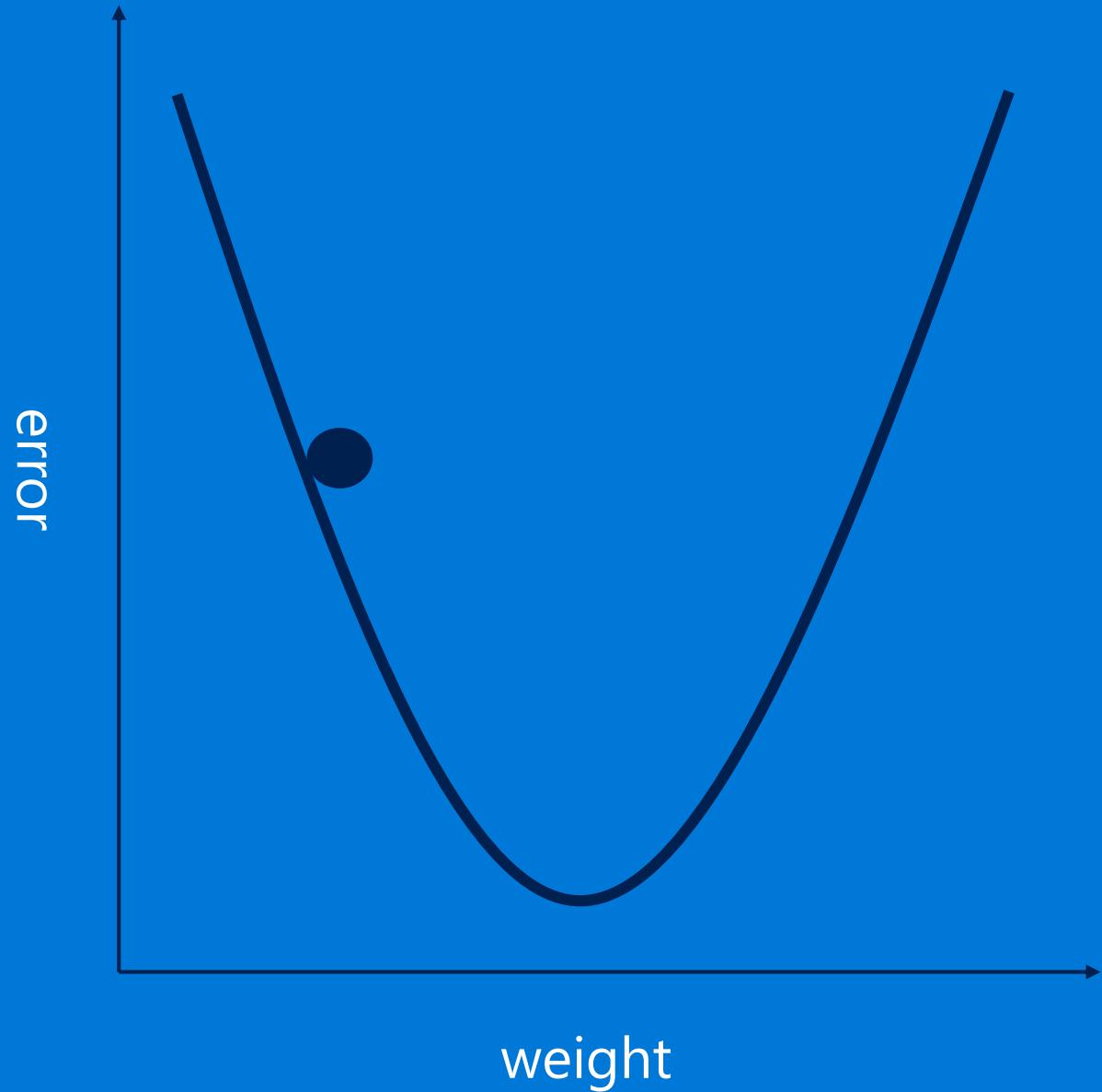
	Right answer	Actual answer	Error
X	1	0.92	0.08
O	0	0.51	0.49
Total			0.57

-1 -1 -1 -1 -1 -1 -1 -1 -1
-1 1 -1 -1 -1 -1 -1 1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 -1 -1 -1 -1
-1 -1 -1 1 -1 1 -1 -1 -1
-1 -1 1 -1 -1 -1 1 -1 -1
-1 1 -1 -1 -1 -1 1 1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1



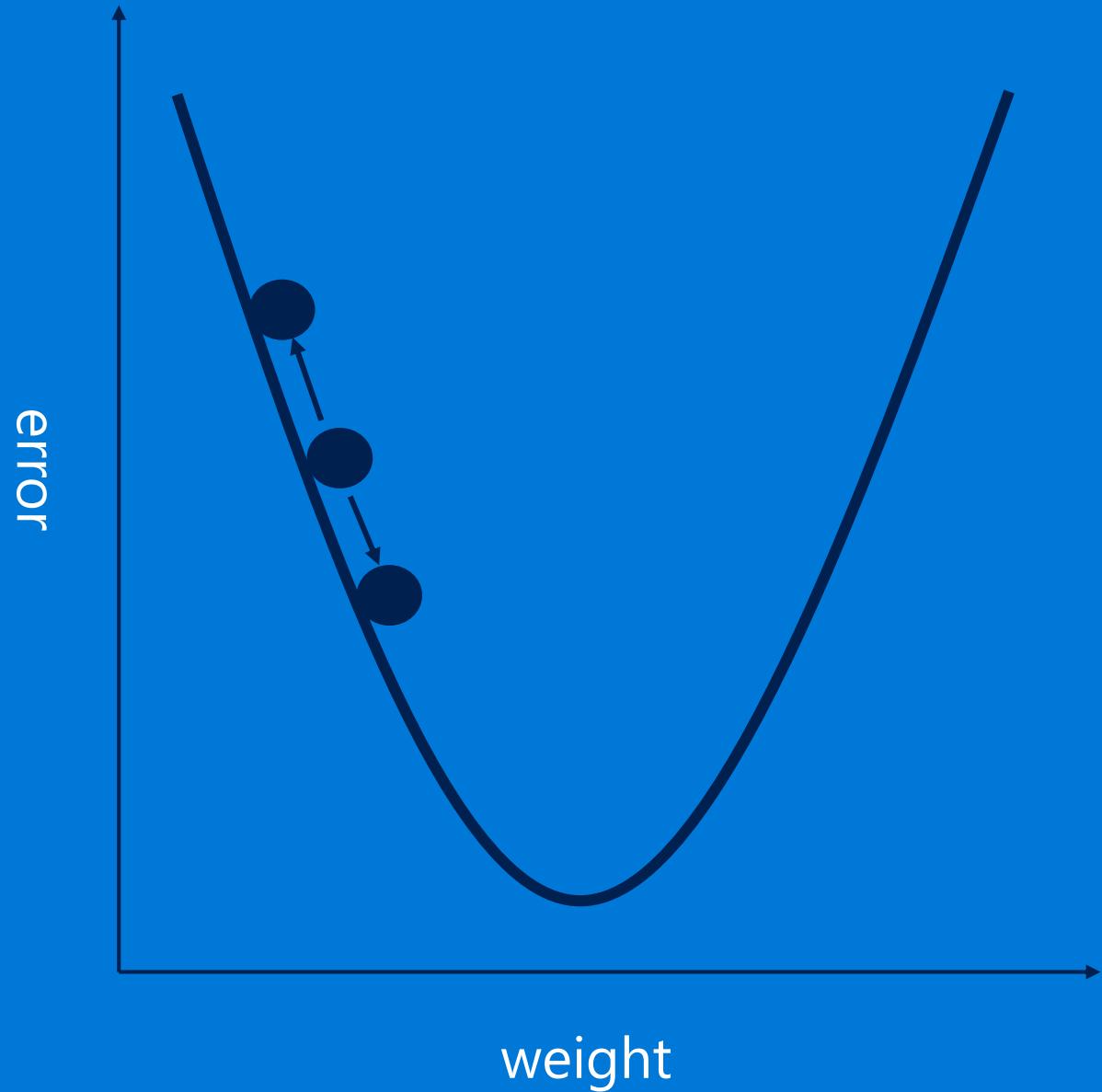
Gradient descent

- For each feature pixel and voting weight, adjust it up and down a bit and see how the error changes.



Gradient descent

- For each feature pixel and voting weight, adjust it up and down a bit and see how the error changes.



Hyperparameters (knobs)

- Convolution
- Number of features
- Size of features
- Pooling
- Window size
- Window stride
- Fully Connected
- Number of neurons

Architecture

- How many of each type of layer?
- In what order?

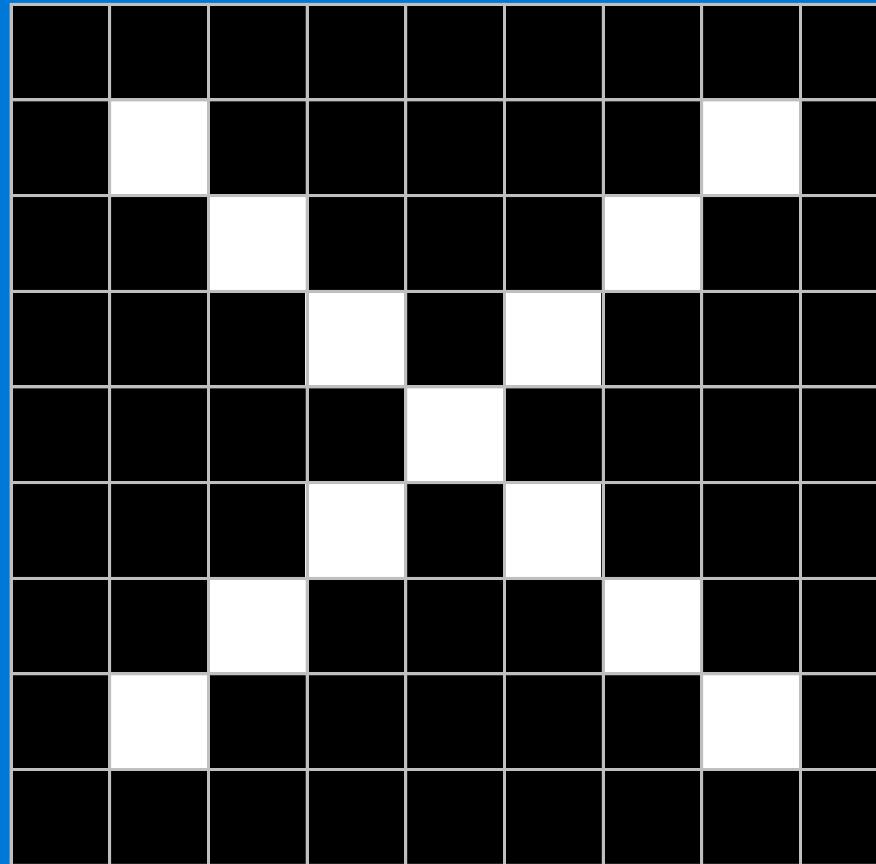
Not just images

- Any 2D (or 3D) data.
- Things closer together are more closely related than things far away.

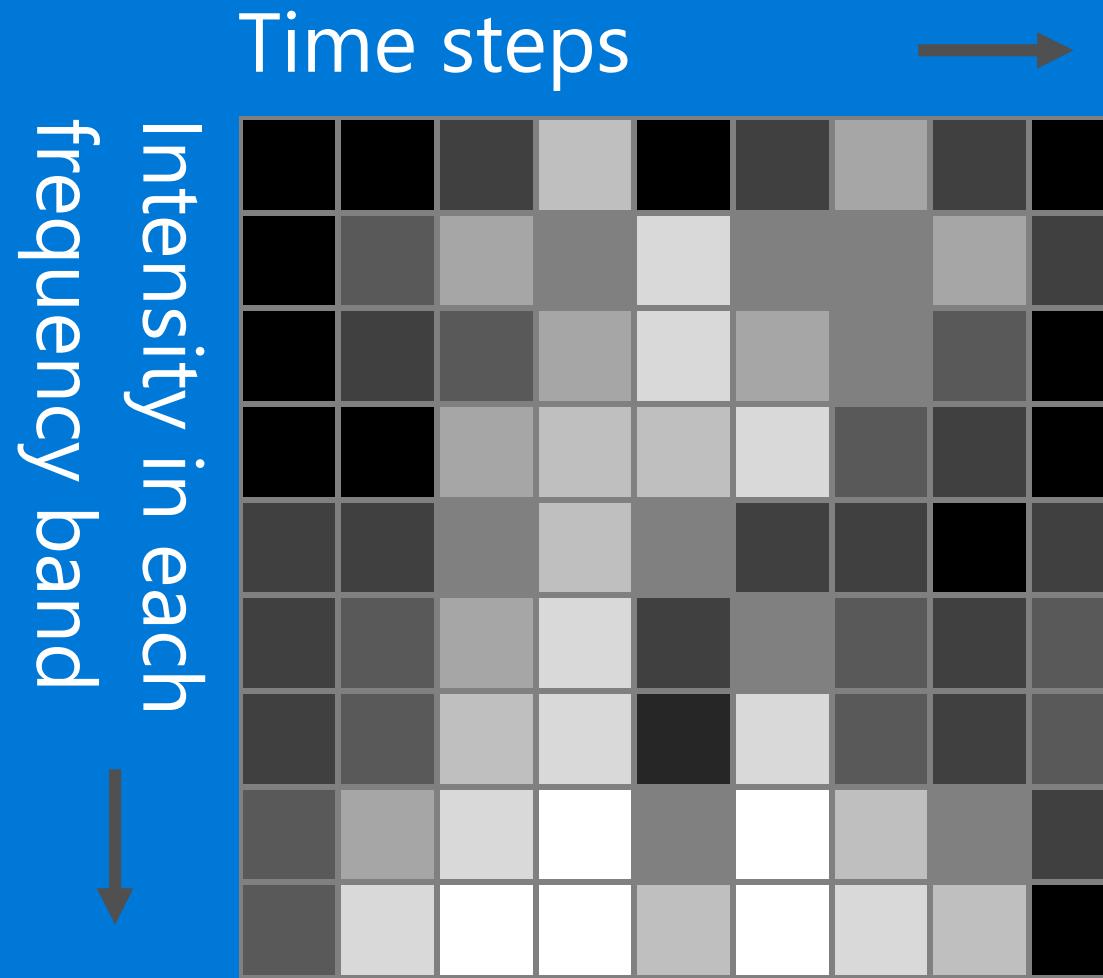
Images

Columns of pixels →

Rows of pixels ↓



Sound

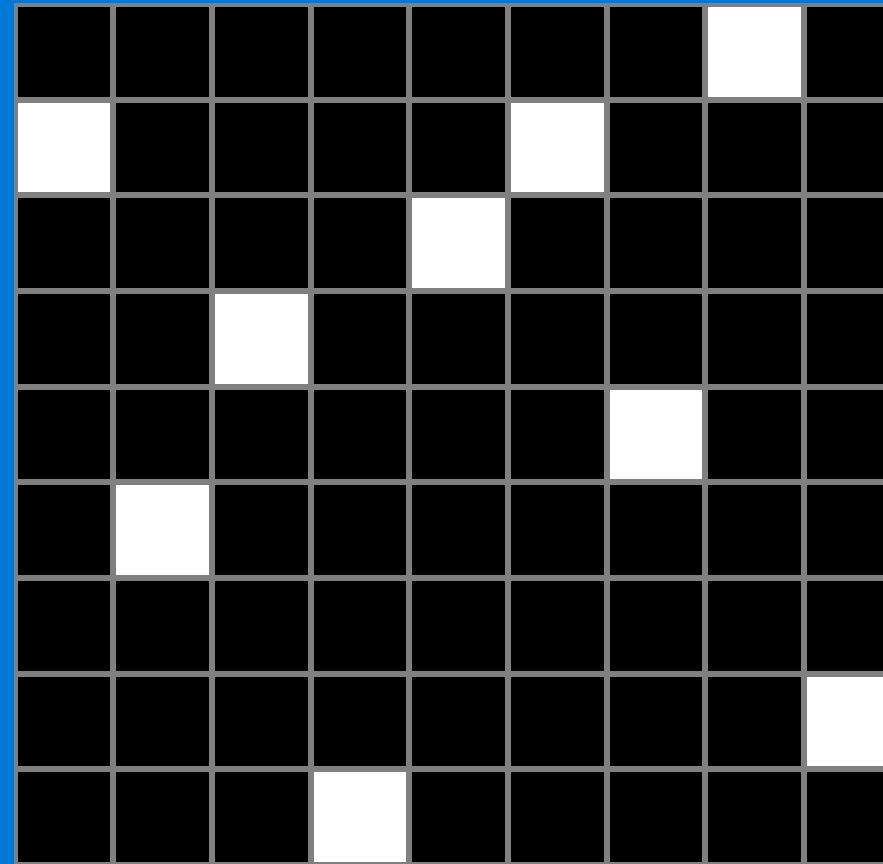


Text

Position in
sentence



Words in
dictionary



Limitations

- ConvNets only capture local “spatial” patterns in data.
- If the data can’t be made to look like an image, ConvNets are less useful.

Customer data

Name, age,
address, email,
purchases,
browsing activity,...



Customers



A	22	1A	a@a	1	aa	a1.a	123	aa1
B	33	2B	b@b	2	bb	b2.b	234	bb2
C	44	3C	c@c	3	cc	c3.c	345	cc3
D	55	4D	d@d	4	dd	d4.d	456	dd4
E	66	5E	e@e	5	ee	e5.e	567	ee5
F	77	6F	f@f	6	ff	f6.f	678	ff6
G	88	7G	g@g	7	gg	g7.g	789	gg7
H	99	8H	h@h	8	hh	h8.h	890	hh8
I	111	9I	i@i	9	ii	i9.i	901	ii9

Rule of thumb

- If your data is just as useful after swapping any of your columns with each other, then you can't use Convolutional Neural Networks.

In a nutshell

- ConvNets are great at finding patterns and using them to classify images.

- Image Analytics After Azure:
No Complex Coding of Algorithms

Azure Encapsulates all complexities and exposing it as RESTful APIs

Programming Language Agnostic

Take care of only the Business Logic and not on the math + statistical implementations of algorithms

Azure Cognitive Services



Build applications that understand people

Intelligence	Vision	Speech	Language	Knowledge	Search
Cognitive Services	Computer Vision	Speaker Recognition	Text Analytics	Academic Knowledge	Bing Search API
Bot Framework	Face	Speech	Bing Speller	Entity Linking Service	Bing Image Search API
Cortana	Emotion	CRIS	Web Language Model	Knowledge Exploration Service	Bing Video Search API
Video			Linguistic Analysis	Recommendations	Bing News Search API
			Language Understanding Intelligent Service		Bing Auto Suggest API

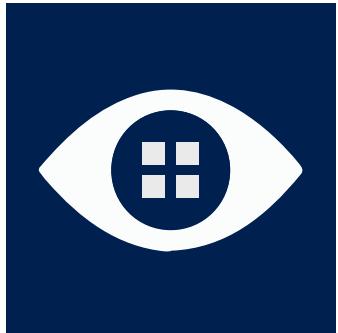
- Faces, images, emotion recognition and video intelligence
- Spoken language processing, speaker recognition, custom speech recognition
- Natural language processing, sentiment and topics analysis, spelling errors

- Complex tasks processing, knowledge exploration, intelligent recommendations
- Bing engine capabilities for Web, Autosuggest, Image, Video and News



Vision

From faces to feelings, allow your apps to understand images and video



Computer Vision API

Distill actionable information from images



Face API

Detect, identify, analyze, organize, and tag faces in photos



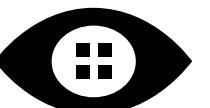
Emotion API

Personalize experiences with emotion recognition



Video API

Analyze, edit, and process videos within your app



Computer Vision APIs

Analyze an image

Understand content within an image

OCR

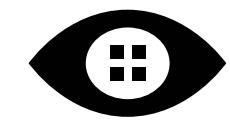
Detect and recognize words within an image

Generate thumbnail

Scale and crop images, while retaining key content

Recognize Celebrities

Thanks to domain specific models, ability to recognize 200K celebrities from business, politics, sports and entertainment around the World



Analyze image



Type of image

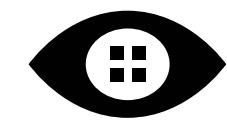
Clip Art Type	0 Non-clipart
Line Drawing Type	0 Non-Line Drawing
Black & White Image	False

Content of image

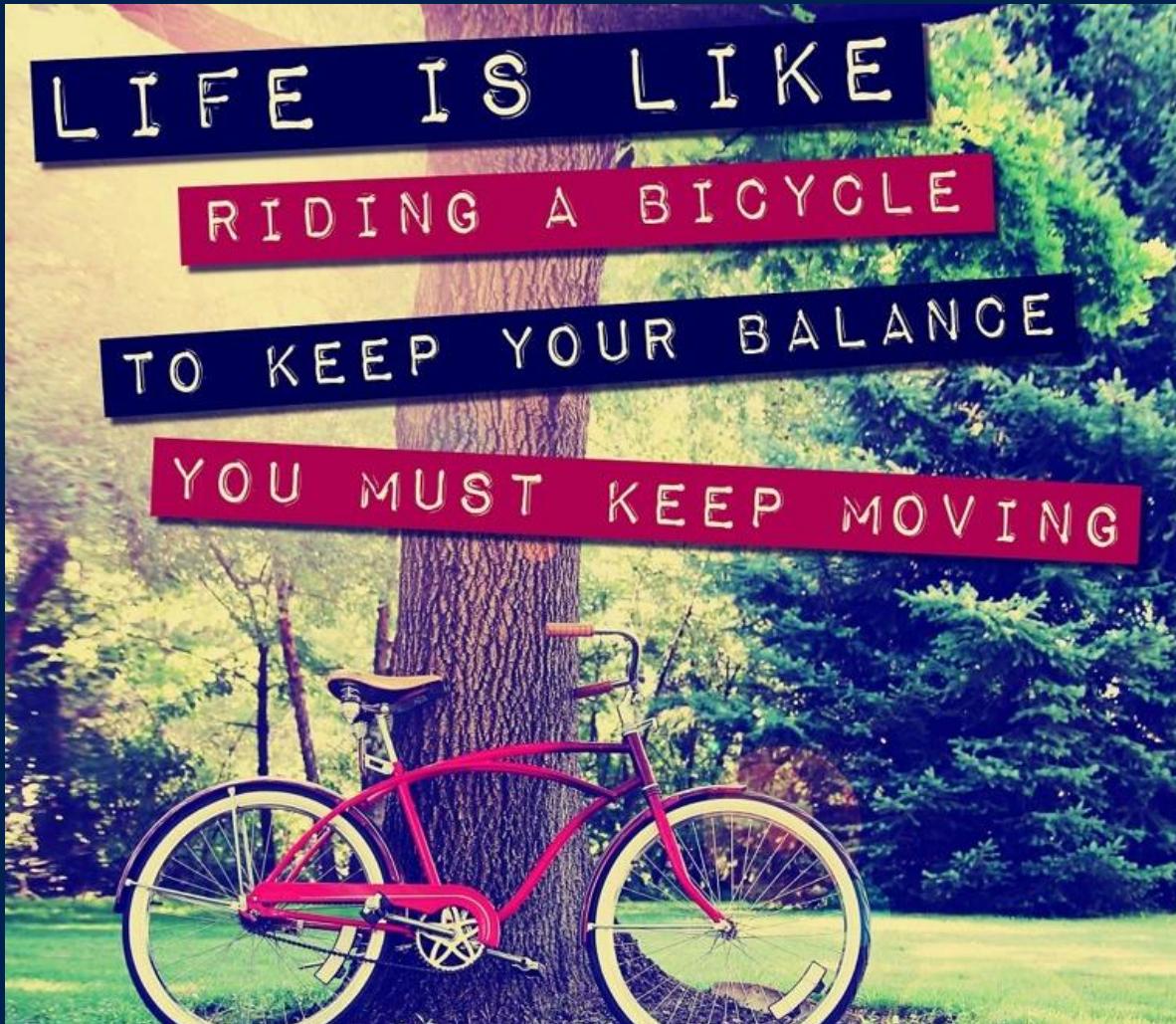
Categories	[{"name": "people_swimming", "score": 0.099609375}]
Adult Content	False
Adult Score	0.18533889949321747
Faces	[{"age": 27, "gender": "Male", "faceRectangle": {"left": 472, "top": 258, "width": 199, "height": 199}}]

Image colors

Dominant Color Background	White
Dominant Color Foreground	Grey
Dominant Colors	White
Accent Color	



OCR



Good at

Scanned documents

Photos with text

Fine grained location information

Lif

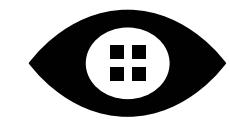
Rii

TC

YC

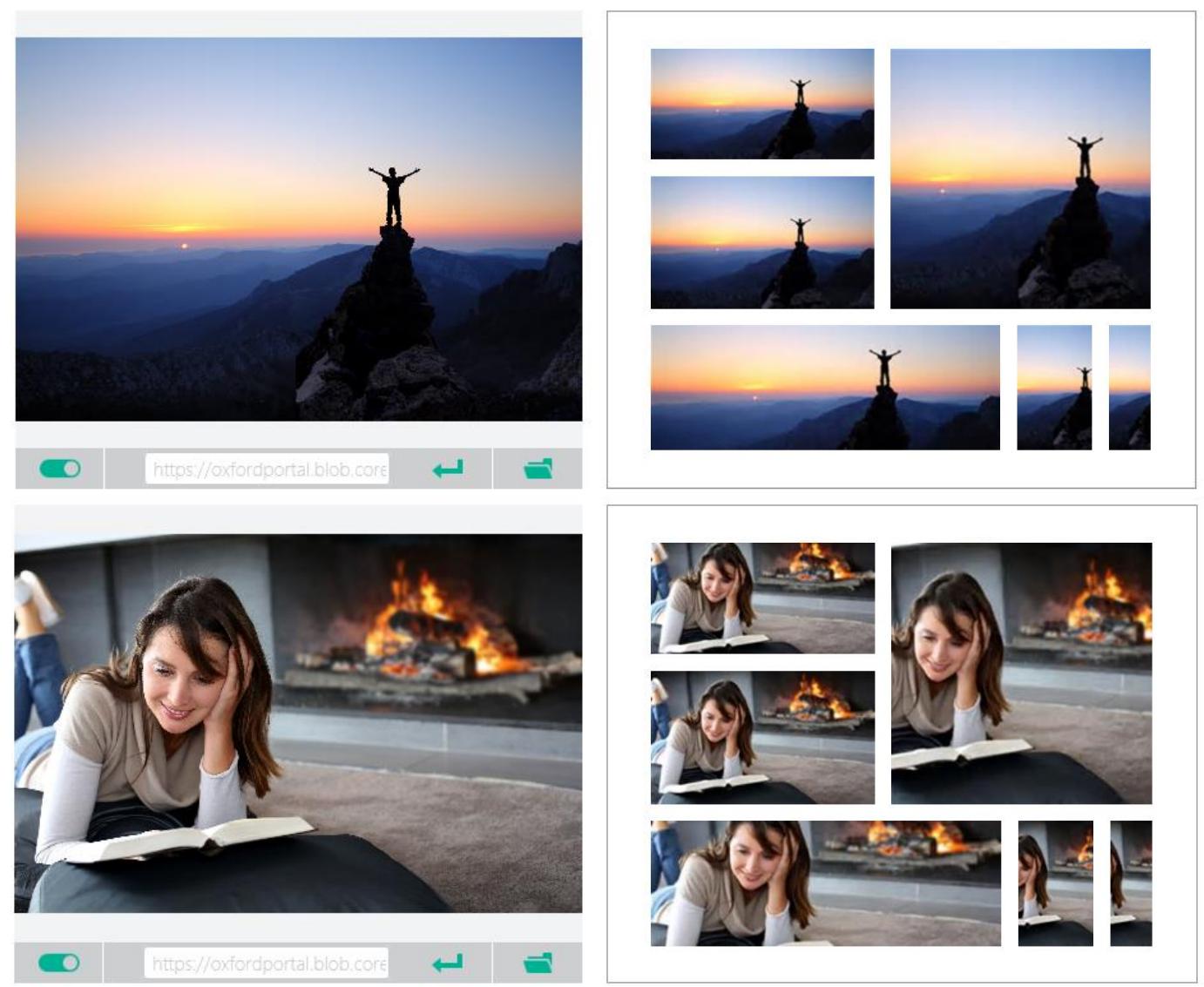
```
JSON
{
  "language": "en",
  "orientation": "Up",
  "text": [
    {
      "boundingBox": "41,77,918,440",
      "lines": [
        {
          "boundingBox": "41,77,723,89",
          "words": [
            {
              "boundingBox": "41,102,225,64",
              "text": "LIFE"
            },
            {
              "boundingBox": "356,89,94,62",
              "text": "IS"
            },
            {
              "boundingBox": "539,77,225,64",
              "text": "LIKE"
            }
          ]
        }
      ]
    }
  ]
}
```

)



Smart thumbnail

Smart cropping **off**





Emotion APIs

Recognize emotions

Detect emotions based on facial expressions
in photos and videos



Emotion APIs



Face detection

```
"faceRectangle": { "width": 193,  
                  "height": 193,  
                  "left": 326,  
                  "top": 204} ...
```

Emotion scores

```
"scores": { "anger": 5.182241e-8,  
            "contempt": 0.0000242813,  
            "disgust": 5.621025e-7,  
            "fear": 0.00115027453,  
            "happiness": 1.06114619e-8,  
            "neutral": 0.003540177,  
            "sadness": 9.30888746e-7,  
            "surprise": 0.9952837}
```



Face APIs

Face detection

Detect faces and their attributes within an image

Face verification

Check if two faces belong to the same person

Similar face searching

Find similar faces within a set of images

Face grouping

Organize many faces into groups

Face identification

Search which person a face belongs to



Face APIs



Detection

```
"faceRectangle": {"width": 193, "height": 193, "left": 326, "top": 204}
```

...

Feature attributes

```
"attributes": { "age": 42, "gender": "male",  
    "headPose": { "roll": "8.2", "yaw": "-37.8", "pitch": "0.0" } }
```

Grouping



Identification

Jasper Williams



Video APIs

Stabilization

Smooth and stabilize shaky video

Face detection and tracking

Detect and track faces in videos

Motion detection

Detect when motion occurs



Stabilization

The Stabilization API provides automatic video stabilization and smoothing for shaky videos

This API uses many of the same technologies found in Microsoft Hyperlapse

Best For:

Small camera motions, with or without rolling shutter effects
(e.g., holding a static camera, walking with a slow speed)





Face detection and tracking

High precision face location detection and tracking

Can detect up to 64 human faces in a video (no smaller than 24x24 pixels)

Detected and tracked faces are returned with coordinates and a Face ID to track throughout the video



Time (sec)	Face ID	x, y	Width, height
0	0	0.59, 0.23	0.09, 0.16
0	1	0.38, 0.15	0.07, 0.12
1	0	0.54, 0.25	0.09, 0.15
1	1	0.23, 0.18	0.07, 0.12



Motion detection

Indicates when motion occurs against a fixed background (e.g., surveillance video)

Trained to reduce false alarms, such as lighting and shadow changes

Current limitations:

- No support for night-vision videos
- Semi-transparent and small objects are not detected well



Start time	End time	In region
1.9	3.6	0
5.2	15.1	0



Speech

Hear and speak to your users by filtering noise, identifying speakers, and understanding intent



Bing Speech API

Convert speech to text and back again, and understand its intent



Speaker Recognition API

Give your app the ability to know who's talking



Custom Recognition Intelligent Service

Fine-tune speech recognition for anyone, anywhere



Speech APIs

Voice recognition (speech to text)
Converts spoken audio to text

Voice output (text to speech)
Synthesize audio from text

Speech intent recognition
Convert spoken audio to intent



Voice recognition

	REST API	Client library
SUPPORTED PLATFORMS	Any	Windows, Android, iOS
DATA SUPPORT	Yes	Yes
MIC SUPPORT	No	Yes
SILENCE DETECTION ON MIC	No	Yes
LENGTH OF UTTERANCE	Short	Short and long
NUMBER OF RESPONSES	n-best response back	Multiple partial results, n-best (short), and multiple phrases (long)

Same technology that supports Microsoft offerings of Xbox, Windows, and Cortana



Voice recognition

	Short form	Long form
Duration of Audio	< 15 seconds	< 2 minutes
Final Result	n-best choice	Best choice, delivered at sentence pauses
Partial Results	Yes	Yes



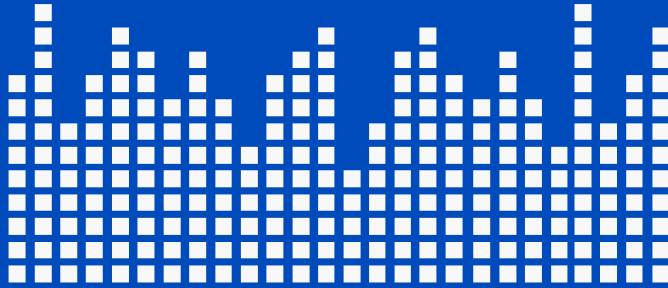
450 6th St.
San Francisco

***** Final N-BEST Results *****

```
[0] Confidence=Normal Text="450 six St San Francisco."
[1] Confidence=Normal Text="For 50 six St San Francisco."
[2] Confidence=Normal Text="456th St San Francisco."
[3] Confidence=Normal Text="450 six St in San Francisco."
[4] Confidence=Normal Text="456 St San Francisco."
```



Voice output



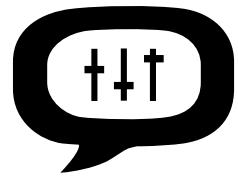
Synthesize audio from text via POST request
Maximum audio return of 15 seconds
17 languages supported

```
<speak version="1.0"  
xmlns="http://www.w3.org/2001/10/synthesis"  
xmlns:mstts="http://www.w3.org/2001/mstts"  
xml:lang="en-US">  
<voice name="Microsoft Server Speech Text to Speech  
Voice (en-US, ZiraRUS)">
```

Synthesize audio from text, to speak to your users.
</voice></speak>

A white silhouette of a person's head and shoulders, facing right, positioned on the right side of the slide. A speech bubble originates from their mouth.

Synthesize
audio from text,
to speak to
your users



Custom Recognition

Customize both language
and acoustic models

Tailor speech recognition to your app and environment



Custom Recognition Intelligent Service

Create custom language models for the vocabulary of the application

Adapt acoustic models to better match the expected environment
of the application's users

Deploy to a custom endpoint and access from any device





Speaker recognition API

Speaker verification
Check if two voices are the same

Speaker identification
Identify who is speaking



Speaker recognition APIs



Enrollment

Create a unique voiceprint for a profile

Recognition

After enrolling one or more voices, identify who is speaking from an audio clip

Verification

Confirm if a voice belongs to a previously enrolled profile

‘ Language

Process text and learn how to recognize what users want



Bing Spell Check API

Detect and correct spelling mistakes within your app



Web Language Model API

Leverage the power of language models trained on web-scale data



Linguistic Analysis API

Easily parse complex text with language analysis



Language Understanding Intelligent Service

Teach your apps to understand commands from your users



Text Analytics API

Detect sentiment, key phrases, topics, and language from your text



9#

Bing spell check APIs

State-of-the-art cloud based spelling algorithms
Recognizes a wide variety of spelling errors

Recognize name errors and homonyms in context
Difficult to spot errors that use the context of the words around them

Updates over time
Support for new brands and coined expressions as they emerge

Bing spell check APIs



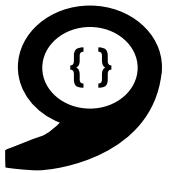
Check a single word or a whole sentence

"Our engineers developed this **four** you!"

Corrected Text: "four" → "for"

Identify errors and get suggestions

```
"spellingErrors": [
  {
    "offset": 5,
    "token": "gona",
    "type": "UnknownToken",
    "suggestions": [
      { "token": "gonna" }
    ]
}
```



Language Understanding

Understand what your users are saying
Use pre-built Bing and Cortana models or create your own



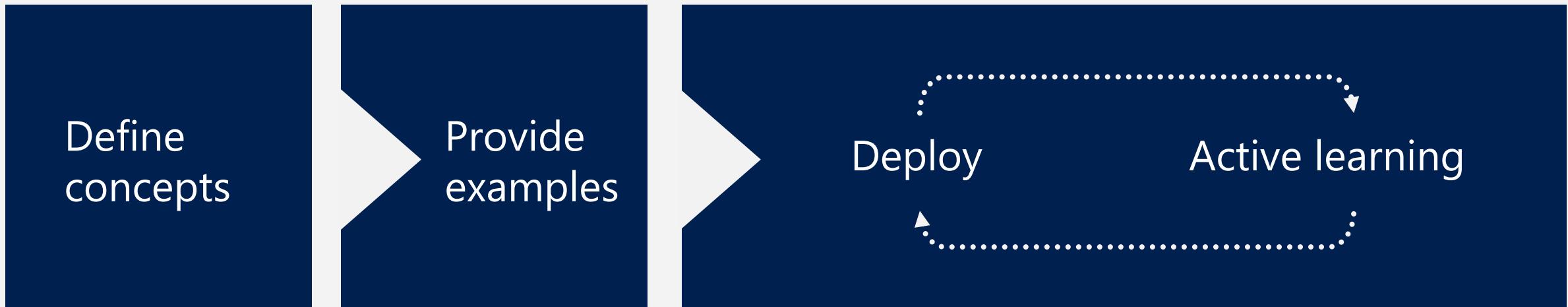
Language understanding intelligent service

Reduce labeling effort with interactive features

Use visualizations to gauge performance and improvements

Leverage speech recognition with seamless integration

Deploy using just a few examples with active learning





Language understanding models



```
{  
  "entities": [  
    {  
      "entity": "flight_delays",  
      "type": "Topic"  
    }  
  ],  
  "intents": [  
    {  
      "intent": "FindNews",  
      "score": 0.99853384  
    },  
    {  
      "intent": "None",  
      "score": 0.07289317  
    },  
    {  
      "intent": "ReadNews",  
      "score": 0.0167122427  
    },  
    {  
      "intent": "ShareNews",  
      "score": 1.0919299E-06  
    }  
  ]  
}
```

ExerciseTracker

New utterances

Search

Suggest

Review labels

Publish

Intents

None

StartActivity

StopActivity

SetHeartRateTarget

Entities

ActivityType

Pre-built Entities

number

Regex Features

No patterns added

Phrase List Features

ActivityWords

Suggest utterances that will improve:

Intent: StartActivity

Select highlight to add another entity or click to clear

begin a jog now

StartActivity(0.96)

Submit

begin bike ride

StartActivity(0.94)

Submit

start tracking a bike ride

StartActivity(0.94)

Submit

Performance analysis

Intents

StartActivity

11 utterances: 11 correctly predicted

StopActivity

5 utterances: 5 correctly predicted

SetHeartRateTarget

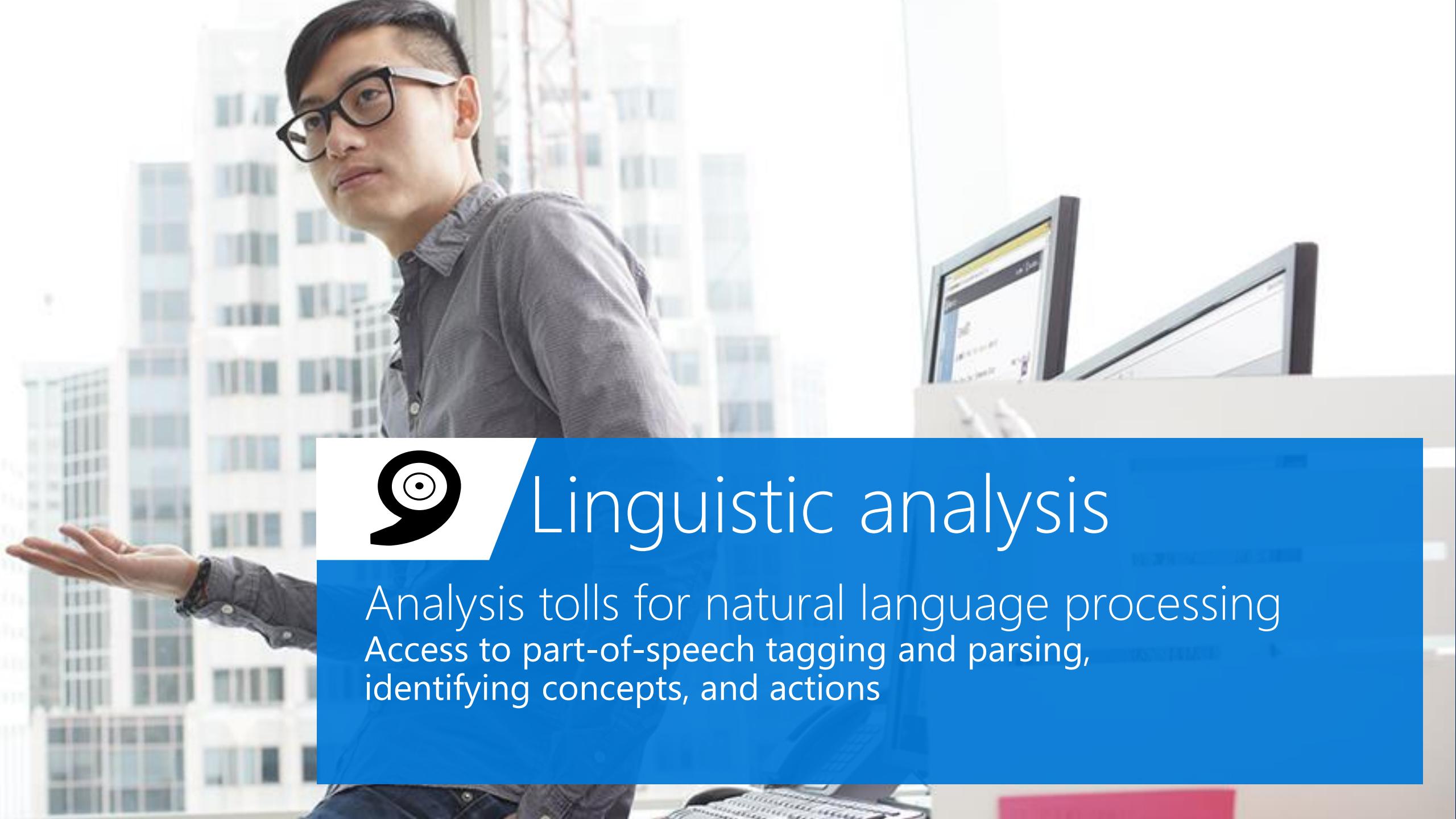
5 utterances: 5 correctly predicted

None

17 utterances: 17 correctly predicted

Correctly predicted

Error (predicted as other intent)

A photograph of a young man with dark hair and glasses, wearing a grey button-down shirt. He is standing in front of a large window with a view of a city skyline. His right arm is extended towards the camera, palm up. In the foreground, there is a blue graphic overlay. On the left side of the overlay, there is a large black number '9' inside a white circle. To the right of the number, the word 'Linguistic analysis' is written in a large, white, sans-serif font.

9 Linguistic analysis

Analysis tools for natural language processing
Access to part-of-speech tagging and parsing,
identifying concepts, and actions



Linguistic Analysis

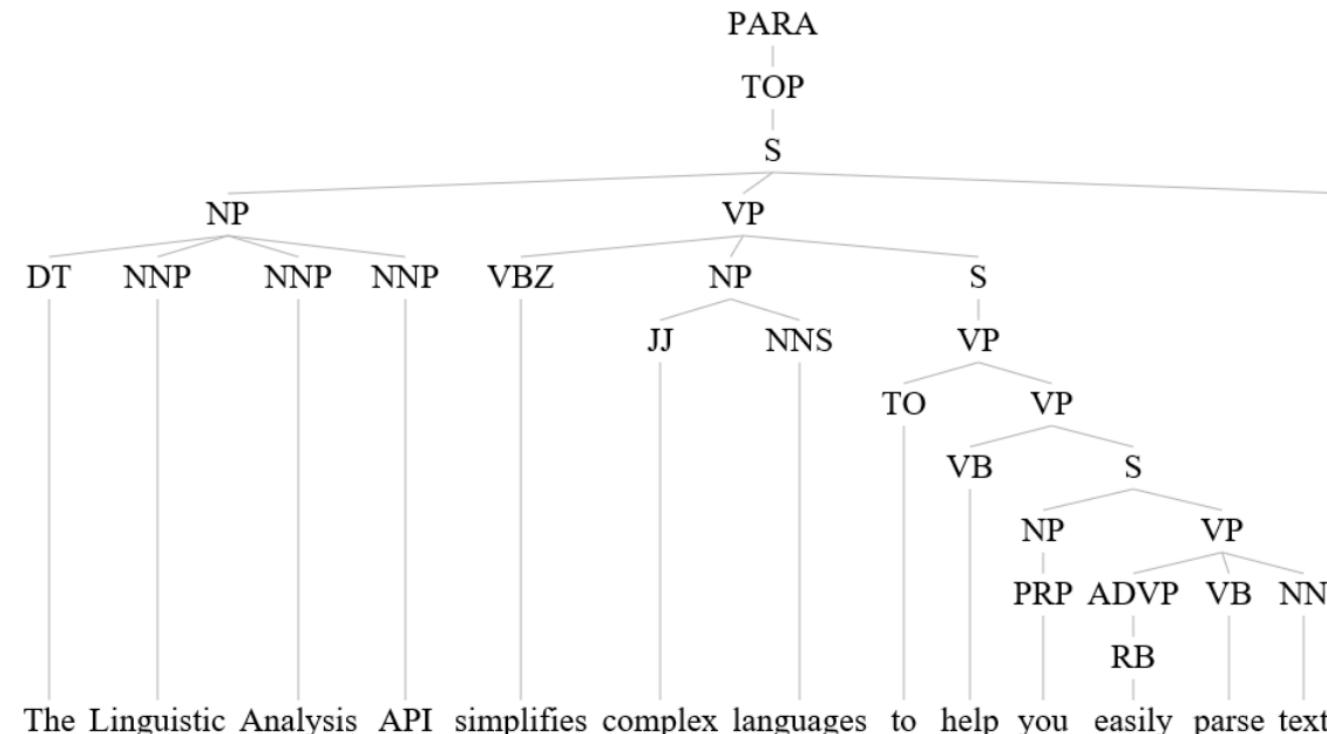
Enter a sentence

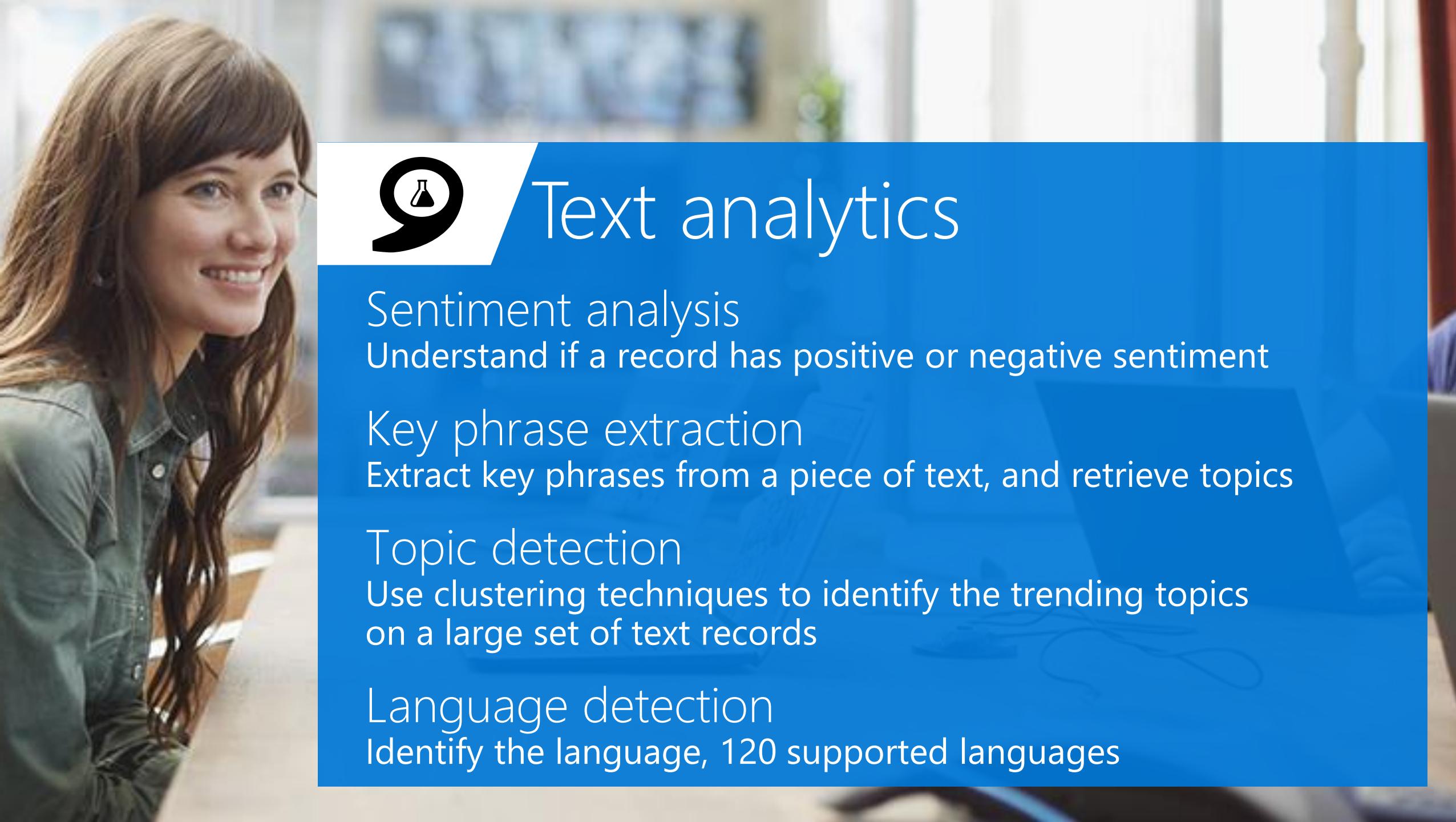
The Linguistic Analysis API simplifies complex languages to help you easily parse text.

POS tags

```
[["DT","NNP","NNP","NNP","VBZ","JJ","NNS","TO","VB","PRP","RB","VBP","NN","."]]
```

Constituency tree





9 Text analytics

Sentiment analysis

Understand if a record has positive or negative sentiment

Key phrase extraction

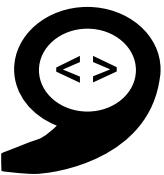
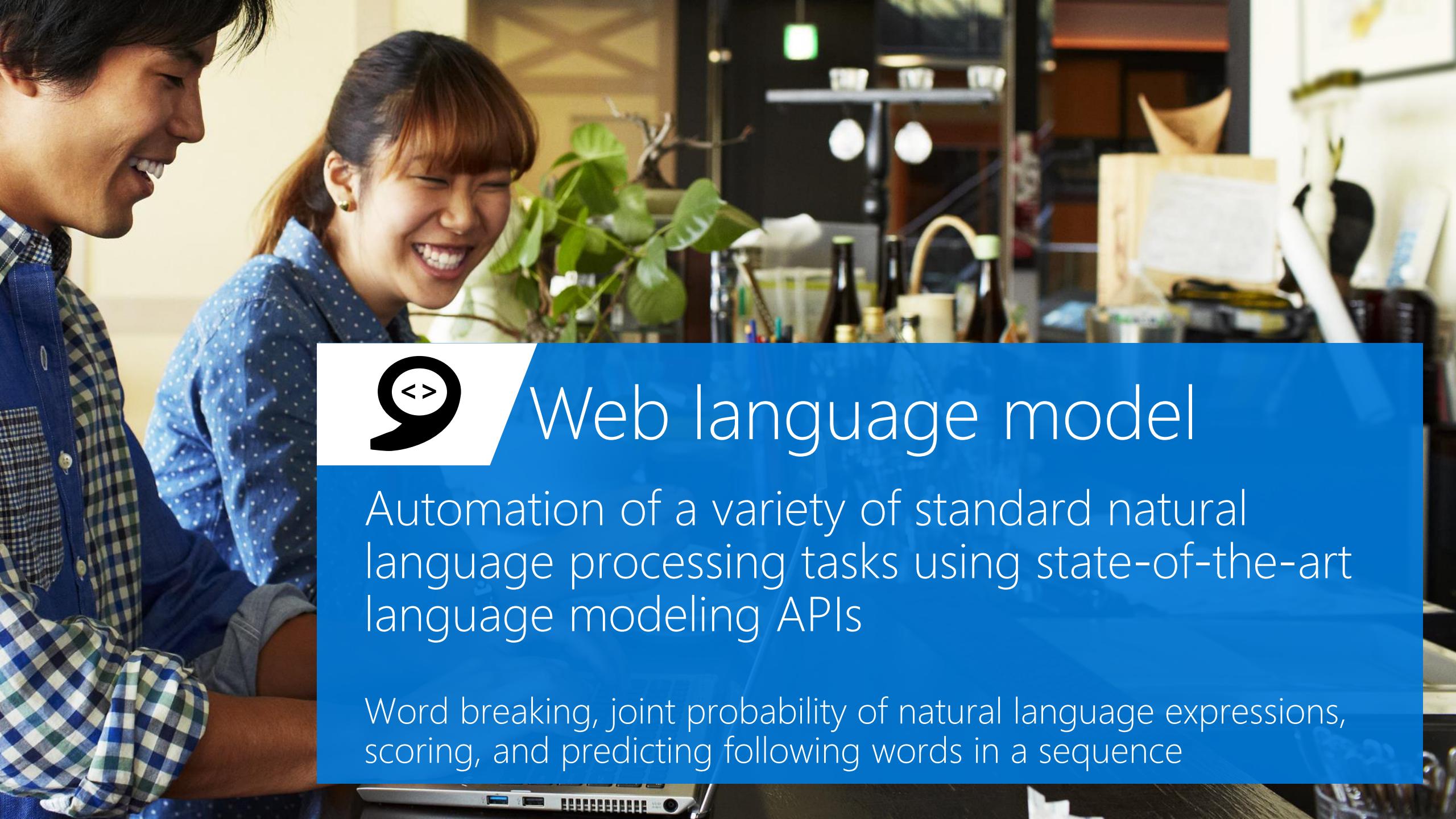
Extract key phrases from a piece of text, and retrieve topics

Topic detection

Use clustering techniques to identify the trending topics
on a large set of text records

Language detection

Identify the language, 120 supported languages



Web language model

Automation of a variety of standard natural language processing tasks using state-of-the-art language modeling APIs

Word breaking, joint probability of natural language expressions, scoring, and predicting following words in a sequence



Knowledge

Tap into rich knowledge amassed from the web, academia, or your own data



Academic Knowledge API

Explore relationships among academic papers, journals, and authors



Knowledge Exploration Service

Add interactive search over structured data to your project



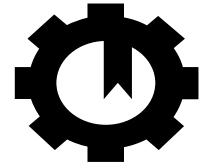
Entity Linking Service

Contextually extend knowledge of people, locations, and events



Recommendations API

Provide personalized product recommendations for your customers



Academic knowledge

Interpret

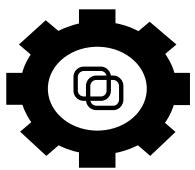
Interprets a natural language user query string. Returns annotated interpretations which can enable rich search-box auto-completion experiences that anticipate what the user is typing

Evaluate

Evaluates a query expression and returns academic knowledge entity results

Calchistogram

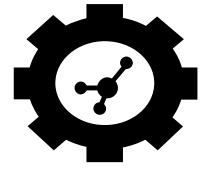
Calculates a histogram of the distribution of attribute values for the academic entities returned by a query expression, such as the distribution of citations by year for a given author



Entity linking

Power your app's data links with named entity recognition and disambiguation
A word might be used as a named entity, a verb, or another word form within a given sentence

The Entity Linking Intelligence Service will recognize and identify each separate entity based on the context



Knowledge exploration

Enable interactive search experiences over structured data via natural language inputs

Attribute histograms

To enable rich visualization and interactive faceted experience

Structured query evaluation

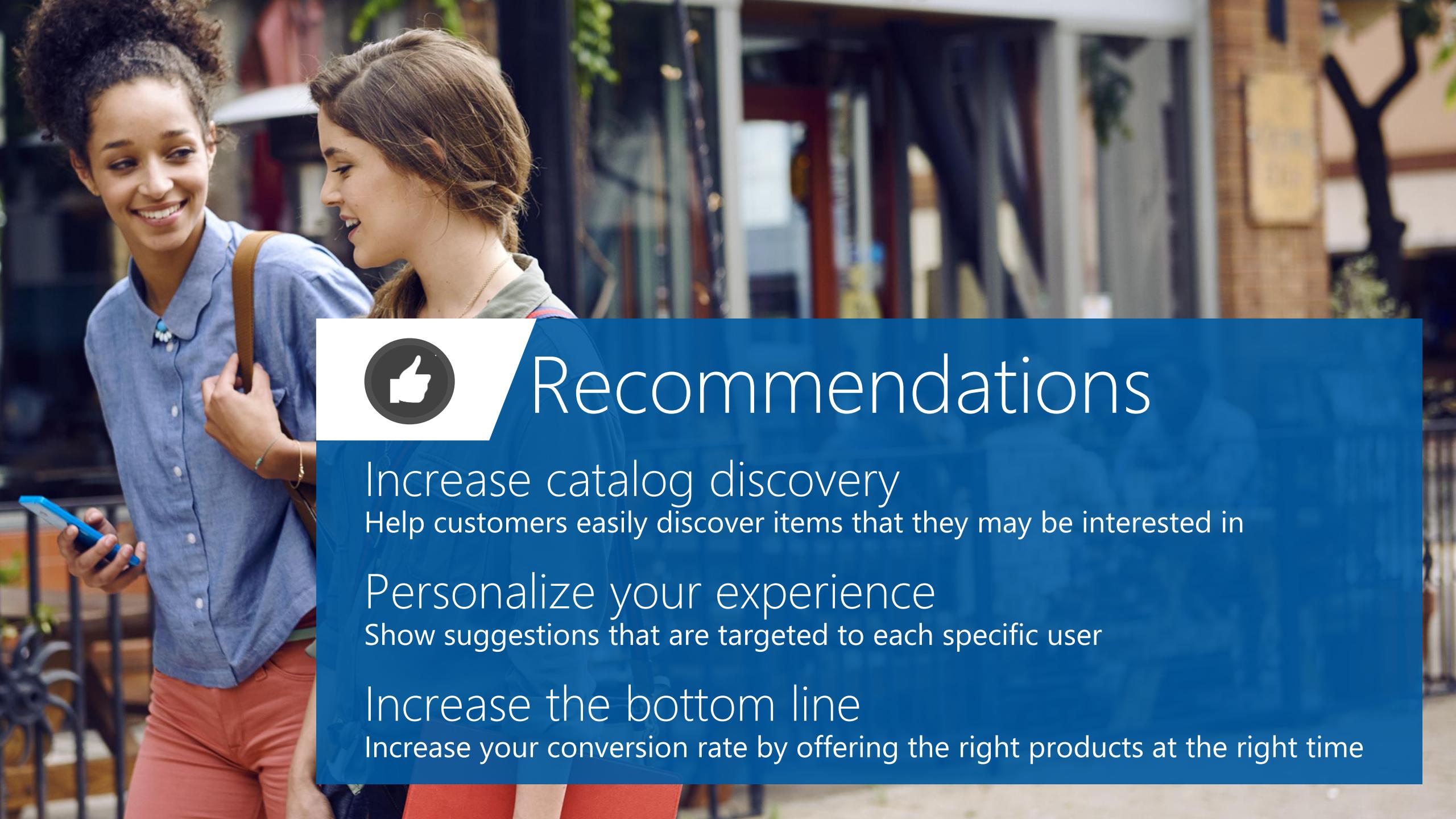
To efficiently retrieve detailed information about matching objects

Query auto-completion

To reduce user effort and help with discovery of rich capabilities

Natural language understanding

To interpret natural language queries into structured query expressions



Recommendations

Increase catalog discovery

Help customers easily discover items that they may be interested in

Personalize your experience

Show suggestions that are targeted to each specific user

Increase the bottom line

Increase your conversion rate by offering the right products at the right time



Search

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



Bing Web Search API

Connect powerful search to your apps



Bing Autosuggest API

Give your app intelligent autosuggest options for searches



Bing Image Search API

Bring advanced image and metadata search to your app



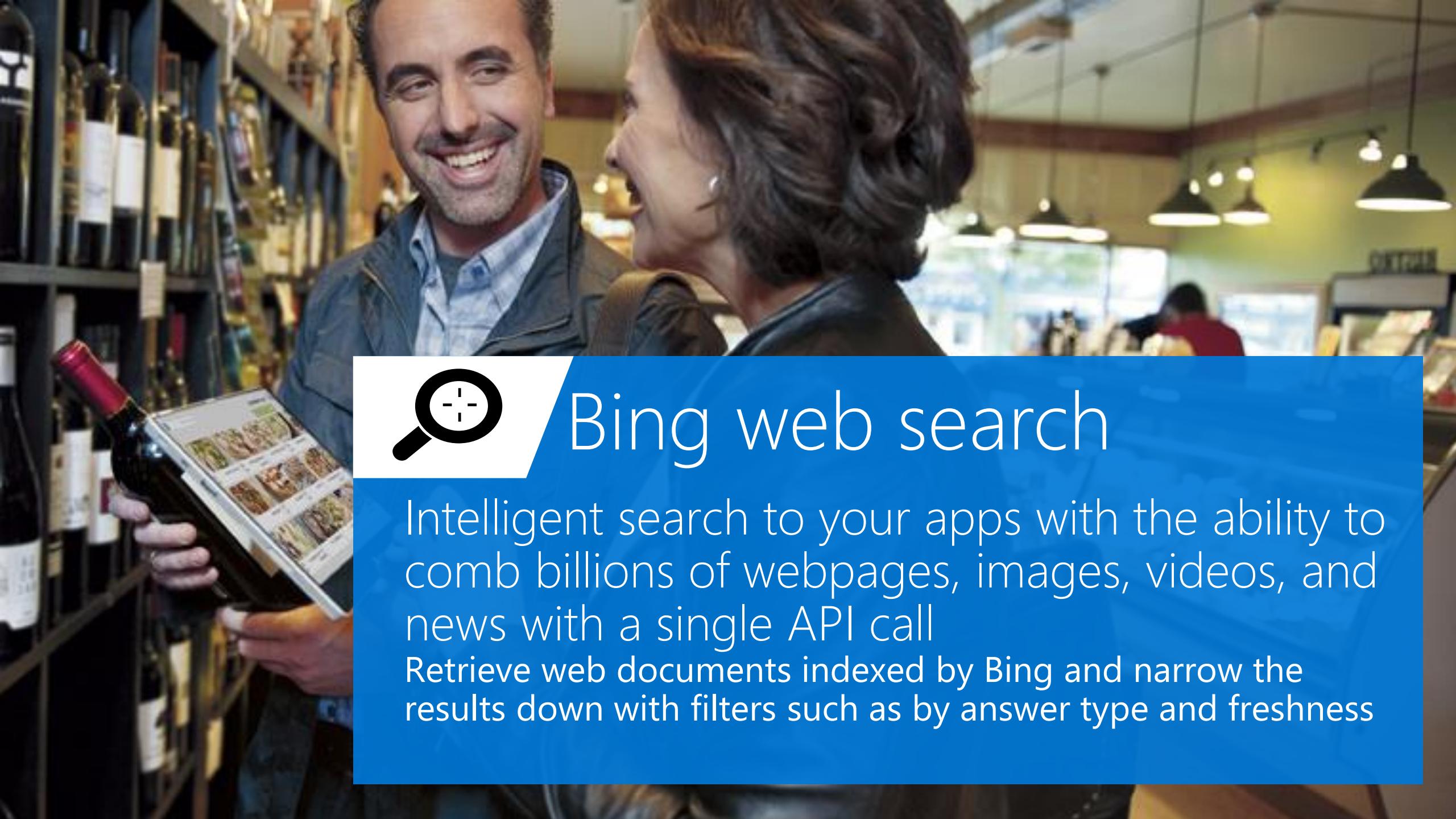
Bing Video Search API

Trending videos, detailed metadata, and rich results



Bing News Search API

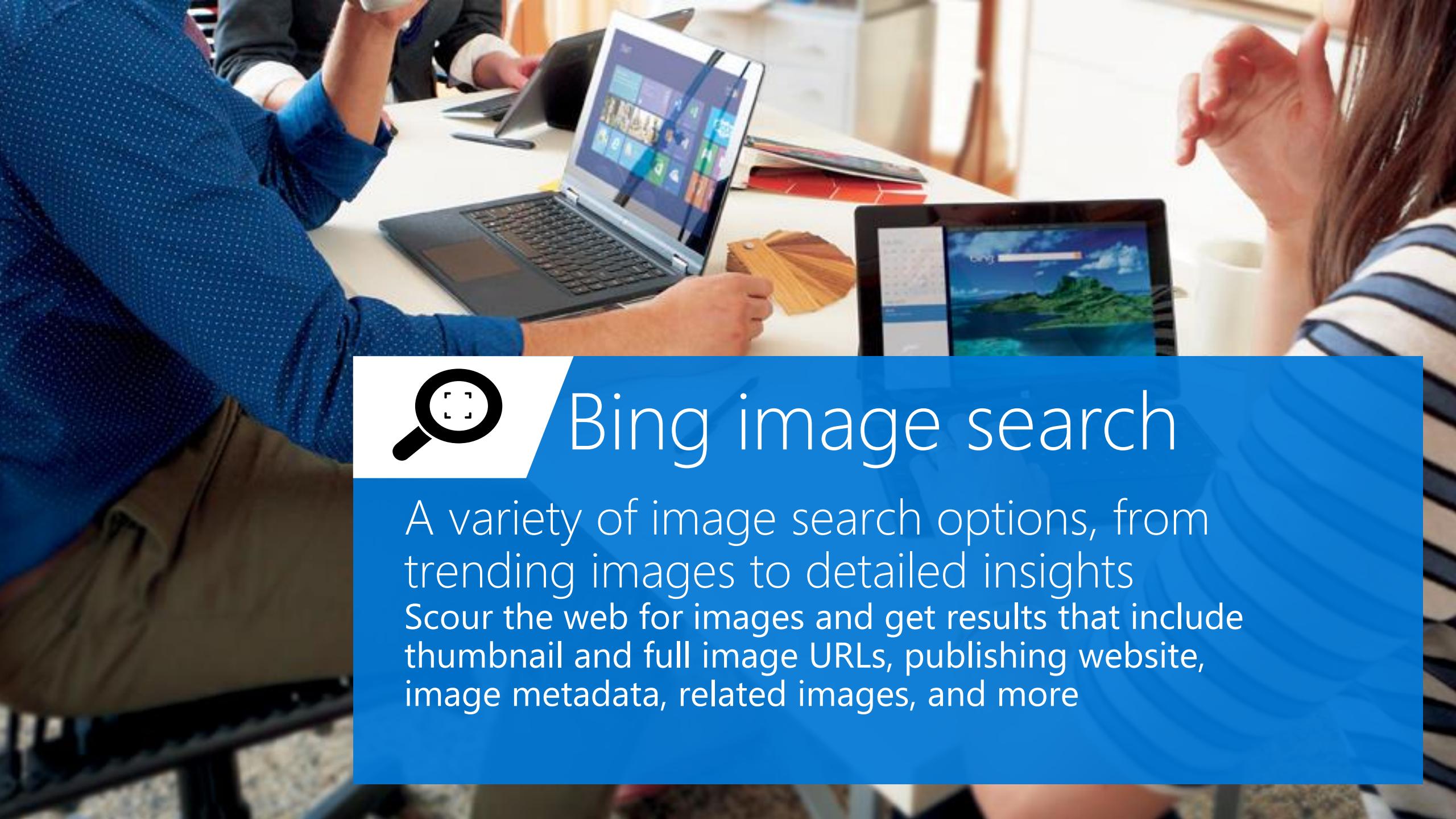
Link your users to robust and timely news searches



Bing web search

Intelligent search to your apps with the ability to comb billions of webpages, images, videos, and news with a single API call

Retrieve web documents indexed by Bing and narrow the results down with filters such as by answer type and freshness



Bing image search

A variety of image search options, from trending images to detailed insights
Scour the web for images and get results that include thumbnail and full image URLs, publishing website, image metadata, related images, and more



Bing video search

A variety of advanced video search features, including trending videos, price, and other useful metadata

Find videos from across the web and get responses that provide useful metadata including creator, encoding format, video size and quality, and source view count



Bing news search

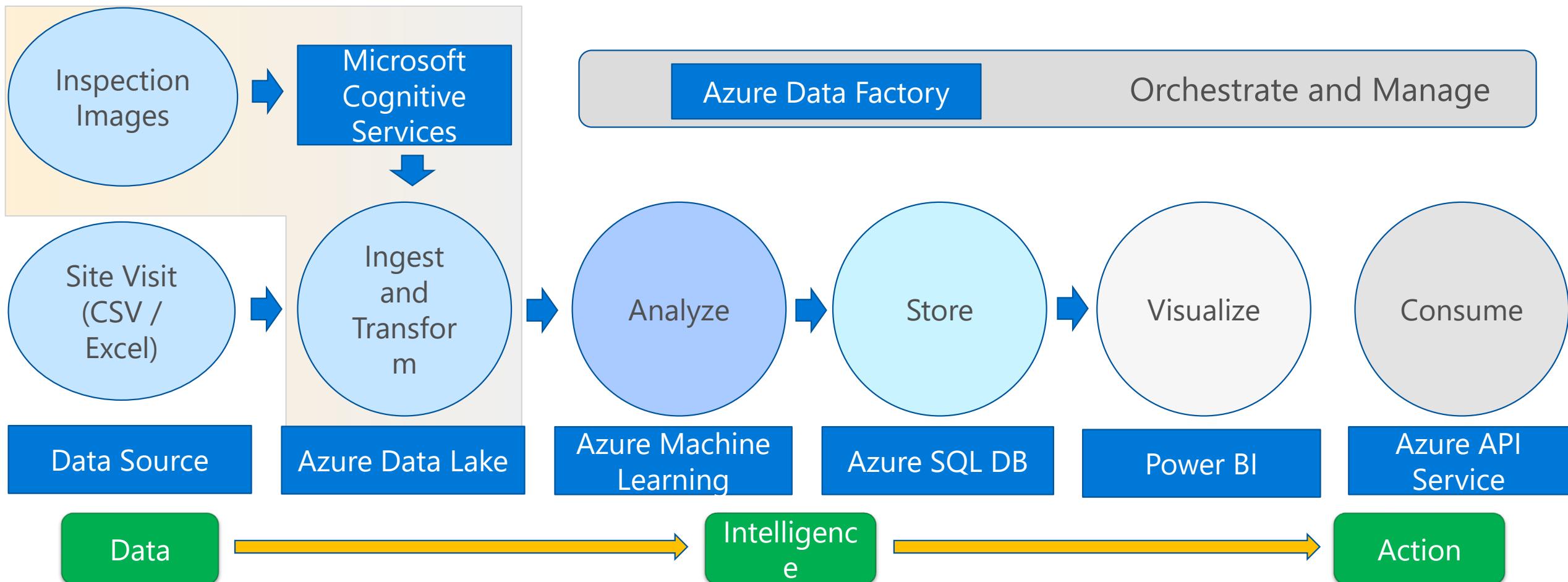
Turn any app into a news desk with world news grouped and filtered by topic, local news, and metadata you can mine



Bing auto suggest

Query completion suggestions capabilities, so users can type less and get to what they want faster

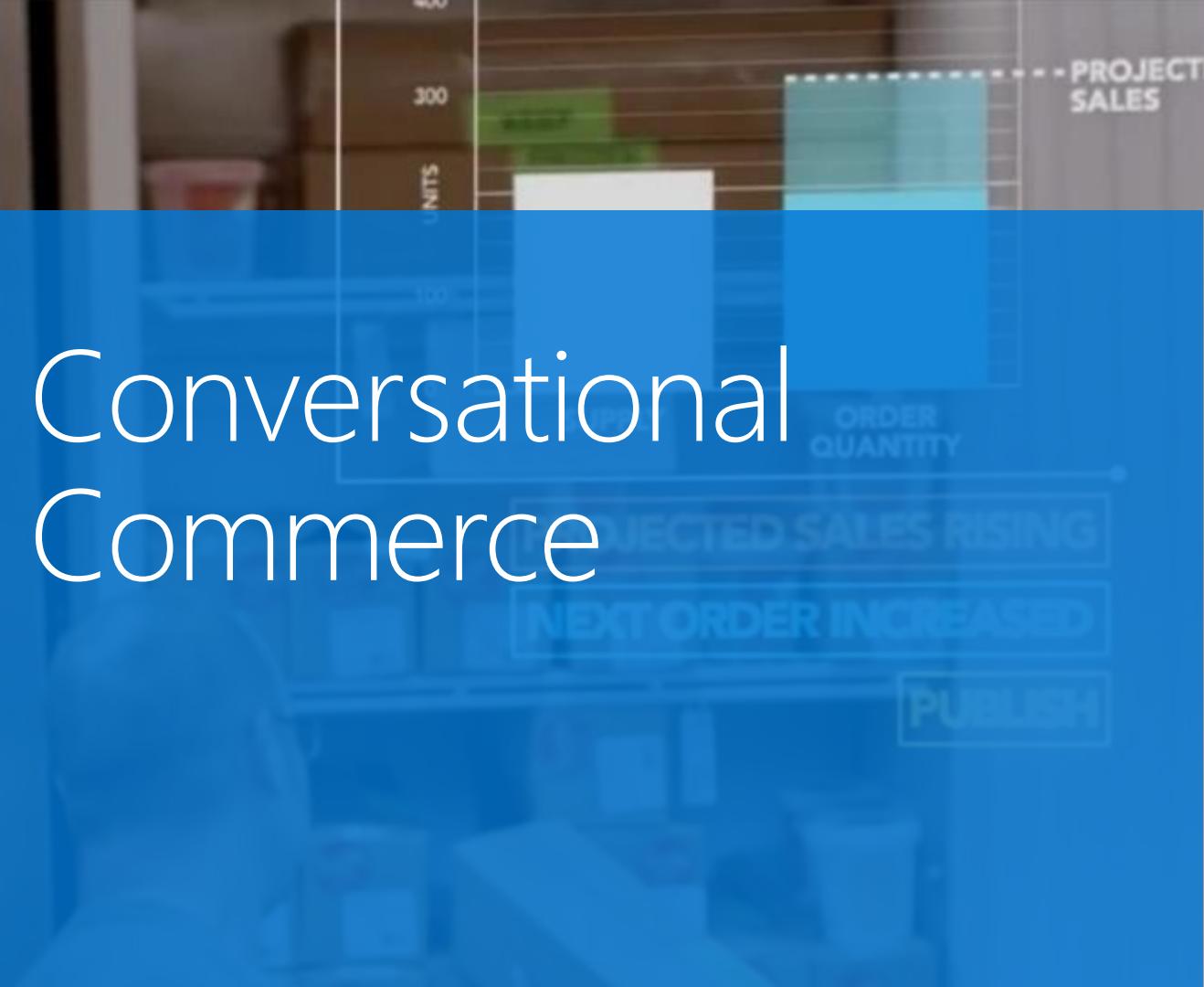
Business Case – Small Business Credit Score Rating



Demo

Conversational Commerce

Azure Bot Service



Your Bots – where your users converse

Intelligence



Cognitive Services



Bot Framework



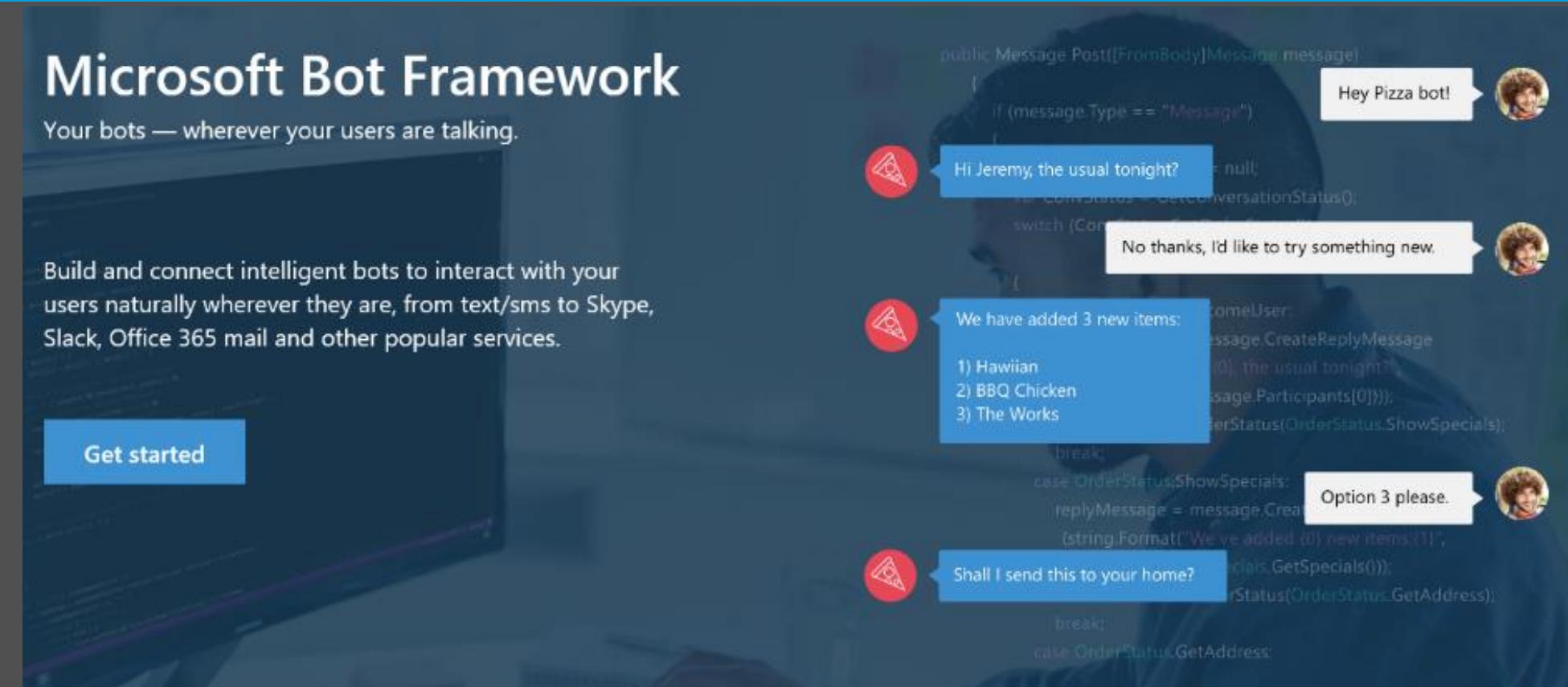
Cortana

Microsoft Bot Framework

Your bots — wherever your users are talking.

Build and connect intelligent bots to interact with your users naturally wherever they are, from text/sms to Skype, Slack, Office 365 mail and other popular services.

[Get started](#)



- Bot Connector Service: A service to register your bot, configure channels and publish to the Bot Directory. Connect your bot(s) seamlessly to text/sms, Office 365 mail, Skype, Slack, Twitter, and more.
- Bot Builder SDK: An open source SDK hosted on GitHub. Everything you need to build great dialogs within your Node.js or C# bot.
- Bot Directory: A public directory of bots registered through the Bot Connector Service. Discover, try, and add bots to conversation experiences.

Bot Framework (Conversational Commerce)

Intelligence



Cognitive Services



Bot Framework



Cortana

Introduction

App Economy to Bot Economy

Conversational Commerce

About Azure Bot Framework

Industry Case Studies

Azure Bot Service

Basic

Form

LUIS

Proactive

Q&A

Bot Builder

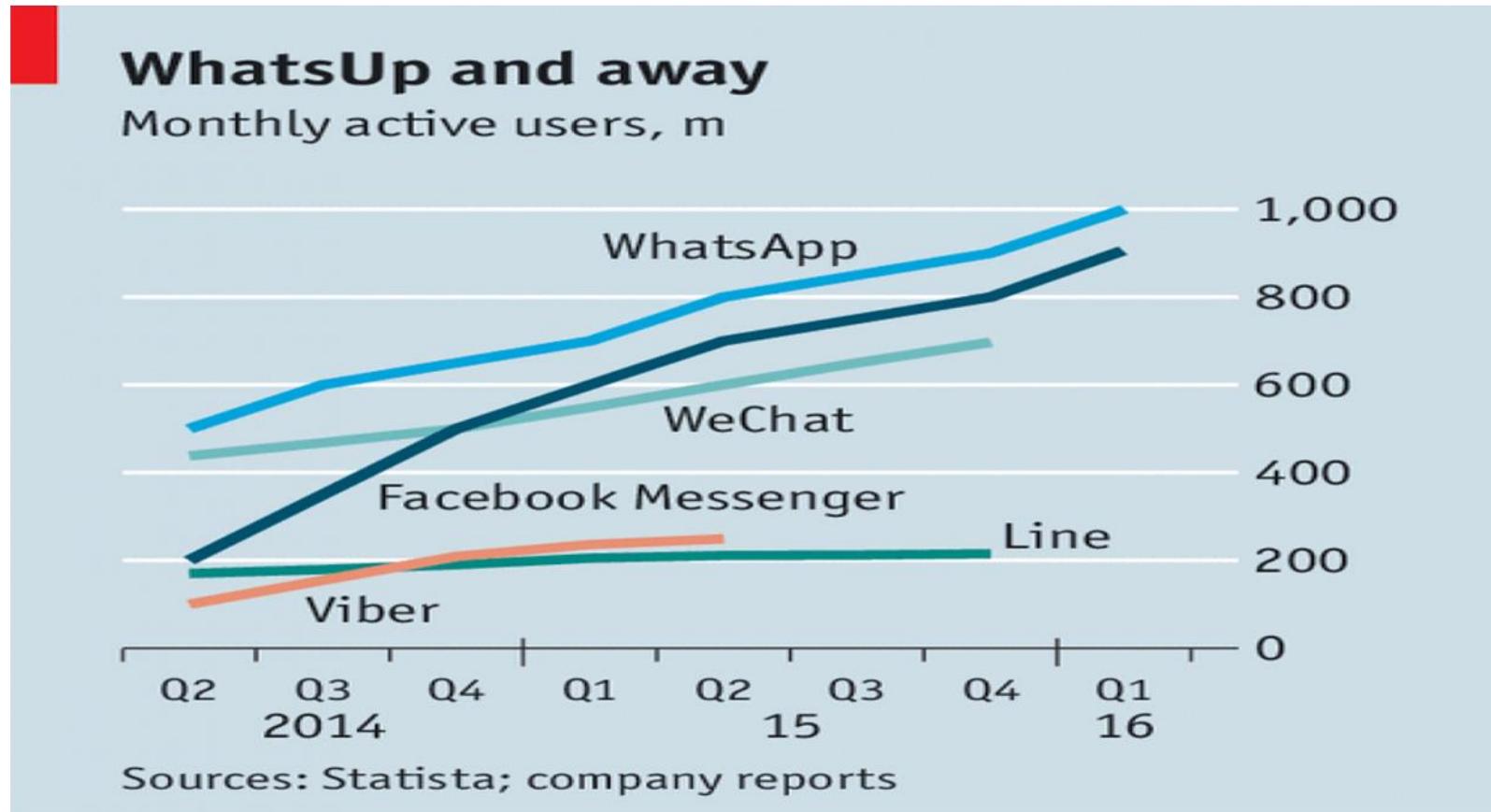
Introduction + SDKs

Bot Simulator

Bot Connectors

Bot Framework Portal

App Economy to Bot Economy



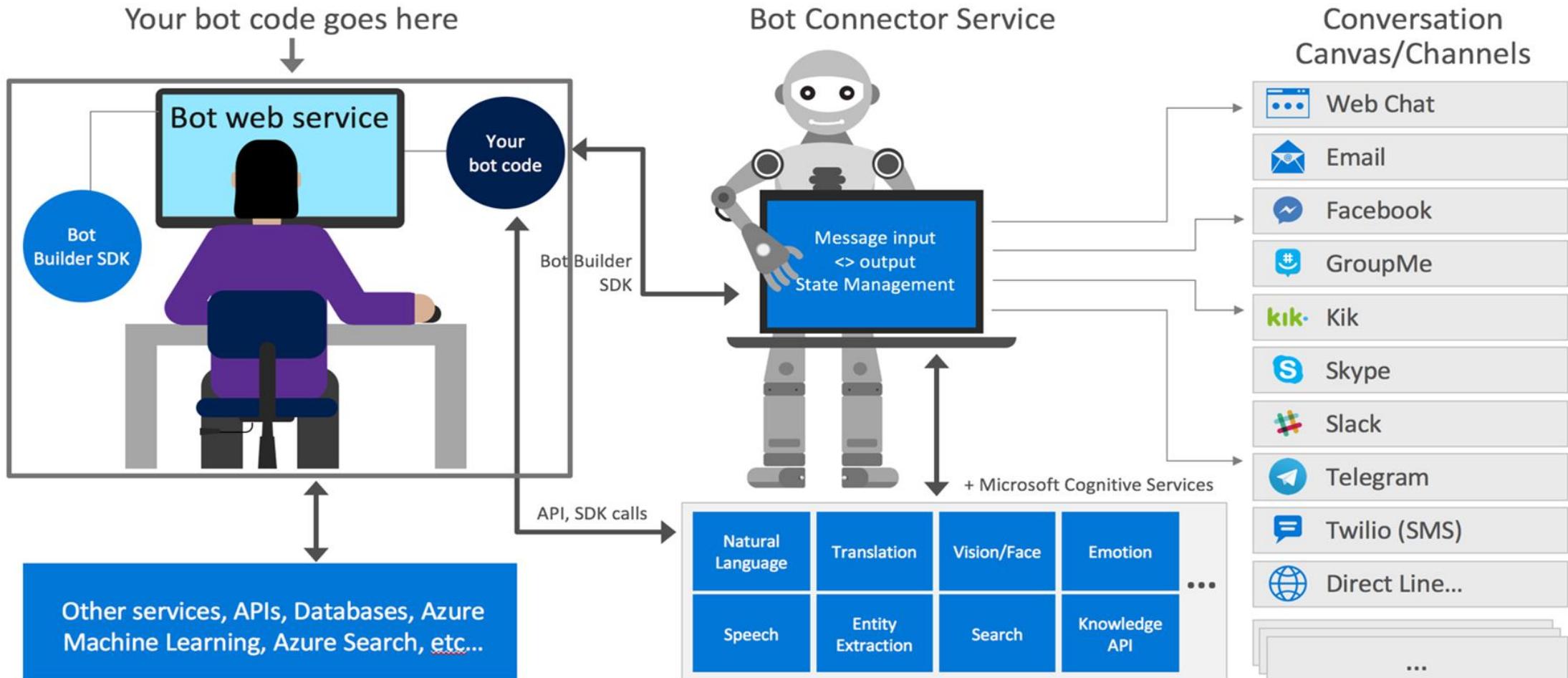
Conversational Commerce





Hello Bot using
Microsoft Bot Framework

Bot Frame Work Components



Azure Bot Service

Template	Description
	Basic Creates a bot that uses dialogs to respond to user input.
	Form Creates a bot that collects input from a user via a guided conversation that is created using FormFlow (in C#) or waterfalls (in Node.js).
Language understanding	Creates a bot that uses natural language models (LUIS) to understand user intent.
	Proactive Creates a bot that uses Azure Functions to alert users of events.
Question and Answer	Creates a bot that uses a knowledge base to answer the user's questions.

Planning for Bot Projects

PHASES	ACTIVITIES	INPUTS	OUTPUTS	TOOLS & TECHNIQUES
Initiating	Industry Type Identification	Discussions with Stake holders	Industry Type Definition	Meetings/Emails
	Use Cases	Discussions with Stake holders	Use cases	Meetings/Emails
Planning	ChatBot Type-LUIS (Q&A, LUIS, Deep Learning)	Use cases	ChatBot Type	Use cases
	Bot Builder(C#, Node.js)	Use Cases	Type of Bot Builder	Use cases
	List of Intents	Use Cases	Intents	Bot Framework
	List of Entities	Intents	Entities	Bot Framework
	List of utterences	Entities	Utterences	Bot Framework
	List of API's to be integrated	Intents,Entities,Utterences,Use cases	API's	Node.js
	Channel for Publishing (Skype,Slack,Messenger,Email, FB,KIK)	Stake holder inputs	Channel	Selected Channel

Planning for Bot Projects

PHASES	ACTIVITIES	INPUTS	OUTPUTS	TOOLS & TECHNIQUES
Executing	Create Azure subscription	subscription details	Azure account to create a bot	Azure Portal
	Creating a Bot	MS Bot framework	Basic Bot	Bot Framework
	Train Intents,Entity and Utterences	List of Intents,Entities,utterences	Trained Bot	Bot Framework
	Integrate the API's	Api's List	Bot	Bot Framework
	Deploy the Bot	Bot		Bot Framework
	Connect to channel	Identified Channel	Availability of Bot on identified Channel	Selected Channel
Monitoring Controlling	Test the Bot	Bot	Modifications Required	Bot Framework
	Modify the bot source and redeploy the Bot	Modifications	Modified Bot	Bot Framework
Closing	Publish the Bot	Modified Bot	Final Bot	Selected Channel

Getting with First Bot

Installation of Components

Node.js

NPM

Bot builder, Restify

Bot Framework Emulator

Sublime Text [Editor]



Creating first Bot and Running using console

C:\Users\Srikanth\Infosys Workshop\Basic\Basic.js - Sublime Text (UNREGISTERED)

File Edit Selection Find Goto Tools Project Preferences Help

Basic.js

```
1 var builder = require('botbuilder');
2 var connector = new builder.ConsoleConnector().listen();
3 var bot = new builder.UniversalBot(connector);
4 bot.dialog('/', [
5   function(session)
6   {
7     builder.Prompts.text(session, "Hello, this is my first ChatBot ! Please enter your Name");
8   },
9   function(session,results)
10  {
11    console.log("Welcome Mr." + results.response +"!...Happy Learning !!");
12  }
13 ]);
14
15 );
16 );
```

Line 13, Column 6

Tab Size: 4 JavaScript

Command Prompt - node basic.js

```
C:\Users\Srikanth\Infosys Workshop\Basic>node basic.js
Hi
Hello, this is my first ChatBot ! Please enter your Name
Srikanth Kumar
Welcome Mr.Srikanth Kumar!...Happy Learning !!
```

Waterfall Bot - Sample

C:\Users\Srikanth\Infosys Workshop\Basic\WaterfallChat.js - Sublime Text (UNREGISTERED)

File Edit Selection Find View Goto Tools Project Preferences Help

Basicjs WaterfallChat.js

```
1 var builder = require('botbuilder');
2 var requestTry = require("request");
3
4 var connector = new builder.ConsoleConnector().listen();
5 var bot = new builder.UniversalBot(connector);
6
7 bot.dialog('/', [
8     function (session) {
9         builder.Prompts.text(session, "Hi! This is sample waterfall bot. Please enter your Name");
10    },
11    function (session,results) {
12        session.userData.name = results.response;
13        builder.Prompts.text(session, "Hi! "+session.userData.name+" Welcome to Infosys WorkShop. Please Enter your Designation");
14    },
15    function (session,results) {
16        session.userData.designation = results.response;
17        builder.Prompts.choice(session, "Glad to Know that you are "+session.userData.designation+"|| Please Enter Last Place you attended a WorkShop");
18    },
19    function (session,results) {
20        session.userData.last_conference_place = results.response.entity;
21        builder.Prompts.text(session, "Glad to Know that you attended the WorkShop in "+session.userData.last_conference_place+"|| May i know your Tra");
22    },
23    function (session,results) {
24
25        session.userData.Trainee=results.response;
26        console.log(session.userData.name);
27        console.log(session.userData.designation);
28        console.log(session.userData.last_conference_place);
29        console.log(session.userData.Trainee);
30
31    }
32]);
33]);
34];
```

Line 34, Column 1 Spaces: 4 JavaScript

Command Prompt - node waterfallchat.js

```
C:\Users\Srikanth\Infosys Workshop\Basic>node waterfallchat.js
HI
Hi! This is sample waterfall bot. Please enter your Name
Srikanth Kumar
Hi! Srikanth Kumar Welcome to Infosys WorkShop. Please Enter your Designation
Technical Architect
Glad to Know that you are Technical Architect|| Please Enter Last Place you attended a WorkShop (1. Bangalore or 2. Pune)
)
1
Glad to Know that you attended the WorkShop in Bangalore|| May i know your Trainee Name
Chandra Gupta
Srikanth Kumar
Technical Architect
Bangalore
Chandra Gupta
```

A photograph showing a person from the waist down, wearing an orange and white plaid shirt. They are sitting on a dark, textured couch, looking down at a silver laptop computer. Their hands are on the keyboard, which has black keys with white lettering. The person's fingernails are painted red, and they are wearing a large, ornate ring on their left hand. The background is a dark, out-of-focus interior.

Hands on Lab

Using Bot Emulator

- Setting up Bot Emulator
- Getting Azure App ID and Passcode
- Connecting Bot to Localhost port
- Making Changes in Basic bot to connect to Simulator
- Running Basic and Waterfall bots using Bot Simulator

Using Bot Emulator



Bot Framework Channel Emulator

http://localhost:3978/api/messages

C ⋮ Details

Hi User

Hi! Welcome to Infosys WorkShop

JSON Site

Bot

Hi! Welcome to Conversational ChatBot. Please enter your Name

Srikan User

Hi! Srikan Welcome to our Infosys WorkShop. Please Enter your Designation

Bot at 12:35:41 PM

Type your message... Log ⋮

The screenshot shows the Bot Framework Channel Emulator interface. The title bar says "Bot Framework Channel Emulator" and the URL is "http://localhost:3978/api/messages". The main window displays a conversation between a user and a bot. The user sends "Hi". The bot responds with "Hi! Welcome to Infosys WorkShop" and a link to "JSON Site". The user then sends "Hi! Welcome to Conversational ChatBot. Please enter your Name". The bot responds with "Hi! Srikan Welcome to our Infosys WorkShop. Please Enter your Designation". At the bottom, there is a text input field with placeholder "Type your message..." and a "Log" button.

Development of Form Based Bots

Bot Framework Channel Emulator

http://localhost:3978/api/messages

Bot

Srikanth

User

Details

```
{
  "type": "message",
  "attachments": [
    {
      "contentType": "application/vnd.microsoft.card.hero",
      "content": {
        "buttons": [
          {
            "type": "imBack",
            "title": "Software Engineer",
            "value": "Software Engineer"
          },
          {
            "type": "imBack",
            "title": "Technical Lead",
            "value": "Technical Lead"
          },
          {
            "type": "imBack",
            "title": "Enterprise Architect",
            "value": "Enterprise Architect"
          }
        ]
      }
    ],
    "text": "Hi! Srikanth Welcome to our Infosys WorkShop. Please Enter your Designation",
    "inputHint": "expectingInput",
    "locale": "en-US",
    "localTimestamp": "2017-12-06T13:04:42+05:30",
    "from": {
      "id": "default-bot",
      "name": "Bot"
    }
  }
}
```

Hi! Srikanth Welcome to our Infosys WorkShop. Please Enter your Designation

Software Engineer

Technical Lead

Enterprise Architect

Bot

Srikanth

User

Technical Lead

User

Srikanth , glad to Know that you are a Technical Lead.Please Enter your Campus

Bangalore

Pune

Bot at 1:04:53 PM

Type your message...

Log

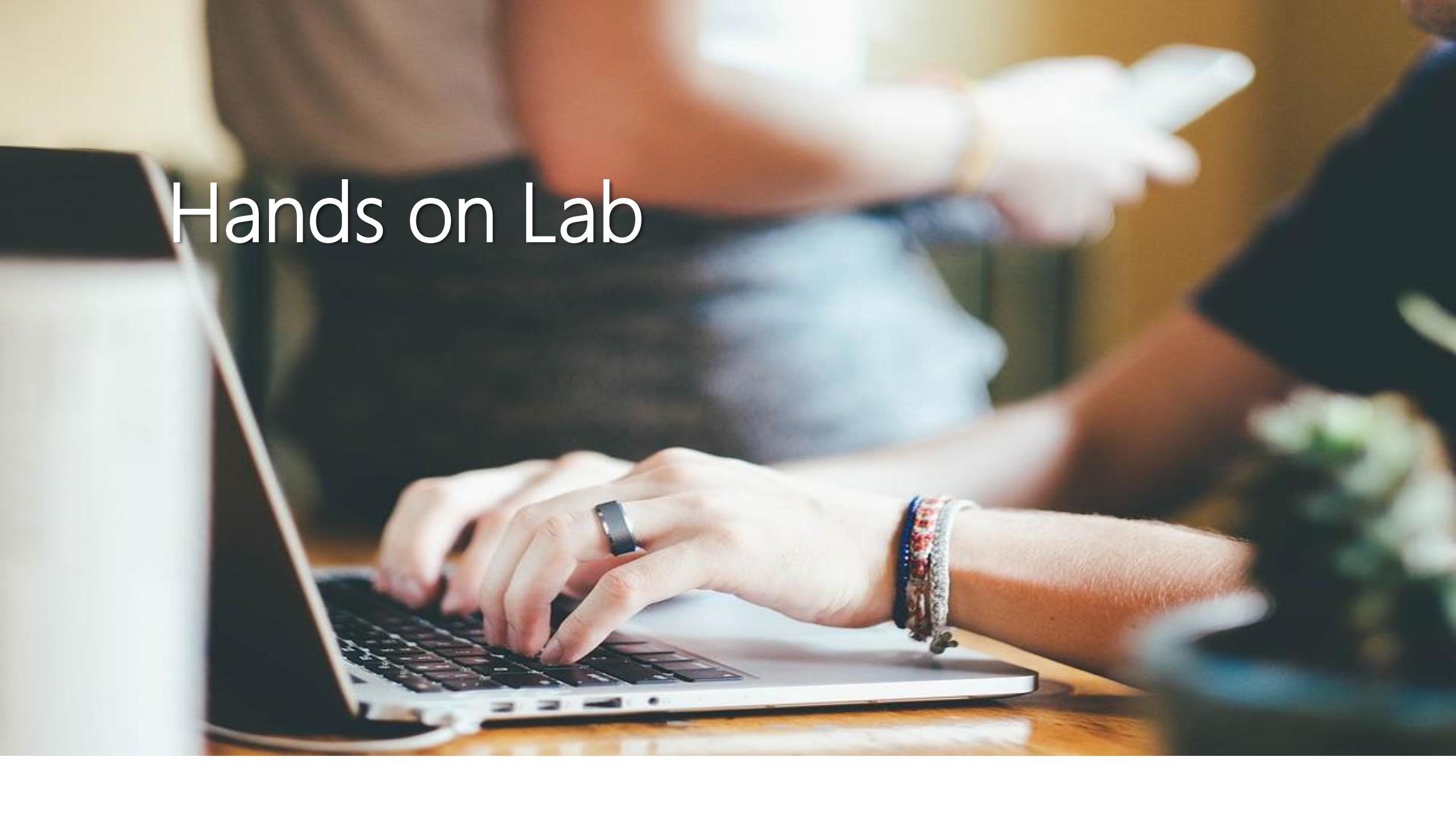
A photograph of a woman with dark hair tied back, wearing a light green short-sleeved shirt, sitting at a desk in what appears to be a computer lab. She is looking down at a silver laptop keyboard. In the foreground, the side of another person's head and shoulders are visible, wearing a black hoodie. On the desk, there are several books and papers. A computer monitor is partially visible in the lower right corner, showing a blue and white interface. The background shows a wall with a red number '2' on it.

Hands on Lab

Bot Talking to your Database

- Database Connect String
- CRM App URL
- Writing Bots Fetching / Storing Data to Database

Hands on Lab

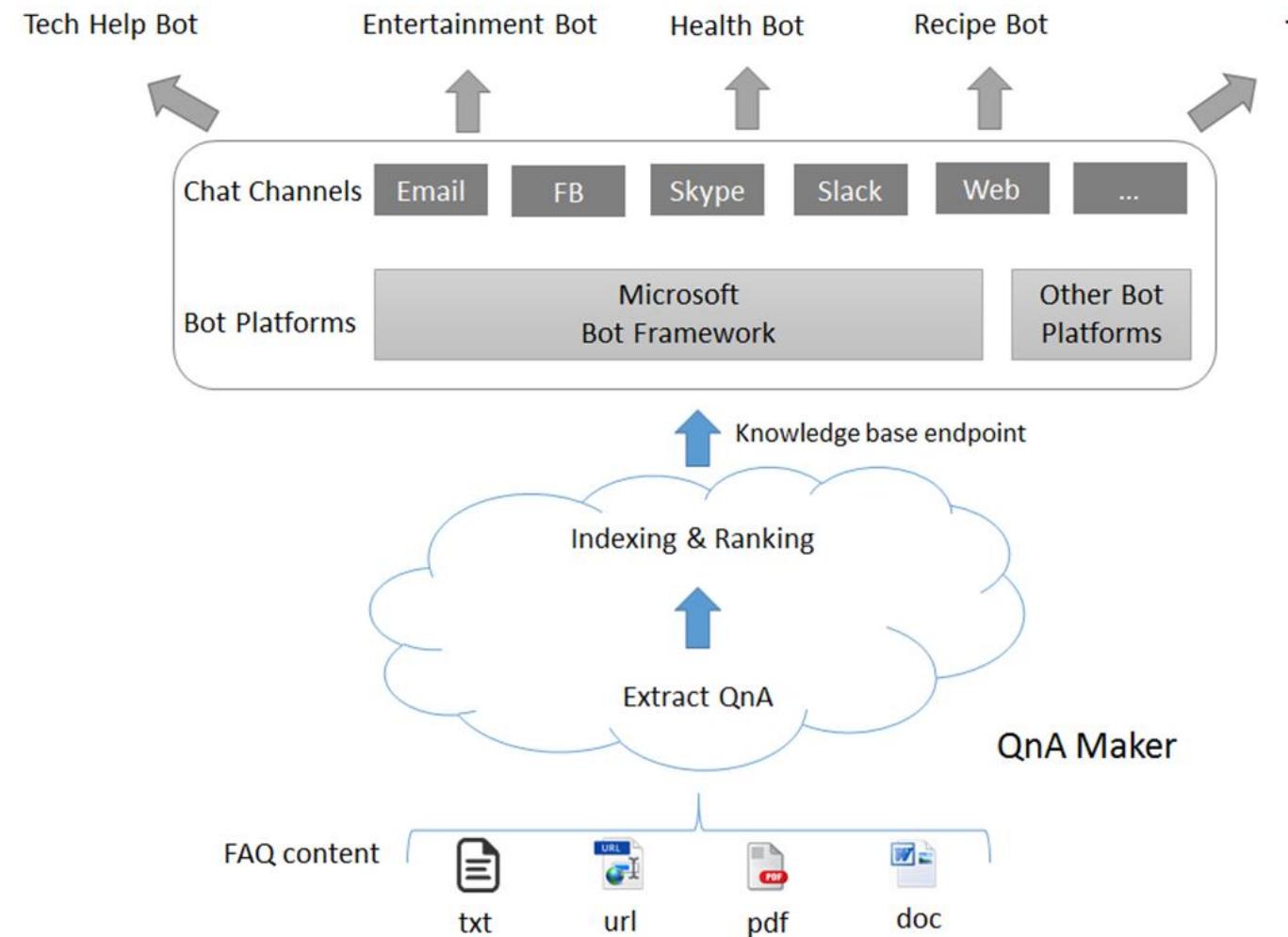


Development of FAQ Bots

From FAQ to Bot in minutes.

Build, train and publish a simple question and answer bot based on FAQ URLs, structured documents or editorial content in minutes.

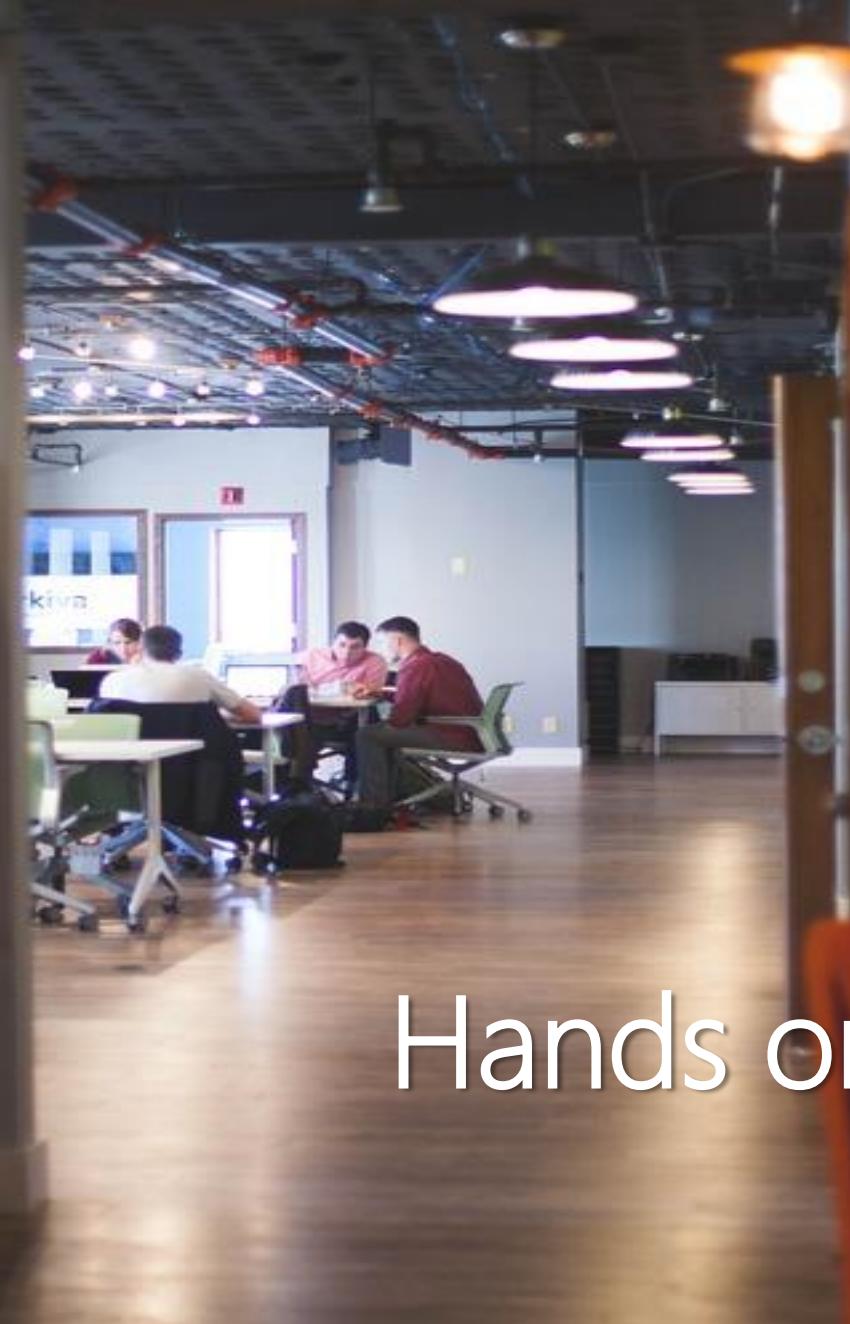
Development of FAQ Bots



Development of FAQ Bots

Integrating QnA Service with Bot

- Installing BotBuilder Cognitive Services npm
- Getting the knowledgebase ID and subscription key
- Integrating with Botbuilder



Hands on Lab

Language Understanding Intelligent Service

Add conversational intelligence to your apps.

What is the **weather** | **today** in **Seattle** ?

```
intent = weather  
place = seattle, wa  
date = May 3 2017, 8am
```

Do I need my **umbrella**?

sunny in Sea

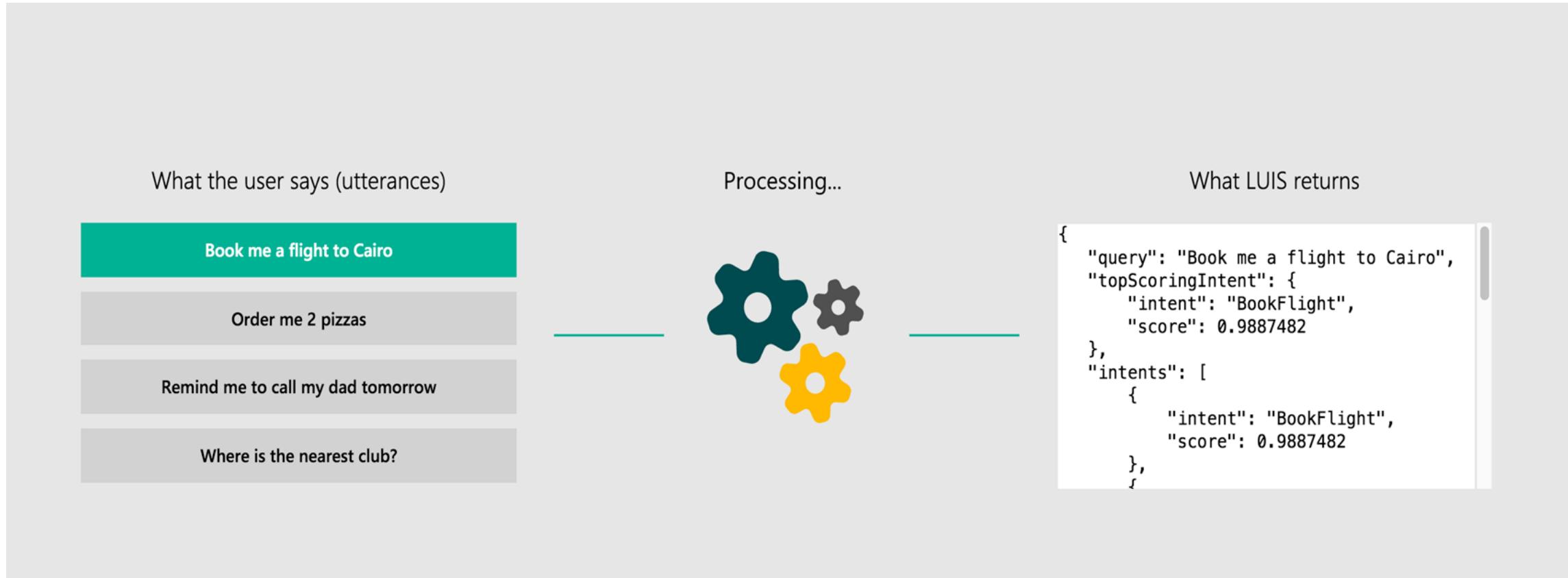
What's today's **weather**?

How cold

Luis – KEY Concepts

Intent	Sample User Utterance	Entities
BookFlight	"Book a flight to Seattle?"	Seattle
StoreHoursAndLocation	"When does your store open?"	open
ScheduleMeeting	"Schedule a meeting at 1pm with Bob in Distribution"	1pm, Bob

Luis – KEY Concepts



Q&A



Microsoft

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